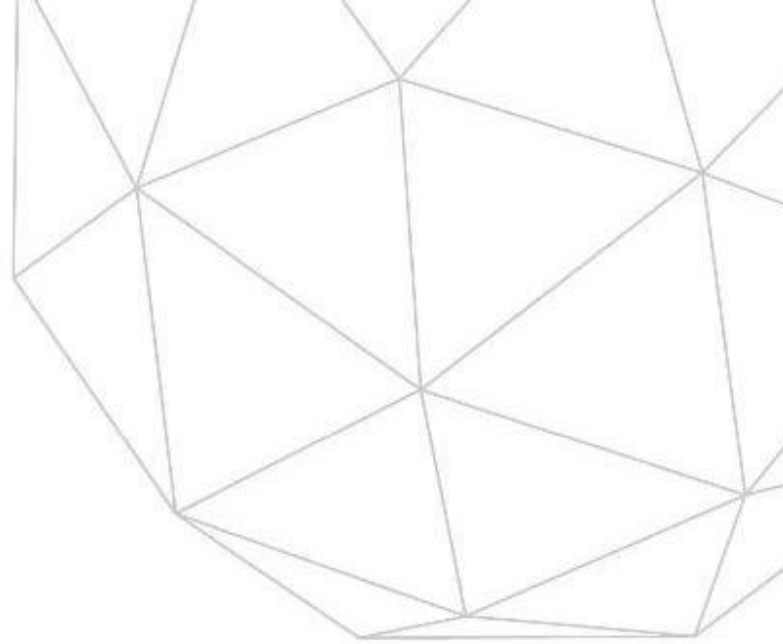




GREEN
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ANNEX 2 FEASIBILITY STUDY

***GCF Funding Proposal: Improving climate
resilience of vulnerable communities and
enabling conditions for local climate action
in Tajikistan***



April 2026

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ACRONYMS AND ABBREVIATIONS

ALRI	Agency for Land Reclamation and Irrigation
CBD	Convention on Biological Diversity
CEP	Committee on Environmental Protection
CCC	Climate Change Centre
CMP	Coupled Model Intercomparison Project
COP 21	21st Conference of the Parties to the United Nations Framework Convention on Climate Change
DRS	Districts of Republican Subordination
EA	Enumeration Areas
EBRD	European Bank for Reconstruction and Development
ESIA	Environmental and Social Impact Assessment
EU	European Union
FAO	United Nations Food and Agriculture Organisation
FSMS	Food Security Monitoring System
GBAO	Gorno-Badakhshan Autonomous Region
GCF	Green Climate Fund
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas
GDI	Gender Development Index
GII	Gender Inequality Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLOF	Glacial Lake Outburst Flood
HCI	Human Capital Index
HDI	Human Development Index
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
KRB	Kofirnighan River Basin
KOICA	Korea International Cooperation Agency
LULUCF	Land Use, Land Use Change and Forestry
NATO	North Atlantic Treaty Organisation
NBBC	National Centre for Biodiversity and Biosafety
NC	National Communication
NCCAS	National Climate Change Adaptation Strategy
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NDVI	Normalised Difference Vegetation Index
NGO	Non-Governmental Organisation
OJSC	Open Joint Stock Company
PPCR	Pilot Programme for Climate Resilience
RSD	Republican Subordination Districts
SDG	Sustainable Development Goal
SSP	Shared Socioeconomic Pathway
TJS	Tajikistani Somoni currency (One somoni = 100 dirams)
TLU	Tropical Livestock Unit
ToC	Theory of Change
UN	United Nations
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
WFP	World Food Programme
WUA	Water User Association

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1. Executive summary

Tajikistan is among the most climate-vulnerable countries in Central Asia, with climate change acting as a systemic threat multiplier across food security, water availability, livelihoods, and rural development. Rising temperatures, accelerated glacial melt, increasing hydrological variability, and more frequent and intense droughts, floods, mudflows, and frost events are already undermining agricultural productivity and rural incomes, particularly in mountainous and remote districts. These climate pressures interact with structural challenges including high rural poverty, land degradation, weak infrastructure, dependence on remittances, and limited institutional capacity for climate risk management at sub-national levels. As a result, vulnerable households (especially women-headed households, smallholder farmers, youth, and persons with disabilities) face heightened exposure to climate shocks and diminishing adaptive capacity.

This Feasibility Study supports the proposed Green Climate Fund (GCF) project “**Improving Climate Resilience of Vulnerable Communities in Tajikistan through Locally-Led Adaptation**”, led by the World Food Programme (WFP). The project aims to strengthen adaptive capacity and resilience of food-insecure and climate-exposed communities by addressing climate risks in an integrated manner across governance, livelihoods, water resources, agriculture, and knowledge systems. It builds on lessons from earlier initiatives, including WFP’s FP067 project, and aligns with Tajikistan’s Nationally Determined Contribution (NDC), National Climate Change Adaptation Strategy, National Adaptation Planning (NAP) process, and relevant Sustainable Development Goals.

The Feasibility Study confirms that the proposed project is technically sound, economically justified, environmentally sustainable, socially inclusive, and institutionally feasible. It demonstrates a strong rationale for GCF support by addressing persistent adaptation barriers that cannot be resolved through incremental development finance alone, particularly those related to sub-national adaptation planning, climate information uptake, anticipatory action, and climate-resilient livelihood transformation.

Climate Risks, Vulnerability, and Rationale

The study provides a comprehensive assessment of Tajikistan’s climate risk profile, with particular emphasis on agriculture and water systems that underpin rural livelihoods. Climate variability is disrupting irrigation reliability, shortening growing seasons, increasing pest and disease pressures, and exacerbating land and soil degradation. In mountainous districts, non-climatic hazards such as landslides, avalanches, and seismic risks compound climate impacts, frequently damaging infrastructure and isolating communities from markets and services.

Despite national-level progress on climate policy, district and local institutions remain weakly equipped to translate climate risk information into proactive, costed, and inclusive adaptation investments. Climate information services are under-utilised by farmers and planners, extension systems are under-resourced, and learning from past adaptation interventions is insufficiently institutionalised. These barriers justify a targeted, locally-led adaptation approach that strengthens governance while delivering tangible resilience benefits at household and community levels.

Project Design and Components

The proposed project is structured around three mutually reinforcing components:

Enabling environment for climate change adaptation at district and local levels

This component strengthens district-level governance and planning through participatory development of District Adaptation Plans (DAPs) that integrate climate risk profiling, disaster risk reduction (DRR), and anticipatory action. It builds institutional capacity across local authorities, extension services, and climate agencies, enabling decentralised and risk-informed decision-making aligned with national adaptation frameworks.

Resilience building at household and community levels through livelihoods, water, and market access

This component delivers direct adaptation benefits through climate-resilient agriculture, improved irrigation and water management, livelihood diversification, and strengthened value chains. Interventions are tailored to local agro-ecological contexts and promote nutrition-sensitive, gender-responsive practices that enhance food security and income stability.

Knowledge management, awareness, and learning for adaptation

This component enhances awareness of climate risks, food security, and nutrition linkages, strengthens access to climate information services, and generates evidence to support learning, scaling, and replication. Knowledge products and learning platforms are designed to institutionalise adaptation lessons and inform national-level policy and investment processes.

Beneficiaries and Expected Results

Using GCF-compliant beneficiary estimation methodologies, the project is expected to deliver direct adaptation benefits to approximately 73,500 people, of whom around 49% are women, across climate-exposed districts in Sughd, Khatlon, the Districts of Republican Subordination, and Gorno-Badakhshan Autonomous Oblast. These direct beneficiaries include smallholder farmers, community members, extension officers, and local officials who experience measurable reductions in climate vulnerability through improved infrastructure, practices, services, and capacities.

An additional 205,000 people are expected to benefit indirectly through strengthened institutions, improved ecosystem services, reduced disaster risks, and market and policy spill-overs, bringing the total number of beneficiaries to approximately 278,500 people. Results contribute directly to GCF adaptation result areas, including strengthened livelihoods, resilient infrastructure, enhanced ecosystem services, improved governance, and increased use of climate information.

Feasibility, Sustainability, and GCF Value-Addition

The Feasibility Study confirms that the proposed interventions are cost-effective and appropriate to Tajikistan's institutional and socio-economic context. Environmental and social risks are low and manageable, with no expected physical resettlement and strong safeguards integration. The project's locally-led adaptation approach enhances ownership, inclusion, and sustainability, while alignment with national systems supports institutionalisation beyond the project lifetime.

GCF financing is essential to enable the scale, integration, and risk-taking required to shift from reactive responses to proactive, anticipatory adaptation. By combining governance reform, community-level investments, and knowledge systems, the project establishes a replicable model for district-level adaptation that can be scaled nationally and inform Tajikistan's long-term adaptation pathway.

In conclusion, the Feasibility Study demonstrates that the proposed project is well-designed, justified, and ready to proceed to full Funding Proposal development, offering a robust contribution to climate resilience, food security, and inclusive rural development in Tajikistan.

2. Background and context

2.1. Physical and geographical situation

2.1.1. Geographical overview

The Republic of Tajikistan (hereafter Tajikistan) is a landlocked country located in the southeastern part of Central Asia, covering an area of 142,100 km² (Figure 1)¹. The country shares borders with Kyrgyzstan to the north (987.5 km), China to the east (495 km), Afghanistan to the south (1,374.2 km), and Uzbekistan to the north and west (1,332 km). Approximately 93%

¹ Tajikistan's Fourth National Communication 2022. [Available online.](#)

of the country's territory is occupied by three major mountain systems: the Tien Shan in the north, the Gissar-Alay stretching roughly west-east in the west, forming a series of ranges, and the Pamir ranges, primarily within the Gorno-Badakhshan Autonomous Region, in the southeast (Figure 2). The country's elevation ranges from 300 m to 7,495 m above sea level, with nearly half of the national territory at altitudes exceeding 3,000 m above sea level².



Figure 1. Map of Tajikistan.

Tajikistan's administrative structure comprises five primary regions: the Gorno-Badakhshan Autonomous Region (GBAO), Sughd Region, Khatlon Region, the Districts of Republican Subordination (DRS)³, and the capital city of Dushanbe, which holds a distinct administrative status. GBAO, situated in the mountainous east, possesses autonomous governance due to its unique cultural and geographic characteristics. Sughd Region, in the north, is an economic hub with extensive agricultural production and cross-border trade. The Khatlon Region in the south is a key centre for cotton and grain cultivation. The DRS, located centrally, includes districts governed directly by the national government, many of which are rural or mountainous. Dushanbe functions as the country's political, cultural, and economic centre and is administratively divided into four districts. Each of Tajikistan's administrative regions is subdivided into urban and rural areas, with the country comprising 68 districts distributed across its regions. Each district is further divided into census divisions, subdivided into instruction areas. These instruction areas are then organised into urban enumeration areas (EAs) and rural villages⁴.

² Tajikistan's Fourth National Communication 2022. [Available online.](#)

³ The Region of Republican Subordination (RRS) is the administrative region, and the DRS is the individual districts (or raions) within the RRS.

⁴ Tajikistan Demographic and Health Survey 2023. Key Indicators Report. [Available online.](#)



Tajikistan's climate is characterised by high aridity, extreme temperatures, and pronounced intra-annual, inter-annual, and regional variability⁶. This variability is primarily driven by the country's geographic position at the convergence of major atmospheric circulation patterns, from tropical systems in the southeast to Siberian systems in the north. The climate spans several zones due to its dramatic topography and geographic variation (Figure 3). Cold semi-arid climate (BSk) is found in the lowland valleys and foothills, particularly in western and southern Tajikistan (Figure 4). These areas have hot, dry summers and cold winters, with low annual precipitation. A cold desert (BWk) climate in the eastern Pamir region is characterised by very cold, arid conditions, minimal precipitation, and extreme temperature ranges. The humid continental (Dsa and Dsb) climates are seen in the mountain regions, especially central Tajikistan. These areas have cold, snowy winters and dry, warm summers (Dsa: hot summer; Dsb: warm summer). Tundra (ET) climate occurs at the highest elevations, particularly in the high Pamirs, where summer temperatures stay below 10°C⁷.



⁸ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

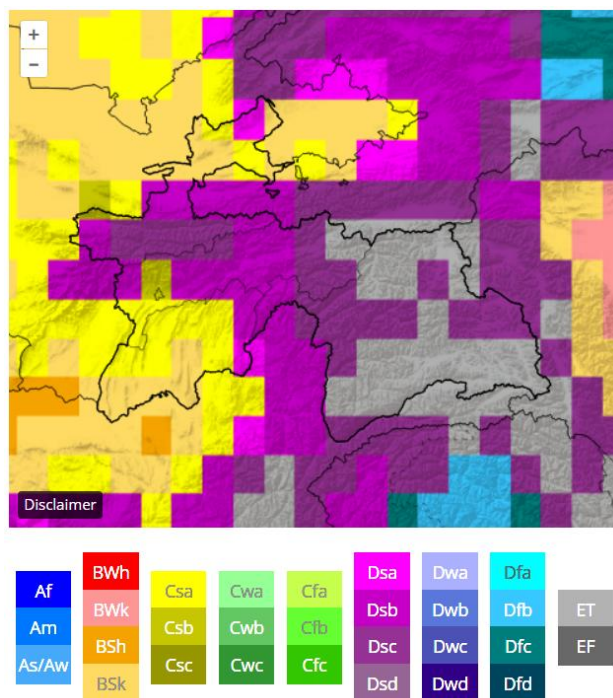


Figure 4. Tajikistan Köppen-Geiger Climate Classification, 1991-2020⁹.

Annual mean temperatures range significantly across the country, from approximately 17°C in the southern lowlands to -6°C in the lower Pamir mountains. Seasonal temperature extremes are notable, with maximum temperatures typically recorded in July and minimum temperatures in January (Figure 5). In the East Pamir region, minimum winter temperatures have been recorded as low as -50°C, while in the southern regions, summer surface air temperatures frequently exceed 40°C¹⁰. The observed annual average mean surface air temperature has increased from -0.89°C in 1950 to 1.58°C in 2023 (Figure 6)¹¹.

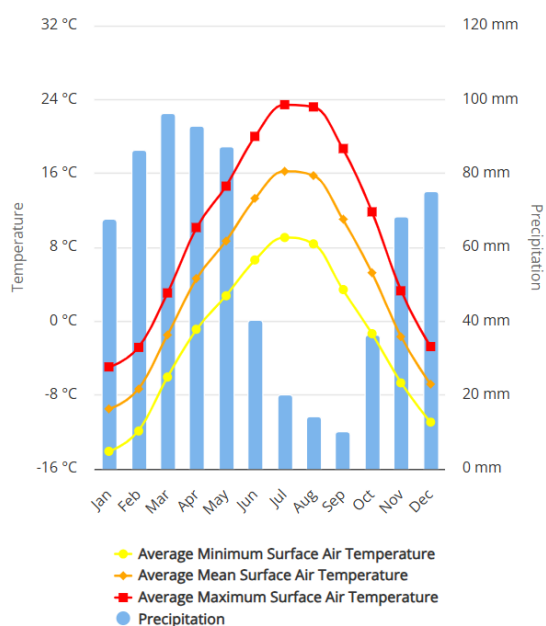


Figure 5. Monthly temperature and precipitation, Tajikistan, 1991–2020¹².

⁹ <https://climateknowledgeportal.worldbank.org/country/tajikistan>

¹⁰ World Bank Group 2021. Tajikistan Climate Risk Country Profile. Available online.

¹¹ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-historical>

¹² <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-historical>

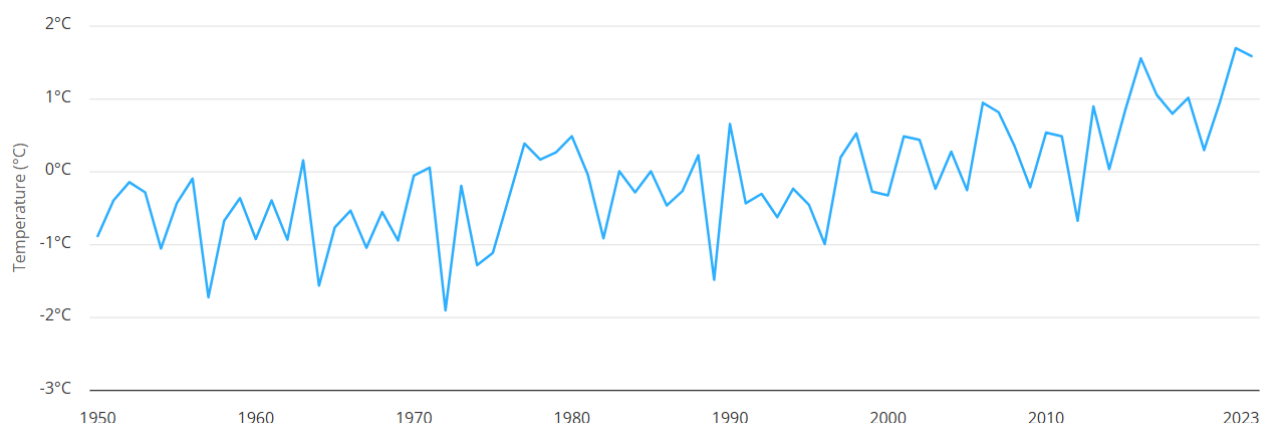


Figure 6. Observed annual average mean surface air temperature, Tajikistan, 1950–2023¹³.

Observed annual precipitation shows fluctuating annual variability (Figure 7). The most significant variability was a high of 974.2 mm in 1969, down to 545.5 mm in 1971. More recent fluctuations have been between 800 and 600 mm. Precipitation patterns also show strong geographic contrasts. The driest parts of the country are the eastern mountain areas, the southern lowland and the Ferghana Valley¹⁴. The arid lowland deserts of northern Tajikistan and the cold mountain deserts of the East Pamir receive only 70–160 mm of precipitation annually. By contrast, the central regions of Tajikistan can receive over 1,800 mm of precipitation per year, reflecting substantial spatial variability. Tajikistan receives minimal precipitation during July, August, and September, contributing to frequent and recurrent drought events, posing significant risks to agriculture, water resources, and ecosystems¹⁵. Rainfall in 2024 and up to mid-2025 was below the average for the first half of the year (Figure 8 and Figure 9). In 2024, this improved to above average for the year's second half.

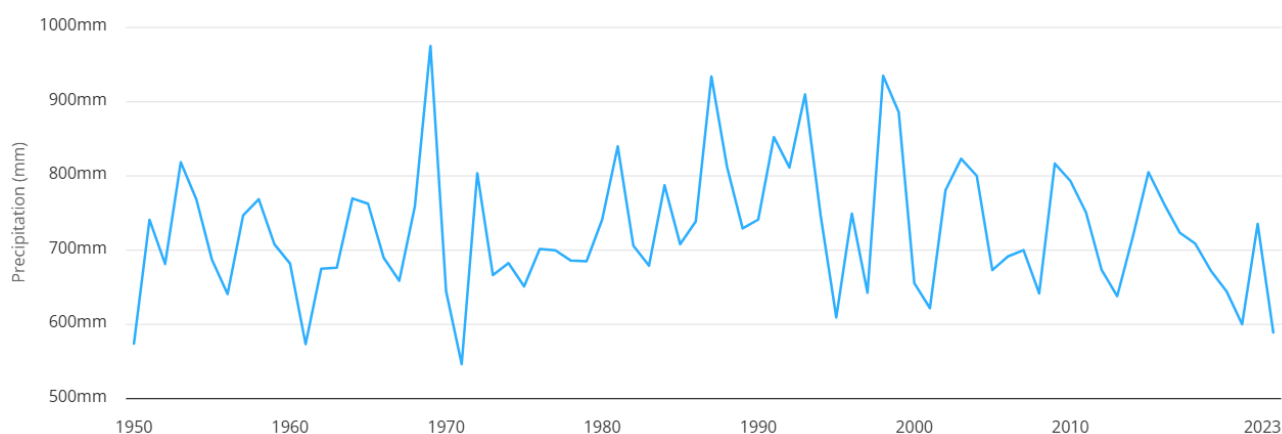


Figure 7. Observed annual precipitation, Tajikistan, 1950–2023¹⁶.

¹³ <https://climateknowledgeportal.worldbank.org/country/tajikistan/era5-historical>

¹⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁵ World Bank Group 2021. Tajikistan Climate Risk Country Profile. [Available online.](#)

¹⁶ <https://climateknowledgeportal.worldbank.org/country/tajikistan/era5-historical>

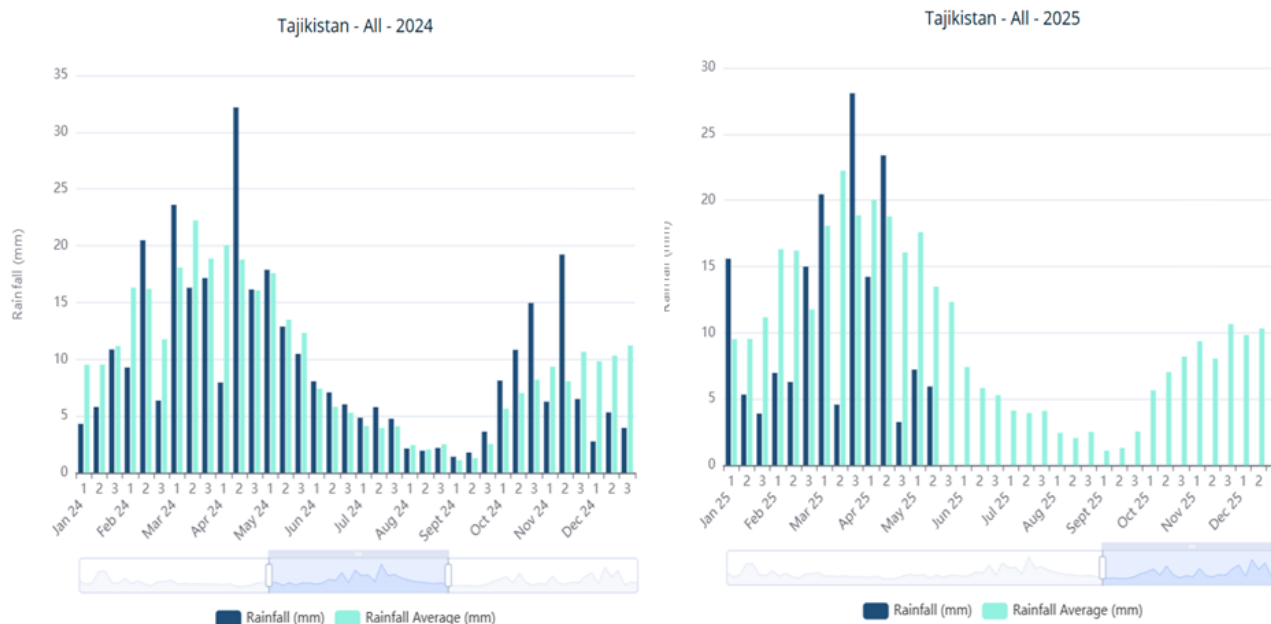


Figure 8. Rainfall and rainfall average for 2024 (left) and up to May 2025 (right), Tajikistan¹⁷.



Figure 9. Rainfall anomalies for 2024 (left) and up to May 2025 (right), Tajikistan¹⁸.

Recent climatological analyses (1991–2020) highlight the seasonal cycles and the observed spatial variation of temperature and precipitation across the country, underscoring the need for climate-resilient development planning and adaptive resource management strategies¹⁹.

2.1.3. Biodiversity and ecosystems

Tajikistan is one of Central Asia's most biodiverse countries, home to over 23,300 species of flora and fauna, including many rare and endemic species (Table 1). As a party to the Convention on Biological Diversity (CBD), Tajikistan has adopted the National Strategy and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP), aligning its efforts with the Aichi Biodiversity Targets. Biodiversity conservation is coordinated by the National Centre for Biodiversity and Biosafety (NBBC), with active involvement from government institutions, research bodies, and NGOs²⁰.

¹⁷ <https://dataviz.vam.wfp.org/asia-and-the-pacific/tajikistan/climate-explorer>

¹⁸ <https://dataviz.vam.wfp.org/asia-and-the-pacific/tajikistan/climate-explorer>

¹⁹ World Bank Group 2021. Tajikistan Climate Risk Country Profile. [Available online.](#)

²⁰ <https://constructive-voices.com/tajikistan-biodiversity/>

Table 1. Summary of biodiversity in Tajikistan.

Record	Description	Number
1.	Ecosystems	12 types
2	Vegetation types	20 types
3	Flora	9,771 species
4	Cultivated plant wild relatives	1,000 species
5	Endemic plants	1,132 species
6	Plants listed in the Red Data Book of Tajikistan	226 species
7	Fauna	13,531 species
8	Endemic animals	800 species
9	Animals listed in the Red Data Book of Tajikistan	162 species
10	Agricultural crops	500 varieties
11	Domestic animals	30 breeds

Ecosystems and ecoregions

The Republic of Tajikistan is situated along one of the key links of the Eurasian highland belt, which stretches from the Atlantic Ocean in the west to the Pacific Ocean in the east. This unique geographic positioning has fundamentally shaped the country's physical, ecological, and climatic character. Tajikistan's soil composition exhibits a distinct altitudinal zonation, reflecting the country's sharp elevation gradients (Figure 10)²¹, which leads to different vegetation belts across the landscape (Figure 11)²²:

- Plains and low mountains (300–1,600 m above sea level) are characterised by grey desert soils;
- Medium-high mountains (1,600–2,800 m a.s.l.) feature mountain brown soils;
- High mountains (2,800–4,500 m a.s.l.) are dominated by high-mountain meadow-steppe, steppe, zang (rocky), and desert soils; and
- Nival belt (above 4,500 m a.s.l.) consists mainly of skeletal soils, reflecting the extreme alpine conditions.

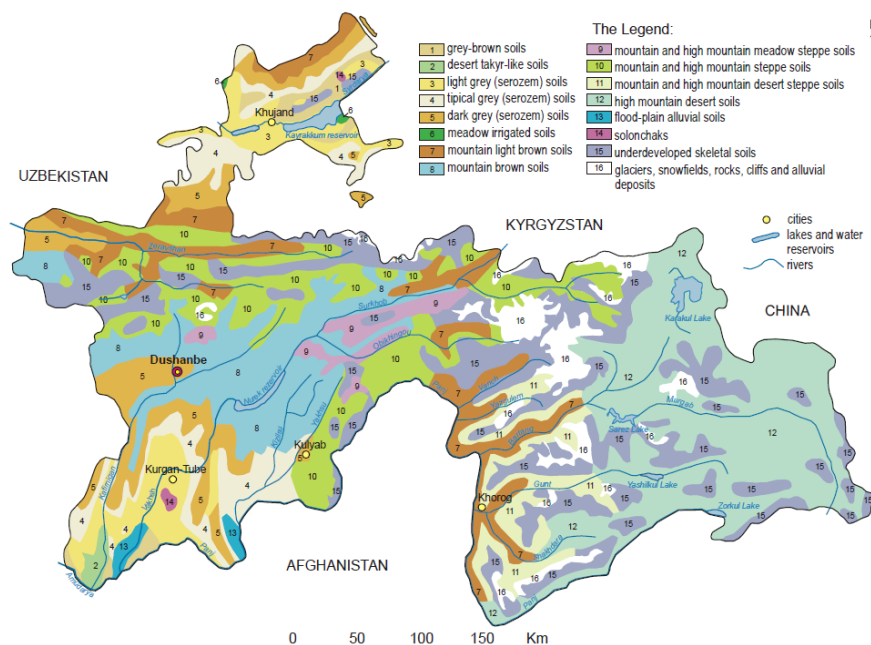


Figure 10. Soils of Tajikistan²³.

²¹ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

²² Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

²³ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

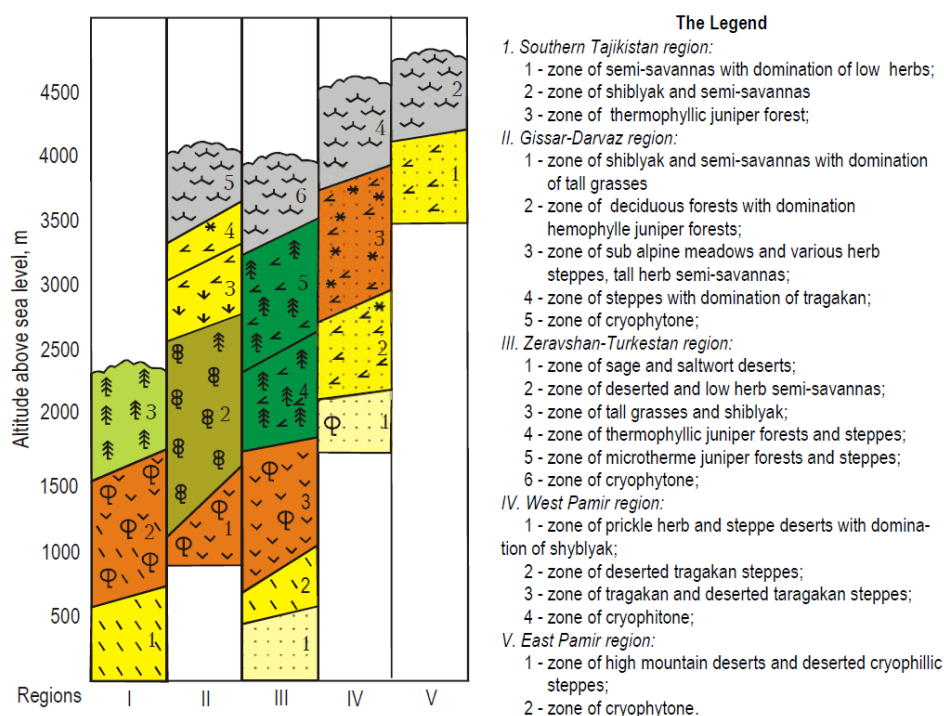


Figure 11. Vegetation belts in botanic-geographical zones²⁴.

The dynamic mountain climatic conditions, combined with complex geological and historical processes over millennia, have fostered the development of a highly unique and rich biological diversity across Tajikistan. These historical natural forces have formed distinct ecosystems, species distributions, and ecological interactions, making Tajikistan a vital biodiversity hotspot within Central Asia²⁵.

The country's provinces are ecologically divided into four management regions with subdivisions (Figure 12). Tajikistan's major ecoregions include deserts, semi-deserts, steppes, alpine meadows, mountain forests, and wetlands. According to the World Wildlife Fund's Terrestrial Ecoregions of the World (TEOW) classification, Tajikistan encompasses the following ecoregions (Figure 13):

1. Pamir Alpine Desert and Tundra: This ecoregion covers the high plateau of the Pamir Mountains. It is characterised by cold, arid conditions with sparse vegetation, supporting unique alpine flora and fauna.
2. Gissaro–Alai Open Woodlands: Located in the western foothills of the Tian Shan Mountains, these woodlands are characterised by juniper trees and shrubs. They form a transition zone between desert lowlands and glaciated mountain peaks.
3. Tian Shan Montane Steppe and Meadows: Stretching along the Tian Shan mountain range, this ecoregion comprises high-altitude grasslands and meadows, providing habitat for various plant and animal species adapted to cooler climates.
4. Central Asian Riparian Woodlands: Situated along riverbanks in arid regions, these woodlands feature tugai vegetation, dense thickets of trees and shrubs that rely on groundwater and support diverse wildlife.
5. Paropamisus Xeric Woodlands: Located in northeastern Afghanistan and extending into Tajikistan, this ecoregion consists mainly of dry scrublands with sparse woodland areas, adapted to arid conditions.

²⁴ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

²⁵ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

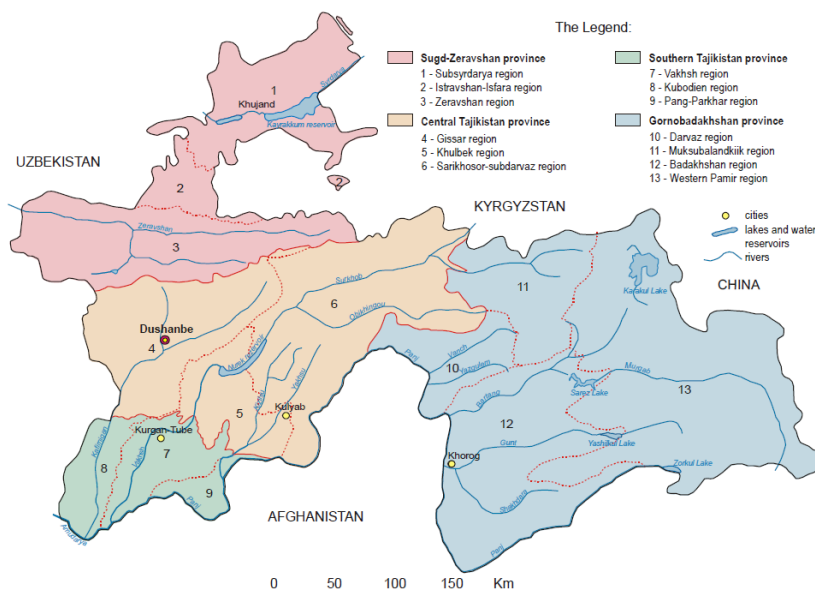


Figure 12. Ecological division of Tajikistan²⁶.

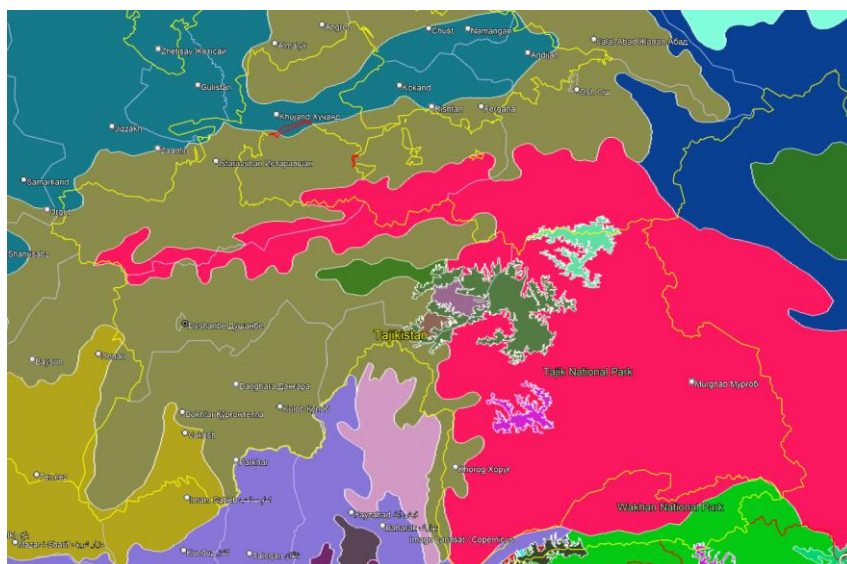


Figure 13. WWF ecoregion divisions of Tajikistan²⁷.

Tajikistan's 2003 National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity categorises the country's ecological zones based on elevation, climate, and vegetation, reflecting its mountainous terrain and diverse ecosystems (Figure 14). The primary ecological divisions include²⁸:

1. **Foothill-Plains Zone:** The zone encompasses lowland areas with fertile soils, supporting agriculture and semi-desert vegetation.
2. **Low Mountain and Valley Zone:** This zone is characterised by river valleys and lower mountain slopes, featuring diverse flora and fauna adapted to moderate elevations.
3. **Mid-High Mountain Zone:** This zone includes elevations with cooler climates, supporting coniferous forests and alpine meadows.

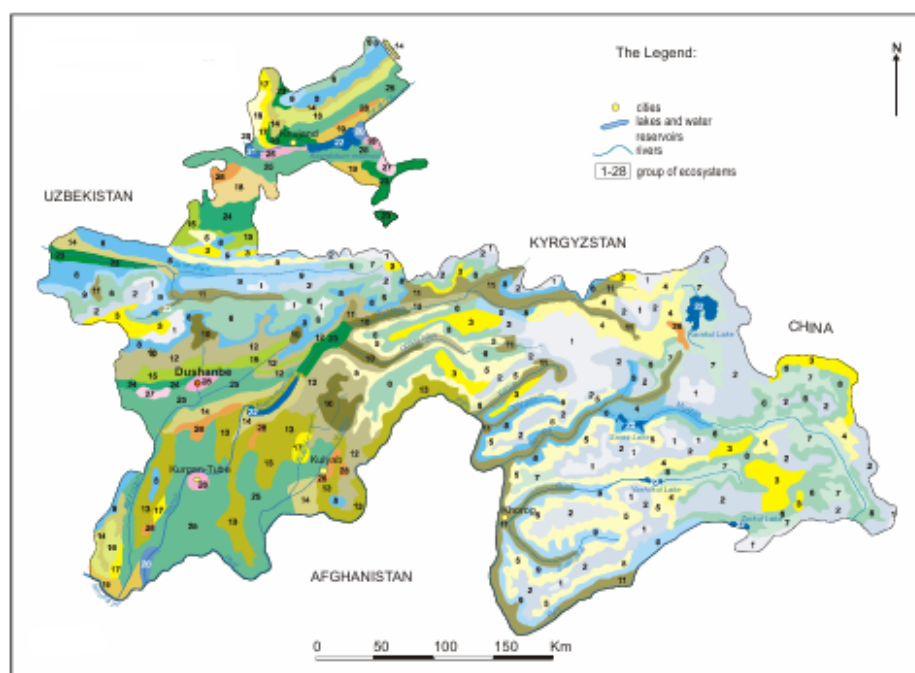
²⁶ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

²⁷ <https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world>

²⁸ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

4. **High Mountain Zone:** This zone comprises areas above the tree line dominated by alpine tundra and glacial landscapes.
5. **High Mountain Snow and Glacier Zone:** This zone features permanent snowfields and glaciers, crucial for regional water resources.

The plan further recognises nine distinct natural ecosystems that cover a considerable part of the national area and are relatively undisturbed due to their isolation, and three anthropogenic ecosystems (Table 2). These varied landscapes host distinct vegetation types and species communities, contributing to the country's ecological richness. Mountain regions, particularly the Pamir and Alay ranges, are global biodiversity hotspots, with high levels of endemism.



Legend

Nival Glacier Ecosystems

- 1 Glaciers and snowfields
- 2 Rocks and taluses with rare vegetation

High Mountain Desert Ecosystems

- 3 Rare vegetation
- 4 Wormwood-teresken, steppe
- 5 Dwarf-shrub-steppe

High Mountain Meadow and Steppe Ecosystems

- 6 Forbs meadow steppe, thymes
- 7 Low-grass meadow, swamp

Mid-Mountain Conifer Forest Ecosystems

- 8 Various-shrub steppe and light forest
- 9 Forbs meadow-forest

Mid-Mountain Mesophyllic Forest Ecosystems

- 10 Broad-leaf forest
- 11 Flood-plain small-leaf forest
- 12 Light forest, foliage tree, mesophyllic shrub

Mid-Mountain Xerophytic Light Forest Ecosystems

- 13 High-grass, shrub, pistachio
- 14 Forbs wormwood, almond

Mid-Low-mountain Semisavanna (savannoide) Ecosystems

- 15 High-grass
- 16 Forbs and shrub
- 17 Low-grass semisavanna

Foothill Semidesert and Desert Ecosystems

- 18 Low-grass, saltwort-wormwood
- 19 Sand, semi-woody, shrub

Wetland Ecosystems

- 20 Tugai
- 21 Meadow, swamp
- 22 Wetland

Agroecosystems

- 23 Gardens, forest-plantations, personal plots
- 24 Rain-fed pastures
- 25 Irrigable pastures

Urban Ecosystems

- 26 Municipal
- 27 Industrial

Ruderal-degraded Ecosystems

- 28 Weed, ruderal

Figure 14. Ecosystems of Tajikistan.

Table 2. Ecosystems of Tajikistan²⁹.

Category	Ecosystem	Description
Natural ecosystems	1. High-mountain/montane ice and nival glacier ecosystems	<ul style="list-style-type: none"> • Occur in the high-mountain landscapes of the Eastern and Western Pamirs; • play a significant role in regional/global climate regulation; • main water-source regions for Central Asia; • cold, rocky glacial landscapes; • support ~16–17 flowering plant species, including ragged robin (<i>Melandrium apetalum</i>), whitlow grass (<i>Draba altaica</i>), milk vetch (<i>Astragalus nivalis</i>), <i>Saussurea glacialis</i>, among others. Mammals such as argali (<i>Ovis ammon</i>), snow leopard (<i>Uncia uncia</i>) and Siberian ibex (<i>Capra sibirica</i>) occur around the lower bounds of these ecosystems.
	2. High-mountain desert ecosystems	<ul style="list-style-type: none"> • Cover large areas of the Eastern and Western Pamirs and occur in the Zeravshan Valley; • used for summer pasturing, tourism and international hunting; • dominant vegetation includes tereskens (<i>Ceratoides</i>), wormwoods (<i>Artemisia pamirica</i>, <i>A. korshinskyi</i>), <i>Ajania tibetica</i>, feather-grasses (<i>Stipa glareosa</i>), <i>Oxytropis immerse</i>, <i>Acantholimon diaspensoides</i>, and <i>A. pamiricum</i>. Key plant communities are wormwood-teresken and meadow-steppe, containing several endemic, rare or endangered plants (e.g. Badakhshan dandelion <i>Taraxacum badachschanicum</i>, Pamir desederia <i>Desideria pamirica</i>). Fauna include argali (<i>Ovis ammon</i>), snow leopard (<i>Uncia uncia</i>), Siberian ibex (<i>Capra sibirica</i>), red marmot (<i>Marmota caudata</i>), Tibetan sandgrouse (<i>Syrrhaptes tibetana</i>), and butterflies such as swallowtail (<i>Papilio machaon</i>), Apollo (<i>Parnassius apollo</i>), and Alexanor (<i>Papilio alexanor</i>); • anthropogenic pressure is leading to pasture degradation and declines in wild animal populations.
	3. High-mountain meadow and steppe ecosystems	<ul style="list-style-type: none"> • Occurring fragmentarily or as belts across Tajikistan's mountain ranges; • are ecologically significant and host many rare and endemic species; • dominant plant species include fescues (<i>Festuca alaica</i>, <i>F. pamirica</i>), feather grass (<i>Stipa kirghisorum</i>), meadow grass (<i>Poa alpina</i>), sedges (<i>Carex melanantha</i>, <i>C. stenocarpa</i>), <i>Cobresia stenocarpa</i>, <i>Oxytropis savellanica</i>, and thyme (<i>Thymus seravschanicus</i>); • over-grazed areas (≥30%) show reduced productivity (from ~20–25 centners per hectare to 10–12)³⁰, with significant losses of high-value species (≥150 rare or endangered); • fauna include snow leopard (<i>Uncia uncia</i>), argali (<i>Ovis ammon</i>), red marmot (<i>Marmota caudata</i>), Tibetan sandgrouse (<i>Syrrhaptes tibetana</i>), Siberian ibex (<i>Capra sibirica</i>) and Tibetan snow partridge (<i>Tetrogallus tibetanus</i>).
	4. Mid-mountain conifer (juniper/light) forest ecosystems	<ul style="list-style-type: none"> • Comprising ~50% of Tajikistan's forest cover; • occur in northern mountain ranges (Kuramin, Turkestan, Zeravshan); • regulate water, stabilise soils and prevent mudflows,

²⁹ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 2. [Available online.](#)

³⁰ Centners per hectare (c/ha) is a metric unit of yield or productivity, commonly used in agriculture, forestry, and ecology in some regions, especially in former Soviet Union countries. One centner = 100 kg; Therefore, 1 c/ha = 100 kg of product per hectare of land

Category	Ecosystem	Description
		<ul style="list-style-type: none"> dominant juniper species include <i>Juniperus seravschanica</i>, <i>J. turkestanica</i>, <i>J. semiglobosa</i>, and <i>J. sibirica</i>. Noteworthy fauna include Tien Shan brown bear (<i>Ursus arctos</i>), urial (<i>Ovis vignei</i>), Tajik markhor (<i>Capra falconeri</i>), Levant viper (<i>Vipera lebetina</i>), and ring dove (<i>Columba palumbus</i>); valuable community types: motley-shrub-steppe and forb-meadow juniper forests.
	5. Mid-mountain mesophyllic broadleaf forest ecosystems	<ul style="list-style-type: none"> Include maple-walnut (<i>Juglans regia</i>, <i>Acer turkestanicum</i>) and willow-poplar-birch forests, with light shrub understorey; valuable communities occur in Sarikhosor, Childukhtaron and Dashti-Jum reserves; notable flora are <i>Ungernia victoris</i>, <i>Ostrowskia magnifica</i>, <i>Cousinia darwasica</i>, <i>Iskandera hissarica</i>, <i>Stipa jagnobica</i>; notable fauna include weasels (<i>Mustela pallida</i>, <i>M. heptneri</i>), Turkestan lynx (<i>Felis lynx isabellina</i>), snow leopard (<i>Uncia uncia</i>), urial (<i>Ovis vignei</i>), Tien Shan brown bear (<i>Ursus arctos</i>), yellow porcupine (<i>Hystrix leucura</i>); birds: ring dove (<i>Columba palumbus</i>), pheasant (<i>Phasianus colchicus</i>), golden eagle (<i>Aquila chrysaetus daphanea</i>), Egyptian vulture (<i>Neophron percnopterus</i>). Forests contain wild relatives of fruit trees (<i>Malus</i>, <i>Pyrus</i>, <i>Prunus</i>, <i>Crataegus</i>, <i>Berberis</i>); forest area is declining and restoration is lacking.
	6. Mid-mountain xerophytic light forest ecosystems	<ul style="list-style-type: none"> Occupy southern and western Tajikistan; dominant vegetation includes pistachio forest (pistachio, wormwood, almond), which helps regulate water and supports arid-zone wildlife; mammals include Persian gazelle (<i>Gazella subgutturosa</i>), urial (<i>Ovis vignei</i>), wolf (<i>Canis lupus</i>), fox (<i>Vulpes vulpes</i>); reptiles include Central Asian cobra (<i>Naja oxiana</i>) and steppe tortoise (<i>Testudo horsfieldi</i>); contains wild relatives of barley (<i>Hordeum spontaneum</i>), vetch (<i>Vicia tenuifolia</i>), almond (<i>Amygdalus bucharica</i>), persimmon (<i>Diospyros lotus</i>), jujube (<i>Zizyphus jujuba</i>), pomegranate (<i>Punica granatum</i>) and grape (<i>Vitis vinifera</i>); are becoming secondary due to intensive cutting.
	7. Mid-low-mountain semi-savanna ecosystems	<ul style="list-style-type: none"> Widespread across southern and northern Tajikistan in hot climates; vegetation communities dominated by barley (<i>Hordeum bulbosum</i>), meadow grass-sedge (<i>Poa bulbosa</i>, <i>Carex pachystylis</i>), ferule (<i>Ferula kokanica</i>, <i>F. kuhistanica</i>), Jerusalem sage (<i>Phlomis bucharica</i>); fauna include amphibians and reptiles such as steppe tortoise (<i>Testudo horsfieldi</i>), glass lizard (<i>Ophisaurus apodus</i>); endemic or rare species such as seese partridge (<i>Ammoperdix griseogularis</i>), great bustard (<i>Otis tarda</i>), Schneider's skink (<i>Eumeces schneideri</i>), Persian gazelle (<i>Gazella subgutturosa</i>), Turkestan saker falcon (<i>Falco cherrug</i>), golden eagle (<i>Aquila chrysaetus</i>); ~70% of these ecosystems suffer severe degradation caused by deforestation, intensive ploughing, fire, absence of rotation, poor haymaking methods, and unregulated grazing.
	8. Foothill semidesert-desert ecosystems	<ul style="list-style-type: none"> Found on high terraces along major river lower reaches (Pyandj, Vakhsh, Kafirnigan, Syrdarya, Zeravshan);

Category	Ecosystem	Description
		<ul style="list-style-type: none"> • vegetation includes saxaul (<i>Haloxylon persicum</i>), black saxaul, <i>Calligonum litvinovii</i>, <i>Salsola richteri</i>, <i>Artemisia tenuisecta</i>, <i>Hammada leptoclada</i>, <i>Carex physodes</i>, <i>Halostachys belangeriana</i>, <i>Halocharis hispida</i>; • they protect soils, prevent erosion, and serve as winter pastures; • mammals include Persian gazelle (<i>Gazella subgutturosa</i>), golden jackal (<i>Canis aureus</i>), big-eared hedgehog (<i>Paraechinus hyromelus</i>), steppe cat (<i>Felis ornata</i>); • reptiles include steppe agama (<i>Agama sanguinolenta</i>), grey monitor lizard (<i>Varanus griseus</i>), spotted brown snake (<i>Taphrometopon lineolatum</i>), saw-scaled viper (<i>Echis carinatus</i>); • many areas are degraded or converted to cotton cultivation; • ~30 000 ha neighbour Tigrovaya Balka Reserve.
	9. Wetland and tugai ecosystems	<ul style="list-style-type: none"> • Include tugai forests, meadow-swamp and wetland ecosystems in the river lower reaches; • crucial for global ecological balance and Eurasian waterfowl regulation; • systems support fish, fur-bearing mammals and birds; intact tugai remain only in Tigrovaya Balka Reserve; • they host ~645 plant species (>70% tugai-specific, ~30% shared with meadow-swamp/desert); • dominant vegetation: <i>Populus pruinosa</i>, <i>Elaeagnus angustifolia</i>, <i>Lycium dasystemum</i>, <i>Typha angustifolia</i>, <i>Imperata cylindrica</i>, <i>Phragmites communis</i>, <i>Saccharum spontaneum</i>, <i>Tamarix hispida</i>, <i>Juncus articulatus</i>. Wintering birds: white and grey heron (<i>Egretta alba</i>, <i>Ardea cinerea</i>), bittern (<i>Botaurus stellaris</i>), garganey (<i>Anas querquedula</i>), Eurasian teal (<i>A. crecca</i>), marsh harrier (<i>Circus aeruginosus</i>), water rail (<i>Rallus aquaticus</i>), moorhen (<i>Gallinula chloropus</i>), pheasant (<i>Phasianus colchicus</i>), pygmy cormorant (<i>Phalacrocorax pygmeus</i>), great cormorant (<i>P. carbo</i>), short-toed snake eagle (<i>Circaetus gallicus</i>); • Tugai mammals include jungle cat (<i>Felis chaus</i>), golden jackal (<i>Canis aureus</i>), Bukhara deer (<i>Cervus elaphus bactrianus</i>) • aquatic biodiversity includes ~330 higher plant species: arcto-alpine sedges and <i>Cobresia</i> species in mountain reservoirs; in lowland reservoirs, species like <i>Equisetum arvense</i>, <i>Potamogeton crispus</i>, <i>Anagallis arvensis</i>, <i>Carex orbicularis</i>, <i>Phragmites communis</i>; • foothill wetlands are critically degraded by irrigation runoff.
Anthropogenic ecosystems	10. Agroecosystems	<ul style="list-style-type: none"> • Found from foothills (~300 m a.s.l.) to high-altitude deserts (3 000–3 500 m a.s.l.); • cultivated soils host many wild relatives of cereals, legumes, industrial and forage plants as genetic resources across ~4 M ha (including pastures); • Approximately 1,550 fruit/berry, 463 vegetable/melon, 46 cereal, 39 legume, 25 industrial, 39 forage and ~1,850 ornamental crop varieties are adapted locally; • ~50% are indigenous; • domestic animal breeds number ~30; • yak conservation in highlands is notable; • non-sustainable irrigation and crop-rotation practices harm soil fertility and increase landslide risk on steep slopes.

Category	Ecosystem	Description
	11. Urban ecosystems	<ul style="list-style-type: none"> • Include cities (Dushanbe, Khujand, Isfara, Kanibadam, Istaravshan, Kulyab, Kurgan-Tyube, Tursunzade) plus settlements and industrial areas; • expansion involves new water supply, central heating, treatment zones and artificial green belts; • urban ecosystems harbour many invasive species.
	12. Ruderal/degraded ecosystems	<ul style="list-style-type: none"> • Present across human-impacted zones, particularly pasture areas; • harmful species include <i>Colchicum luteum</i>, <i>Thermopsis dolichocarpa</i>, <i>Trichodesma incanum</i>, <i>Heliotropium dasicarpum</i>, and <i>Artemisia</i> spp.; • dominant plant families include Asteraceae, Poaceae, Polygonaceae, Ranunculaceae, Hypericaceae and Lamiaceae. Foothill ruderal habitats are often simple communities (e.g. <i>Capparis spinosa</i>, <i>Hordeum leporinum</i>, <i>Salsola</i> spp., <i>Alhagi kirghisorum</i>); • low-mountain variants include <i>Cynodon dactylon</i>, <i>Prosopis farcta</i>, <i>Cousinia</i> spp., and forbs; • secondary regrowth after forest cutting features <i>Glycyrrhiza</i>, <i>Saccharum spontaneum</i>, <i>Alhagi kirghisorum</i>, and <i>Imperata cylindrica</i>; • sub-alpine long-grazed areas have <i>Rumex paulsenianus</i> and <i>Polygonum coriarium</i>; • alpine ruderal zones include <i>Artemisia</i> with meadow-steppe vegetation; • ruderal flora comprises ~690 species and 30 community types.

Forests

Tajikistan's mountain ranges form part of a global biodiversity hotspot. Fruit-and-nut forests host the wild ancestors of numerous domesticated species, including apples, pears, pistachios, almonds, and cherries³¹. As of 2020, the total land area under Tajikistan's State Forest Fund was estimated at 1.9 million hectares, which includes land without forest. Following the collapse of the Soviet Union, Tajikistan experienced severe deforestation, and today it is considered one of the most sparsely forested countries in the region, with forest area in 2020 covering approximately 423,800 hectares, or only 3% of the national land area. Natural regenerating forest comprises 72% and planted forests 28%. Regarding disturbance, primary forest was 70% and other forest was 30%. Precise estimates of the forestry sector's mitigation potential remain unknown, and forestry is among the least explored sectors regarding climate change impacts and its potential contributions to mitigation and adaptation³². Hawthorn forests make up a significant portion of the country's forest cover. Pistachio forests, which are well adapted to hot and dry climates, are predominantly found in the southern regions at elevations between 600 and 1,400 metres above sea level (masl). Walnut forests, which require fertile soils and favourable climatic conditions, are located in the central areas at altitudes ranging from 1,000 to 2,000 masl. Juniper forests are among the most prominent forest types nationally, extending from 1,500 to 3,200 masl elevations. Other forest types, including poplars, willows, birches, and sea-buckthorns, occur in more fragmented distributions throughout the country. Between 2009–2018, reforestation activities occurred on 7,315 ha. The government has committed to improve 66,000 ha by 2030, including 15,000 ha of afforestation and 30,000 ha of reforestation. A further 120,000 ha has been targeted to promote natural regeneration by 2030^{33,34}.

Protected area management

Tajikistan has demonstrated a strong national commitment to biodiversity conservation by establishing an extensive network of protected areas and a dedicated institutional framework. These efforts aim to conserve the country's rich and unique ecosystems, safeguard endangered species, and promote sustainable land-use practices. Tajikistan's protected area system encompasses many ecological zones and currently covers approximately 22% of the country's total land area. The system includes³⁵:

- Four strict nature reserves
- Two national parks
- Seventeen conservation areas

The most prominent is the Tajik National Park, spanning over 2.6 million ha. Established in 1992, this park covers many ecosystems, including high-altitude lakes, glaciers, alpine meadows, and endemic-rich habitats. These protected areas are essential for maintaining ecological integrity and supporting climate resilience by preserving vital ecosystem services. The National Biodiversity and Biosafety Centre (NBBC) is the central coordinating body for biodiversity conservation in Tajikistan. Established through Government Decree No. 392 in 2003, the NBBC plays a pivotal role in fulfilling the country's obligations under the UN Convention on Biological Diversity and related international agreements. The NBBC's key functions include^{36,37}:

- Coordinating the implementation of the National Biodiversity Strategy and Action Plan (NBSAP) and related conservation programmes.
- Creating and maintaining a comprehensive national flora, fauna, ecosystems, and landscapes database.
- Attracting and coordinating financial and technical support from domestic and international donors.

³¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

³² Tajikistan's Fourth National Communication 2022. [Available online.](#)

³³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

³⁴ FAO Global Forest Resources Assessment 2020. Tajikistan. [Available online.](#)

³⁵ BioDB 2023. Tajikistan. [Available online.](#)

³⁶ <https://constructive-voices.com/tajikistan-biodiversity/>

³⁷ BioDB 2023. Tajikistan. [Available online.](#)

- Monitoring, evaluating, and reporting on biodiversity conservation initiatives, including preparing national status reports and annual assessments.
- Promoting the integration of biodiversity into sectoral and cross-sectoral policies, and supporting policy analysis and implementation.

The NBBC collaborates with government agencies, academic institutions, local communities, and international and national NGOs, ensuring a multi-stakeholder approach to conservation planning and implementation³⁸.

Tajikistan's conservation strategy also recognises the importance of agrobiodiversity and traditional farming systems. Traditional agricultural practices have historically contributed to the in situ conservation of locally adapted crop and livestock varieties, supporting food security and biodiversity conservation. The government promotes sustainable agriculture and the preservation of indigenous knowledge to ensure the continuation of these practices. At the same time, forest ecosystem degradation due to overharvesting, grazing, and land conversion remains a significant concern. Forest loss has adversely affected both biodiversity and local livelihoods. As a response, efforts are underway to conserve and restore forest ecosystems, focusing on ecological restoration, improved land-use planning, and sustainable forest management³⁹.

Despite these achievements, several challenges constrain effective protected area and biodiversity management in Tajikistan:

- Limited and inconsistent financial resources for protected area management and ecosystem restoration.
- Gaps in technical and institutional capacity, particularly in the application of modern conservation practices and technologies.
- Inadequate monitoring and enforcement mechanisms, especially in remote and high-altitude regions.
- Increasing pressure from climate change, population growth, and land-use intensification.

Tajikistan's protected area network and biodiversity governance framework provide a strong foundation for future climate-resilient conservation and sustainable land use. Strengthening institutional capacities, securing long-term financing mechanisms, and enhancing inter-sectoral collaboration will be crucial for scaling up conservation efforts and ensuring the resilience of ecosystems that underpin livelihoods and national development priorities^{40,41}.

Biodiversity of Tajikistan

The country's biodiversity includes endemic and threatened plant and animal species, many of which are listed in the Red Data Book of Tajikistan. The Institute of Botany, Physiology, and Plant Genetics leads research on flora classification, botanical resource use, plant-environment relationships, physiology, genetics, and biotechnology. Tajikistan is also a centre of origin for several agricultural crops, making agrobiodiversity critical for food security and national sovereignty⁴².

The varied topography spanning high-altitude mountain ranges, alpine meadows, river valleys, deserts, and glaciers creates a mosaic of ecosystems supporting a rich flora and fauna. The Pamir Mountains dominate the eastern region, often called the Roof of the World, which constitutes a globally significant centre of biodiversity. These high-elevation landscapes are inhabited by rare and iconic species uniquely adapted to extreme environmental conditions. Notable fauna include the snow leopard (*Panthera uncia*), Marco Polo sheep (*Ovis ammon polii*), Siberian ibex (*Capra sibirica*), and the endangered Pamir argali. The alpine meadows and tundra

³⁸ <https://constructive-voices.com/tajikistan-biodiversity/>

³⁹ <https://constructive-voices.com/tajikistan-biodiversity/>

⁴⁰ <https://constructive-voices.com/tajikistan-biodiversity/>

⁴¹ BioDB 2023. Tajikistan. [Available online.](#)

⁴² <https://constructive-voices.com/tajikistan-biodiversity/>

zones of the Pamirs also support a range of endemic and medicinal plant species, including various wildflowers and herbaceous plants with traditional therapeutic uses⁴³.

The country's river valleys, including those of the Amu Darya and Syr Darya, are vital for both biodiversity conservation and agricultural production. These riparian zones sustain forests and wetlands that serve as critical habitats for numerous aquatic and terrestrial species. Wetland ecosystems, in particular, function as essential stopover points for migratory bird species, such as the common crane (*Grus grus*), various species of ducks, and geese⁴⁴.

In the southern and western regions, Tajikistan's desert and semi-desert zones, including areas like the Kyzylkum Desert, support arid-adapted ecosystems with specialised biodiversity. Faunal species in these environments include the goitered gazelle (*Gazella subgutturosa gracilicornis*), desert fox (*Vulpes vulpes pusilla*), and several reptile species. Vegetation in these areas comprises drought-tolerant species such as saxaul (*Haloxylon spp.*), tamarisk (*Tamarix spp.*), and various xerophytic grasses⁴⁵.

This ecological richness underscores the importance of conserving Tajikistan's diverse habitats, which are critical in maintaining regional biodiversity, ecosystem services, and community resilience. Tajikistan's biodiversity is rich, comprising around 5,000 higher flowering plant species, approximately 1,000 species of algae, over 1,500 species of fungi, and about 500 species each of lichens and mosses. Around 10 genera and more than 1,000 species are endemic, found only within the country's borders. Additionally, approximately 400 species of medicinal plants are widely used by the local population, alongside over 100 species of food- and vitamin-bearing plants, and about 60 species, including three ether-bearing plants, found across the republic⁴⁶.

Ecosystem threats

Tajikistan's rich biodiversity faces mounting pressures from anthropogenic activities and climate change. These threats compromise the integrity of ecosystems and their services, posing significant challenges to conservation and sustainable development.

1. Land Degradation and Soil Erosion

Soil degradation remains a critical issue, with arable land decreasing by 3.2% over the past 15 years due to erosion and unsustainable agricultural practices. The country's mountainous terrain, combined with deforestation and overgrazing, exacerbates soil erosion, reducing agricultural productivity and habitat loss⁴⁷. Land degradation imposes growing economic burdens. In 2023, costs exceeded US\$325 million and are projected to rise beyond US\$782 million by 2050 if current trends persist. These costs stem from foregone agricultural productivity, greenhouse gas emissions, degraded ecosystem services, and damage to critical infrastructure, including irrigation, hydropower and transport systems. Degradation also disrupts essential public services, such as schools and healthcare facilities. Agriculture bears the highest share of land degradation costs, accounting for ~73% of total losses. From 2024 to 2050, foregone crop and livestock production and emissions are projected to cost an average of US\$181 million annually (in present value terms). Addressing these multifaceted threats requires integrated approaches that combine conservation efforts with sustainable land management, climate adaptation strategies, and community engagement. Strengthening institutional capacities and fostering international cooperation are essential to safeguard Tajikistan's biodiversity for future generations^{48,49}.

⁴³ BioDB 2023. Tajikistan. [Available online.](#)

⁴⁴ BioDB 2023. Tajikistan. [Available online.](#)

⁴⁵ BioDB 2023. Tajikistan. [Available online.](#)

⁴⁶ Tajikistan's Fourth National Communication 2022. [Available online.](#)

⁴⁷ <https://constructive-voices.com/tajikistan-biodiversity/>

⁴⁸ <https://constructive-voices.com/tajikistan-biodiversity/>

⁴⁹ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

2. **Deforestation and Forest Ecosystem Decline**
Although reforestation programs have successfully reduced illegal logging by 95–97%, forests still cover only about 2.9% of Tajikistan's land area. The limited forest cover, primarily composed of primary forests, is vulnerable to overexploitation and climate-induced stresses⁵⁰.
3. **Overexploitation of Biodiversity Resources**
Population growth has intensified the demand for natural resources. This has led to increased deforestation, overfishing, and hunting, particularly in areas rich in wild fruit trees and other valuable species, threatening the survival of endemic flora and fauna⁵¹.
4. **Climate Change Impacts**
Climate change poses a significant threat to Tajikistan's biodiversity. Rising temperatures, altered precipitation patterns, and extreme weather events disrupt habitats and species distributions. Notably, a recent heatwave saw temperatures soar 5–10°C above pre-industrial levels, an event attributed to climate change, impacting agriculture and water resources⁵².
5. **Loss of Genetic Diversity and Agrobiodiversity**
The shift towards uniform, high-yield crop varieties has led to a decline in agrobiodiversity. Traditional farming practices that preserved diverse genetic resources are being abandoned, reducing the resilience of agricultural systems to pests, diseases, and climate variability⁵³.
6. **Desertification and Water Scarcity**
Extended dry periods and increased temperatures contribute to desertification, particularly in the southern and central regions. These conditions, coupled with inefficient water use, exacerbate water scarcity, affecting both human populations and ecosystems⁵⁴.
7. **Invasive Species and Habitat Fragmentation**
The introduction of non-native species and habitat fragmentation due to infrastructure development further threaten native biodiversity. These factors disrupt ecological balances, leading to declines in native species populations⁵⁵.

Tajikistan faces high exposure to natural hazards such as floods, earthquakes, landslides, and wildfires, all of which pose increasing threats to ecosystems and the vital services they provide. A recent World Bank risk assessment estimates that natural disasters could cost the country up to 18% of GDP, with flood-related damages alone projected to double by 2050. Rising temperatures, occurring faster than the global average, are accelerating glacial melt, intensifying hydrological variability, and placing mounting pressure on fragile mountain ecosystems. The degradation of forested and vegetated slopes, particularly in mountainous areas around Dushanbe, Bokhtar, and Kulob, is reducing natural buffers against erosion, landslides, and flash floods. This ecological degradation increases the vulnerability of both urban and rural populations to climate and disaster risks. Air pollution and the loss of natural vegetation further diminish ecosystem services such as water regulation, carbon sequestration, and microclimate stabilisation. Urban areas are particularly at risk. In Dushanbe, nearly the entire population resides in an earthquake-prone zone, with 2.5% vulnerable to pluvial flooding and landslides. In Khujand, 60% of residents face seismic risk, and smaller proportions are exposed to floods and landslides. The scarcity of urban green space, 12 m² per capita in Dushanbe and just 2 m² in

⁵⁰ <https://worldrainforests.com/deforestation/forest-information-archive/Tajikistan.htm>

⁵¹ <https://constructive-voices.com/tajikistan-biodiversity/>

⁵² <https://earth.org/climate-change-made-bonkers-central-asia-heatwave-up-to-10c-hotter-report/>

⁵³ <https://www.unep.org/news-and-stories/story/curbing-agrobiodiversity-deterioration-central-asia>

⁵⁴ <https://ca-climate.org/eng/news/ledniki-tadzhikistana-intervyu-s-ekspertom/>

⁵⁵ <https://constructive-voices.com/tajikistan-biodiversity/>

Khujand, compared to a European average of 18.2 m², limits both climate resilience and public health benefits provided by urban ecosystems⁵⁶.

2.2. Socioeconomic context

2.2.1. Population and demography

Tajikistan is experiencing very rapid population growth. Over the period from 2000 to 2019, the country's population grew by 52% from 6.13 million to 9.31 million people. By mid 2024, this number had increased to 10.59 million of which 49.13% were male and 50.87% were female⁵⁷. According to forecast data, with a growth rate of 2.1%, the population of Tajikistan will reach 11.5 million people by 2030, which is 88% higher than in 2000, 55% higher than in 2010 and 26% higher than in 2019⁵⁸. The population density increased from 42.8 people per km² in 2000 to 64.5 people per km² in 2019⁵⁹. Such a trend has continued with the population density reaching 74 people per km² in 2024⁶⁰. Although the average population density is not very high, it varies significantly due to the geographical features of the mountainous terrain, and the most densely populated areas are the lowlands of Northern and Southwestern Tajikistan. The lowest population density is observed in mountainous regions, where the density is less than 50 people per km² of territory. In GBAO, the population density is 3.5 people per km². The highest population density is in the city of Dushanbe, 8,486 people per km², and in other major cities of the country⁶¹.

The population is divided into four central regions and Dushanbe as follows: Khatlon region with 35.9% of the population; Sughd region, which has 29.1% of the population, GBAO 2.5%, Republican Subordination Districts (RSD) 23.2% and Dushanbe 9.3%⁶². Dushanbe has a population of 846,400 people, with other major cities including Khujand, Bokhtar and Kulyab, having populations of 180,700, 109,900, and 104,900, respectively⁶³. In 2019, 73.7% of the total population resided in rural regions, whereas 26.3% resided in urban areas. In 2023, the percentage of the total population living in rural areas decreased to 71.8%, showing an increasing trend in urbanisation and increasing density of populations in urban areas⁶⁴. At least 50% of the population comprises children, the elderly, or the disabled. The number of children under 17 years of age is at least 40% of the country's total population. According to the Agency for Statistics of the Republic of Tajikistan in 2019, the total number of elderly people in the country was 700,000 or 8% of the total population. More than 180,000 people, or 2.2% of the total population, are disabled⁶⁵.

2.2.2. Economy

The economy of Tajikistan is primarily agro-industrial, with agriculture as its basis: cotton growing, crop production, animal husbandry, industry, mechanical engineering, aluminium production, mineral fertilisers, textile and light industry, energy and consumer goods production. The modern development of industry in the country is based on a large stock of raw materials for the metallurgical, chemical and construction industries. More than 600 deposits of precious stones, non-ferrous, and rare metals have been explored in the country, and they contain more than 50 types of raw mineral materials. In 2019, compared to 1990, the number of enterprises in the industrial sector increased from 300 to 1,996 units, enterprises in the construction complex from 30 to 997 units, and the chemical and petrochemical industry from 10 to 58 units. Despite the COVID-19 pandemic in 2020, the industrial sector still accounted for 21.9% of GDP⁶⁶.

⁵⁶ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

⁵⁷ Database.earth 2025. Population of Tajikistan. [Available online.](#)

⁵⁸ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁵⁹ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶⁰ [Population of Tajikistan 1950-2024 & Future Projections](#)

⁶¹ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶² [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶³ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶⁴ [Tajikistan - Rural Population - 2025 Data 2026 Forecast 1960-2023 Historical](#)

⁶⁵ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶⁶ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

In addition to the global economic climate and pandemics, local markets experience volatility due to relative remoteness and communication isolation from the existing international transport infrastructure, high altitude terrain, and lack of access to the sea, which determines the unfavourable economic and geographical position. From 2010 to 2019, GDP increased by 43.8%, including agriculture by 45.2%, industry by 70%, construction by 24.2%, transport and communications by 15%, and services by 51%. The total GDP in 2019 amounted to US\$8.1 billion, US\$840 per capita. GDP growth and GDP per capita have increased steadily between 2020 and 2023 (Table 3) due to changing market dynamics, enhanced global trade, economic reforms and industrial development. In the structure of GDP, 19.8% is accounted for by agricultural products, 17.4% for industry, 8.8% for construction, 34.7% for the service sector, 8.9% for transport and communications and 10.4% for net tax on products. The country's public external debt at the end of 2018 amounted to \$2.9 billion (40% of GDP) compared to 24% in 2014. According to the World Bank, real GDP growth slowed from 7.3% in 2018 to 6.2% in 2019. It decreased further to 4.1% in 2020 due to the weakening Russian economy and the decline in world commodity prices associated with the regression due to COVID-19. By the end of 2020, GDP amounted to over US\$8 billion, and the inflation rate in 2020 was 9.4%, which is 1.4 percentage points higher than in 2019 (8%)⁶⁷. By 2023, GDP had increased to over US\$12 billion and continued such a trend with an 8.4% increase to over US\$14 billion in 2024⁶⁸.

Table 3. GDP in Tajikistan^{69,70}.

GDP Tajikistan	2024	2023	2022	2021	2020
Annual GDP (US\$ billion)	14.20	12.24	10.71	8.94	8.13
GDP per capita (US\$)	1,341.20	1,178.50	1,052.20	896.70	834.30

2.2.3. Income and poverty

Tajikistan made significant progress in reducing poverty before the COVID-19 pandemic. From 2012 to 2018, the poverty level in Tajikistan decreased by 10%, from 37.4% to 27.4%. Data analysis showed that the factors of poverty reduction were, among other things, wage increases, money transfers from different countries, and timely pension payments. In the world ranking on the Human Capital Index (HCI), Tajikistan ranked 57th among 130 countries in 2018 with an indicator of 0.53. This score had remained almost the same at 0.5 in 2020, and the country ranked 107 out of 169 countries. This means that the contributions of health and education to worker productivity had not changed much, while other countries in Asia had experienced improvement in HCI in the same period⁷¹.

In 2022, 22.5% of the population lived below the national poverty line, which is still considerable. After the COVID pandemic, it has remained a challenge to reduce unemployment rates. Regions also show a significant variation in poverty levels. In 2020, the GBA and Khatlon regions showed the worst poverty scores compared to Dushanbe (Figure 15). This is also primarily attributed to labour migration, increasing inequality, and limited access to education and employment. The level of poverty is still widely prevalent in the rural areas and among women and girls, due to more restricted access to employment. Other reasons for the persistence of poverty are the lack of well-paid employment, skills shortage and labour migration. Statistics indicate that 11.4% of the total population was unemployed in 2023. Of the total employed population, 46% are employed in agriculture, 6.8% in industry, 8.6% in construction, 12.2% in trade and services, 4.6% in public administration, 4.1% in healthcare, 8.1% in education and 9.3% in other sectors of the economy (finance, communications, science)⁷².

⁶⁷ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶⁸ [Tajikistan's GDP grows 8.4% in 2024](#)

⁶⁹ <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=TJ>

⁷⁰ <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=TJ>

⁷¹ [Countries ranked by Human capital index \(HCI\) \(scale 0-1\)](#)

⁷² [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

Impressive poverty reduction rates and investments in public services, such as education, have also increased the Human Development Index (HDI). The HDI score of the Republic of Tajikistan improved from 0.642 in 2015 to 0.656 in 2019. In 2024, the country's HDI had improved further to 0.679⁷³. Thus, the country ranks 128th among 189 countries worldwide, indicating steady progress in improving the quality of life and human development. Yet, the inequality-adjusted HDI was 0.574, or 11% lower than the total HDI indicator. This indicates losses in human development due to inequality. Furthermore, research shows that the average annual HDI growth is slowing down due to rapid population growth and economic difficulties. In 2020, the GBA and Khatlon regions showed the poorest HDI scores compared to Dushanbe. This is also primarily attributed to labour migration, reduced access to public services, education, and employment⁷⁴.

Tajikistan is a middle-income country with household incomes mainly used for personal consumption, while savings are either insignificant or absent, reducing resilience to economic and financial setbacks. Income had improved by 2024, with the proportion of the employed population living on less than US\$2.15 a day being 2.1%. Also, the average Monthly Household Income per Capita was reported at US\$91 in 2023, an improvement from US\$79 in 2022⁷⁵. Despite progress in income generation, this is still significantly less than the regional average. The average daily income in Asia in 2023 was US\$18⁷⁶. The daily income for those employed in Tajikistan was a mere US\$5.33, in the same year⁷⁷. Similarly, income inequality has been an inhibiting factor to economic progress. In 2015, the country's GINI coefficient was 34%, a measure of income inequality, with higher values indicating greater disparity between a country's most affluent and poorest inhabitants. This value is higher than that of Kazakhstan, Uzbekistan and Kyrgyzstan, indicating that income inequality is more prominent in Tajikistan compared to these neighbouring countries⁷⁸.

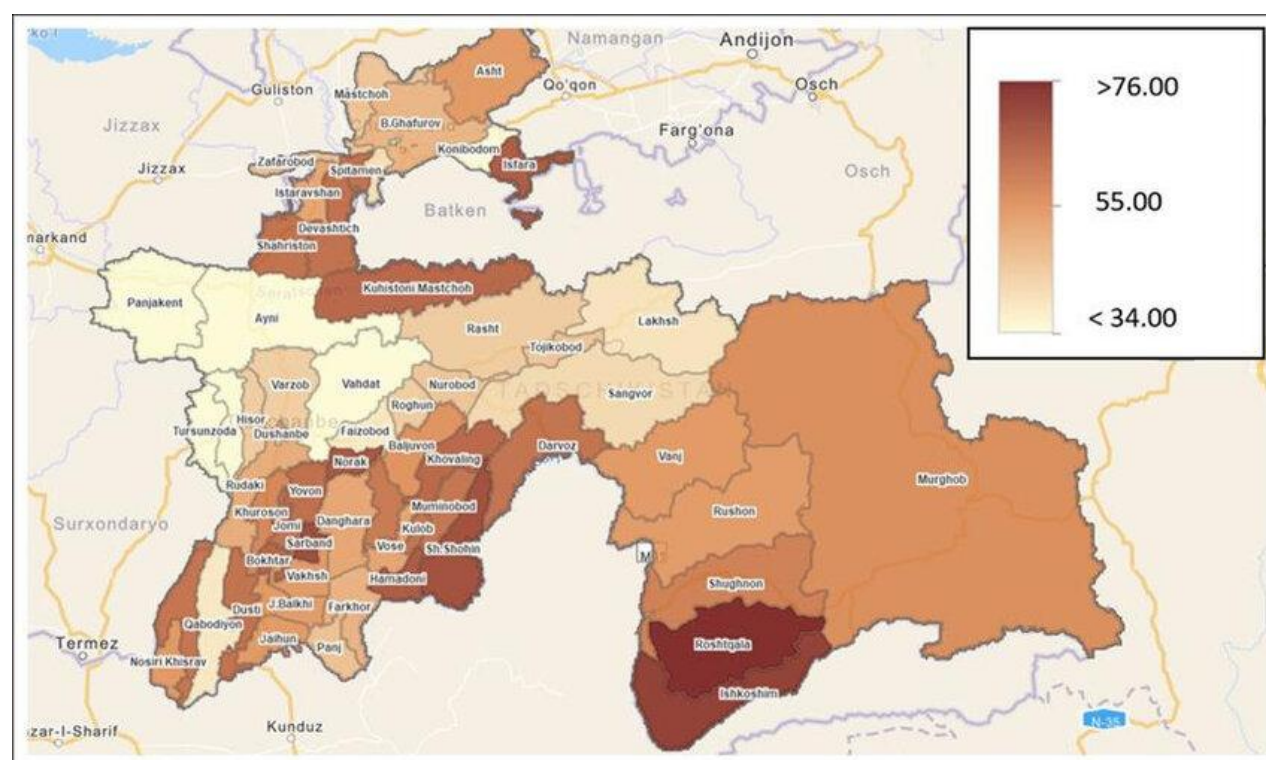


Figure 15. Poverty distribution according to region, Tajikistan, 2020⁷⁹.

⁷³ [Human Development Index \(HDI\) – Country Rankings 2024 - The Facts Institute](#)

⁷⁴ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁷⁵ [Tajikistan Average Monthly Household Income per Capita | Economic Indicators | CEIC](#)

⁷⁶ [Average income around the world](#)

⁷⁷ [The median income of Tajiks was estimated at \\$5.33 per day | Tajikistan News ASIA-Plus](#)

⁷⁸ [Gini index - Tajikistan | Data](#)

⁷⁹ Schütte, Stefan & Dörre, Andrei. 2020. Exchange Relations and Regional Development in Gorno-Badakhshan, Tajikistan. Figure 8 Poverty Distribution Map. [Available online.](#)

2.2.4. Gender considerations

Large gender disparities persist in Tajikistan, particularly in areas such as tertiary education enrolment, labour force participation, wage equity, intra-household decision-making, and control over productive assets⁸⁰. Gender inequality has remained a notable factor contributing to reduced economic growth and social development across the country. Contributing to this include traditions and gender stereotypes adopted regarding the role of women in the family and society. Furthermore, many female-headed households exist due to large-scale male labour migration. Women remain vulnerable to climate change impacts due to unequal income, health, education and representation opportunities. Gender inequality and gender development still have considerable room for improvement, which is reflected in the country's GDI (Gender Development Index) and GII (Gender Inequality Index) values. GII reflects gender-based disadvantage in three dimensions: reproductive health, empowerment, and the labour market. It indicates the loss in potential human development due to inequality between female and male achievements in these dimensions. GII values range from 0, where women and men fare equally, to 1, where one gender scores poorly across all measured dimensions.⁸¹ According to the GII scores for 2019, Tajikistan ranked 84th in the world with an indicator of 0.377. By 2023, the GII had decreased further to 0.258, with women being underrepresented in parliament and having a poor participation rate in the labour force (Figure 16)⁸².

In contrast, the HDI compares female and male achievements in health, education and command over economic resources by taking the ratio of the female HDI to the male HDI. A value of 1 denotes gender parity, while values below 1 indicate disadvantage for women. This value also highlights how much human development potential is lost to gender disparities and guides gender-responsive budgeting and measures gender inequalities across three basic dimensions of human development: health, measured by female and male life expectancy at birth; education, measured by female and male expected years of schooling for children and female and male mean years of education for adults ages 25 years and older; and command over economic resources, measured by female and male estimated earned income⁸³. In addition, the UNDP Human Development Report for 2019 indicated that the GDI was 0.799, which is significantly lower than that of other Central Asian countries. By 2023, Tajikistan had a GDI score of 0.926, which indicates that equality across the measured dimensions of human development has improved for women since 2019⁸⁴.

Health, education, participation, and employment equality for women have been key factors in promoting gender development and resilience to climate change in the country. The maternal mortality ratio has improved from 98 in 2000 to 16.6 in 2023 (Figure 16). This coincides with enhanced nutrition and health care access for the female population. The maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births⁸⁵.

The adult female literacy rate in 2017 was 94.6% in Tajikistan, which is lower than in Europe and Central Asia (Figure 17). Adult literacy rate is the percentage of people ages 15 and above who can both read and write with understanding. This indicates that compared to neighbouring countries, there is considerable room for improving gender equality through education⁸⁶. Yet, the average developing country literacy rate for males aged 15 and over equals 90%, while that for females is 82.7%. Least developed nations manage an average literacy rate of only 65%. This shows that, according to global standards, Tajikistan has fared well as a developing country in

⁸⁰ WFP 2024. Tajikistan Annual Country Report 2024. [Available online.](#)

⁸¹ [Gender Inequality Index | Human Development Reports](#)

⁸² [Tajikistan | World Bank Gender Data Portal](#)

⁸³ [Gender Development Index, 2023](#)

⁸⁴ [Tajikistan | World Bank Gender Data Portal](#)

⁸⁵ [Tajikistan | World Bank Gender Data Portal](#)

⁸⁶ [Tajikistan | World Bank Gender Data Portal](#)

terms of equality in literacy rates⁸⁷. Similarly, the percentage of women and men obtaining secondary education was just less than 94% in 2023 (Figure 16)⁸⁸.

In 2023, the female labour force participation rate was 34.4%, compared to males, where participation equalled 52.7% (Figure 16). Since 1990, female labour force participation has remained roughly the same. There is thus notable improvement required in equal participation within the labour force, which is the proportion of the population ages 15 and older that is economically active⁸⁹. Vulnerable employment for females has, however, improved since 1991. Workers in vulnerable employment are less likely to have formal work arrangements, social protection, and safety nets to guard against economic shocks. Those in vulnerable employment are thus more likely to fall into poverty. Vulnerable employment among women equalled 26.2% and 21.4% among men in 2023. The rate of vulnerable employment overall remains higher for Tajikistan compared to the average rate in Europe and Central Asia⁹⁰.

Women play a crucial role in making significant decisions regarding major household purchases, decisions about their healthcare, and visits to family, relatives, and friends. In 2017, 33.1% of women aged 15 to 49, participated in making significant decisions in their household. Women in parliament indicate the percentage of parliamentary seats held by women. The proportion of seats held by women in Tajikistan has increased since 2010. The current rate is higher than the global average for lower-middle-income economies (23.3%), with 27% of seats in national parliament held by women in 2024⁹¹.

To improve gender equality and resilience of women to climate change impacts, the government has focused on developing gender-sensitive indicators on climate change and disaster risk management. Gender indicators are also included in vulnerable sectors of the economy, such as agriculture, water supply and energy, social protection, education and health. Raising awareness of the relationship between gender and climate change is essential in enhancing gender development across these sectors. This also entails including gender considerations in planning, budgeting, and developing climate change adaptation and mitigation strategies. Promoting capacity-building and enabling women's active participation in sustainable socio-economic development is also part of Tajikistan's sustainable development plan⁹².

⁸⁷ [Literacy Rate by Country 2025](#)

⁸⁸ [Tajikistan | World Bank Gender Data Portal](#)

⁸⁹ [Tajikistan | World Bank Gender Data Portal](#)

⁹⁰ [Tajikistan | World Bank Gender Data Portal](#)

⁹¹ [Tajikistan | World Bank Gender Data Portal](#)

⁹² [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

Tajikistan			
2023 GII value	0.258		
GI change from 2022	-0.004		
Maternal Mortality Ratio	16.6 death/100,000 live births		
Adolescent Birth Rate	40.4 births/1,000 women age 15-19		
	Female	Male	Gender gap
Share of seats in parliament	26.6%	73.4%	-46.8%
Population with at least some secondary education (age 25 and older)	93.7%	93.6%	0.1%
Labour force participation rate (age 15 and older)	34.4%	52.7%	-18.2%

Figure 16. Gender Inequality Index for Tajikistan in 2023⁹³

Adult literacy rate, by sex (% of people ages 15 and above)

● Female ● Male

Tajikistan



Europe & Central Asia



Lower middle income



Figure 17. The adult literacy rate for Tajikistan in 2017 compared to the regional average and other low/middle-income countries⁹⁴

2.2.5. Fragility and conflict

Tajikistan faces a combination of structural fragilities and localised tensions that pose risks to long-term stability and resilience. Although the country has remained largely peaceful since the end of its civil war in 1997, several conflict drivers persist. These include chronic poverty, weak governance institutions, limited access to basic services in rural areas, and pronounced regional

⁹³ [Tajikistan | World Bank Gender Data Portal](#)

⁹⁴ [Tajikistan | World Bank Gender Data Portal](#)

disparities^{95,96,97}. In recent years, most security concerns in Tajikistan have originated domestically, although official reports have included external threats. Regional groups and ethnic minorities, including the Pamiri-Ismaili community, have experienced increased marginalisation. Developments in Afghanistan and the broader Middle East, including the participation of an undetermined number of Tajik nationals in Islamic State (IS) activities, have had limited direct effect on domestic stability thus far. Following the Taliban's return to power and the rapid withdrawal of NATO forces from Afghanistan, the Tajik government adopted a more guarded posture toward its southern neighbour. The government has issued repeated warnings about the potential for cross-border violence and regional destabilisation linked to extremist movements. In this context, the government has sought increased international security cooperation and continues to frame national leadership as central to maintaining order and stability. While diplomatic ties with Uzbekistan have shown steady improvement, tensions with Kyrgyzstan have persisted. Disputes over shared resources such as water, land, and market access have led to periodic clashes, notably in the northern Sughd region, where violence in 2022 resulted in over 150 fatalities. Meanwhile, the ongoing war in Ukraine has affected regional dynamics by reducing Russia's political leverage. However, Russia continues to exert considerable influence in Tajikistan through its longstanding political, military, and economic ties⁹⁸.

In addition to regional concerns, the country faces latent fragility linked to limited political inclusiveness and restrictions on civil society, which can erode social cohesion and hinder participatory approaches to resilience-building. Tajikistan is listed on the World Bank's Harmonised List of Fragile Situations for 2022. It ranks high on the Fund for Peace Fragile States Index for 2024, particularly in indicators such as group grievance, factionalised elites, and external dependence. Furthermore, the economy remains vulnerable to external shocks, including climate change, global commodity fluctuations, and heavy reliance on remittances from labour migrants. These factors collectively constrain adaptive capacity and increase the population's exposure to compounded risks^{99,100,101}. Addressing these fragilities requires integrated and inclusive development approaches that build institutional capacity, strengthen social safety nets, and enhance community resilience to climate and non-climate stressors.

2.3. *Agriculture sector*

2.3.1. Overview of the agriculture sector

Agriculture contributed 24.6% to Tajikistan's total GDP in 2022 and serves as the backbone of the rural economy, employing over 60% of the population. Within the sector, crop production accounted for 72% of gross agricultural output, while animal husbandry contributed 28%. The national industrial sector is heavily reliant on agricultural products. In 2010, the production value of the food industry made up 28% of the total manufacturing industry, with nearly two-thirds of existing industrial enterprises engaged in agribusiness. Agricultural commodities, particularly cotton, vegetables, wheat flour, canned food, dried fruits, and nuts, form a significant portion of the country's total exports. Cotton fibre alone represented 9% of the total export value in 2022. Tajikistan imports a substantial share of agricultural products to meet domestic consumption needs. In 2021, approximately 60% of cereal needs and 80% of vegetable oil were covered by imports. However, the country is nearly self-sufficient in meat and milk products, potatoes, vegetables, and fruits (with exports exceeding imports in these categories). In 2022, grain and wheat flour imports represented 6.3% of the country's total import value (approximately half the

⁹⁵ <https://reliefweb.int/report/tajikistan/tajikistan-kyrgyzstan-border-clashes-icrctajikistan-red-crescent-society-kyrgyzstan-red-crescent-society-media-echo-daily-flash-20-september-2022>

⁹⁶ Tajikistan Common Country Analysis 2021. [Available online.](#)

⁹⁷ <https://reliefweb.int/report/kyrgyzstan/when-we-moved-they-shot-laws-war-violations-september-2022-kyrgyzstan-tajikistan-border-conflict-enru>

⁹⁸ BTI 2024 Tajikistan Country Report: BTI 2024

⁹⁹ <https://thedocs.worldbank.org/en/doc/9b8fbd62f7183cef819729cc9073671-0090082022/original/FCSList-FY06toFY22.pdf>

¹⁰⁰ https://www.theglobaleconomy.com/tajikistan/fragile_state_index/

¹⁰¹ UNDP Human Development Report 2023-24. [Available online.](#)

value of petroleum products), with nearly 1 million tonnes imported at an estimated cost of US\$330 million¹⁰².

Tajikistan has approximately 4.6 million hectares (ha) of agricultural land, with a theoretical potential of 1.573 million ha suitable for irrigation. However, due to the predominantly mountainous terrain and the elevation of much of this land, only around 749,656 ha—just under 50% of the potentially irrigable area—are effectively irrigated. In addition, there are approximately 203,785 ha of rainfed arable land. Agriculture in Tajikistan is highly dependent on irrigation, particularly in lowland areas, and in some regions, irrigation requires energy-intensive high-lift pumping systems due to elevation differences. Roughly 73.6% of the country's 8.55 million people reside in rural areas, where formal employment opportunities are limited. The average amount of arable land per rural inhabitant is just 0.08 ha, contributing to the prevalence of subsistence farming and low agricultural incomes. Irrigated arable land managed by public and *dehkan* (smallholder) farms amounts to approximately 458,300 ha. Of the total arable land, public farms utilise 17.0%, *dehkan* farms 60.0%, and the remaining 23.3% is cultivated by the rural population independently. In terms of output, these groups contribute 6.0%, 30.6%, and 63.4% to the country's gross agricultural production, respectively, demonstrating the significant role of household-level and smallholder agriculture in national food production¹⁰³.

Due to Tajikistan's mountainous geography, the total arable land area is estimated at 847,000 ha, representing only 6% of the national territory. Agriculture is mainly practiced in plains situated within lowland areas. As the contribution of the GBAO to national agricultural output is marginal, there are three principal agricultural production zones¹⁰⁴:

- The Ferghana Valley in the north of the country along the Syr Darya River.
- The Hissor Valley, stretching between Vahdat (east of Dushanbe) and Tursunzoda on the Uzbekistan border to the west.
- The Khatlon Lowlands in the southwest, broadly extending from Khovaling District in the east to the border with Uzbekistan in the west.

During the land reform process, former *kolkhoz* (collective farms) and *sovkhos* (state farms from the Soviet era) were privatised and divided into small private *dehkan* farms. As a result, the agricultural sector in Tajikistan is now structured around three main types of producers¹⁰⁵:

1. Agricultural Enterprises

These include former state farms taken over by companies, agricultural cooperatives, collective farms, and state farms. Although they represent only about 0.3% of all agricultural production units, they operate 14.4% of the country's total agricultural land (124,000 hectares). In 2021, 4,890 agricultural enterprises were registered, each cultivating on average 25 hectares of land. They contribute to roughly one-quarter of national cotton production and around 10% of wheat and barley output, but play a relatively minor role in the production of fruits and vegetables. These enterprises hold two-thirds of national poultry stocks (mainly laying hens), but manage very few cattle, sheep, or goats.

2. Dehkan Farms

These are individual farms that generally emerged from former collective farm workers gaining access to the collective land. Dehkan farms operate as independent economic entities, typically organised around families or small groups jointly farming collective land. Farmers are issued a land lease certificate; however, as the lease does not confer ownership rights, the trading of land use certificates is restricted (though an informal market reportedly exists). This category of land remains among the most restricted in

¹⁰² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁰³ <https://www.fao.org/family-farming/countries/tjk/en/>

¹⁰⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁰⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

terms of farmers' crop choices. In 2021, approximately 167,000 dehkan farms were registered, each managing an average of 3.4 hectares. While they account for only about 10% of all agricultural production units, they operate nearly two-thirds (567,200 hectares) of the country's agricultural land. Of this, only 12% is irrigated, with the remaining 88% under rainfed cultivation. Dehkan farms contribute about three-quarters of the national cotton harvest, nearly two-thirds of wheat and barley outputs, and more than half of the country's fruits, vegetables, and potatoes. However, they play a relatively minor role in livestock production. Notably, dehkan farms and agricultural enterprises together account for only 11.5% of all farming units but manage 80.2% of total agricultural land.

3. Household Farms

Most families in rural areas and small towns have access to small household plots (typically 0.08–0.20 hectares) located adjacent to their homes. There are an estimated 1.3 million household farms, representing 88% of all farming units. Despite their small size (averaging only 0.13 hectares), these household farms collectively operate about 170,500 hectares, or roughly 20% of the country's agricultural land. Their contribution to national agricultural output is significant: they hold over 93% of the country's cattle, 83% of sheep and goats, and produce approximately 95% of the nation's milk. They also account for more than half of maize production (mainly used as animal feed) and are responsible for around 40–45% of national fruit and vegetable output. Production from these small plots serves both household self-consumption and local market sales, making household farms a critical component of national food security (Figure 18).

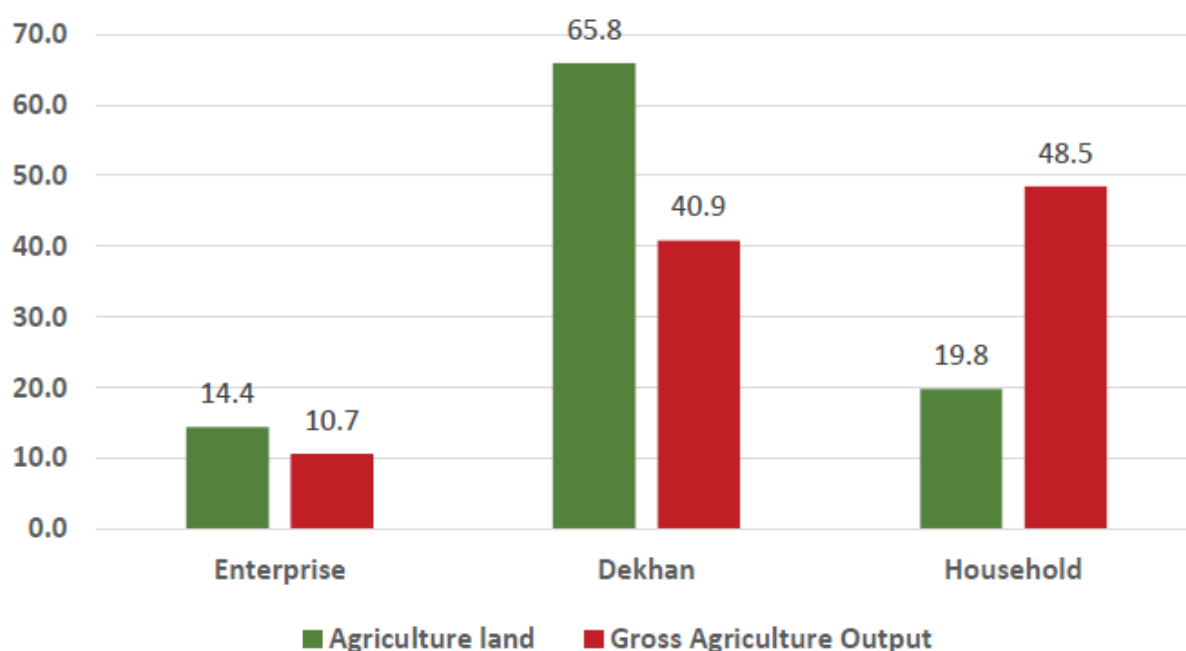


Figure 18. Proportion of agricultural land and gross agricultural output by farm type, Tajikistan, 2021¹⁰⁶.

In 2024, the total volume of agricultural production in Tajikistan reached TJS73.98 billion, equivalent to approximately US\$6.3 billion, representing a real growth rate of 10.6% compared to 2023. This growth reflects the impact of improved land use practices and the adoption of more efficient production methods across the country. Crop production contributed TJS50.98 billion (approx. US\$4.34 billion) and expanded by 13.4%, while livestock production increased by 4.8% to TJS 22.99 billion (approx. US\$1.96 billion). The distribution of output across farm types indicates the central role of smallholders. Household farms accounted for 50.4% of total

¹⁰⁶ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

agricultural production, followed by dehkan farms at 38.2%, and public/state farms at 11.4%. Household farm contributions were highest in the Gorno-Badakhshan Autonomous Region (GBAO) at 65.1%, with other significant shares in Khatlon (57.1%), cities and districts under republican subordination (51.6%), and Sughd Region (37.3%)¹⁰⁷.

2.3.2. Irrigation and water management

Irrigation

As of 2021, Tajikistan had 745,000 ha equipped for irrigation, of which 74% or 548,000 ha were actively cultivated. Around 62% of all irrigated land relies on water delivered by pumping stations. Many of these systems were constructed during the Soviet era and employ cascade pumping systems with four to six stages of elevation. The operation and maintenance (O&M) of irrigation pumping stations, including those employing multi-stage cascade systems constructed during the Soviet era, are primarily the responsibility of the Agency for Land Reclamation and Irrigation (ALRI). This agency oversees the management of irrigation and drainage systems, including pumping stations and vertical boreholes, and is tasked with developing state policies and regulations for land reclamation and irrigation¹⁰⁸. The general condition of these pumping systems is concerning. A significant portion of the infrastructure is outdated, with many pumping stations constructed between the 1960s and 1990s. Reports indicate that approximately 80% of these stations are considered outdated, and water losses due to technical inefficiencies can reach up to 45%. Additionally, some pressure pipelines have been in operation for over fifty years and are characterised by water leakages. Approximately 77% of Tajikistan's irrigation systems require reconstruction. Of the country's 720,000 hectares of irrigated farmland in 2025, nearly 60% must be restored^{109,110}.

Historically, diesel-powered pumps have been commonly used in Tajikistan's irrigation systems, especially in remote areas where the electricity supply is unreliable. However, there is a growing shift towards adopting solar-powered pumps to address issues related to high diesel costs, frequent power outages, and water shortages. This transition aims to improve the sustainability and efficiency of irrigation practices in the region^{111,112}.

The agricultural sector represents a substantial portion of Tajikistan's electricity consumption. In 2015, it was the third-largest energy consumer, accounting for 15% of the total annual energy use and rising to 20% during summer. In the country's southern parts, extensive agricultural lands remain unused due to issues such as salinisation and waterlogging. Clogged drainage systems, incomplete infrastructure, and outdated irrigation technology contribute to low irrigation efficiency, high water losses, and rising groundwater levels. These challenges have led to a decline in irrigated arable land over time. Despite the Agency for Land Reclamation and Irrigation (ALRI) efforts to rehabilitate infrastructure, the irrigated cultivated area declined from 612,500 ha in 1991 to 566,250 ha in 2022 (Table 4). Furthermore, as of 2022, approximately 32,000 ha of land were estimated to be affected by salinisation and waterlogging¹¹³.

Table 4. Total irrigated land ploughed, Tajikistan, 1991 and 2019–2022.

Type	1991	2019	2020	2021	2022	Percentage
Enterprise and Dehkan Farms (ha)	559,205	463,188	463,209	463,419	462,298	81.6
Household/Backyard Farms (ha)	53,346	103,659	103,922	103,308	103,952	18.4
Totals	612,551	566,847	567,131	566,727	566,250	100

¹⁰⁷ TAJSTAT 2025. Tempo growth in agriculture provided at the level of 110.6 %. [Available online.](#)

¹⁰⁸ UNECE 2017. Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus in the Syr Darya River Basin. [Available online.](#)

¹⁰⁹ The Times of Central Asia 2025. Tajikistan's Irrigation Plans Require Major Upgrades. [Available online.](#)

¹¹⁰ World Bank 2017. Central Asia. The Costs of Irrigation Inefficiency in Tajikistan. [Available online.](#)

¹¹¹ Panorama 2025. Expansion of Renewable Energy Solutions in Agriculture. [Available online.](#)

¹¹² UN Tajikistan 2025. Tender – for the purchase and supply of Solar Pumping Stations for Irrigation Systems of Agricultural Lands in Rasht and Muminobod Districts. [Available online.](#)

¹¹³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

Water User Associations (WUAs) and community-based water management

As part of post-Soviet land and water reforms, WUAs were introduced in Tajikistan following the first phase of land reforms implemented 1998–2000. These non-profit organisations were established to improve the management, distribution, and maintenance of on-farm irrigation systems by involving water users directly in governance. Members include individual farmers, leaseholders, cooperatives, private landowners, and home garden plot users who withdraw irrigation water from areas supplied by one or more distributary canals¹¹⁴. As of 2019, 416 WUAs were registered across the country, collectively managing the irrigation of approximately 379,430 ha, representing 50.05% of the country's irrigated agricultural land, primarily in gravity-fed irrigation zones¹¹⁵. Despite progress, WUAs face several constraints, including¹¹⁶:

- Shortages of qualified technical and managerial personnel;
- limited access to equipment and mechanisation;
- inadequate collection of service and membership fees;
- poor maintenance of intra-farm drainage networks; and
- inefficient use of land and water resources.

Recognising the challenges, the Government of Tajikistan took legal and institutional steps to reinforce WUAs. Under Government Resolution No. 755 (2014) and Article 21 of the Law on Water User Associations, the Agency for Land Reclamation and Irrigation (ALRI) was designated the authorised state body for regulation and state support of WUAs. ALRI established a dedicated WUA Support Unit, which in 2023 assisted 361 associations¹¹⁷. The WUA Support Unit, embedded within ALRI, works in coordination with district-level land reclamation departments and international partners to strengthen WUA performance. As part of ongoing water sector reforms, the Government plans to amend and update the Law on WUAs, complete an inventory of intra-farm drainage systems, formally transfer these assets to WUA management, and expand WUAs into pump irrigation zones, which are currently underserved¹¹⁸. Several international and national NGOs provide capacity building, technical assistance, and training in governance, conflict resolution, and water use efficiency¹¹⁹.

A water fee system, introduced in 1996, enables farmers to contribute to the costs of delivering irrigation water from main canals or pumping stations to their farms. Fees are collected by WUAs and transferred to ALRI accounts to fund the operation and maintenance (OandM) of irrigation and drainage infrastructure. However, fee collection, financial sustainability, and infrastructure rehabilitation challenges persist¹²⁰.

2.3.3. Crop production in Tajikistan

National agriculture comprises two broad cropping systems: irrigated and rainfed. In irrigated lowlands, the main crops include cotton, fodder crops (alfalfa and maize for silage), wheat, and orchards (apricots, pomegranates, almonds, as well as vineyards, apples, and stone fruits at mid-elevation). Approximately 85% of crop production comes from irrigated land and is mainly located in the western parts of the country (Figure 19)¹²¹. The main irrigated crop is cotton, which in 2021 covered around 173,770 ha, with two-thirds located in the Khatlon Region and one-third in the Sughd Region. On average, a cotton crop requires approximately 10,000 m³ of irrigation water per hectare¹²² making it highly climate-vulnerable due to its intensive irrigation needs at a time

¹¹⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹¹⁵ ALRI 2019. State support of the Water Users Associations (WUA). [Available online.](#)

¹¹⁶ ALRI 2019. State support of the Water Users Associations (WUA). [Available online.](#)

¹¹⁷ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹¹⁸ ALRI 2019. State support of the Water Users Associations (WUA). [Available online.](#)

¹¹⁹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²⁰ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

when the country's water resources are under increasing pressure from glacial retreat, reduced river flows, and inefficient irrigation systems.

In rainfed areas (both low and higher lands), cereals (wheat, barley, rye), legumes (peas, chickpeas, vetches, lentils), oil crops (flax, safflower), and some fruit trees and vineyards are cultivated. In upland valley floors, wheat, barley, potatoes, alfalfa, and horticultural crops are grown alongside rainfed and irrigated pastures. About 77% of wheat is planted in autumn (October to December), while barley is mostly planted in spring (63%). Rainfed agriculture in Tajikistan is risky due to low and variable precipitation, and therefore, yields fluctuate significantly from year to year. Cereal crops grown on irrigated land yield two to four times as much as those cultivated on rainfed land. Unfortunately, national statistics do not provide a breakdown between rainfed and irrigated production¹²³.

Crops are cultivated at elevations ranging from 300 to over 3,000 metres above sea level (masl). As a result, crop planting activities occur continuously from October to the end of July, while harvesting takes place from February to November. According to the Agency on Statistics (AoS), there are three cropping seasons defined by planting periods¹²⁴:

- Autumn (October to December): main crops include wheat, barley, pulses, and oil crops.
- Spring (January to March): main crops include cotton, maize, and wheat and barley in higher elevations.
- Summer (from April onward): crops include cotton, rice, maize for silage, sorghum, soybeans, and beans.

Potatoes can be planted in any of the three seasons; however, in higher elevations, they are generally planted in spring. Vegetables can be cultivated year-round. Pasture and cropland show the highest vegetation density after the rainy season (Figure 20 and Figure 21).

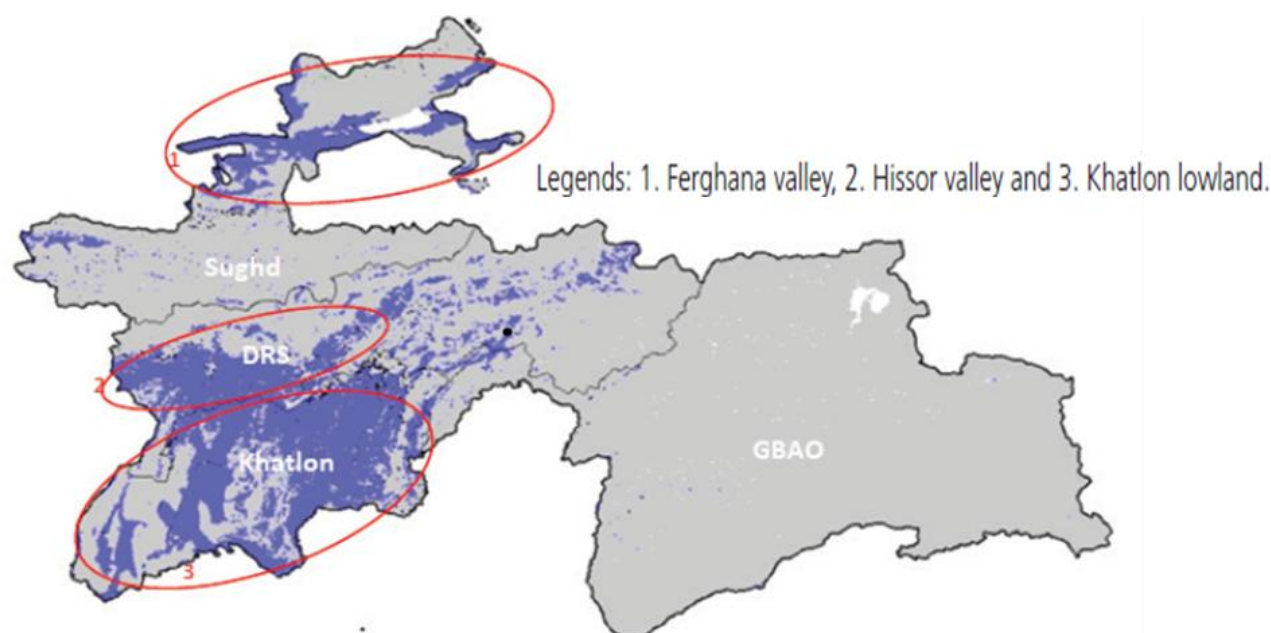


Figure 19. Primary cropping areas of Tajikistan¹²⁵.

¹²³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)



Figure 20. Rainfall and NDVI (Normalised Difference Vegetation Index) for pastures in 2024 (left) and 2025 (right), Tajikistan¹²⁶.

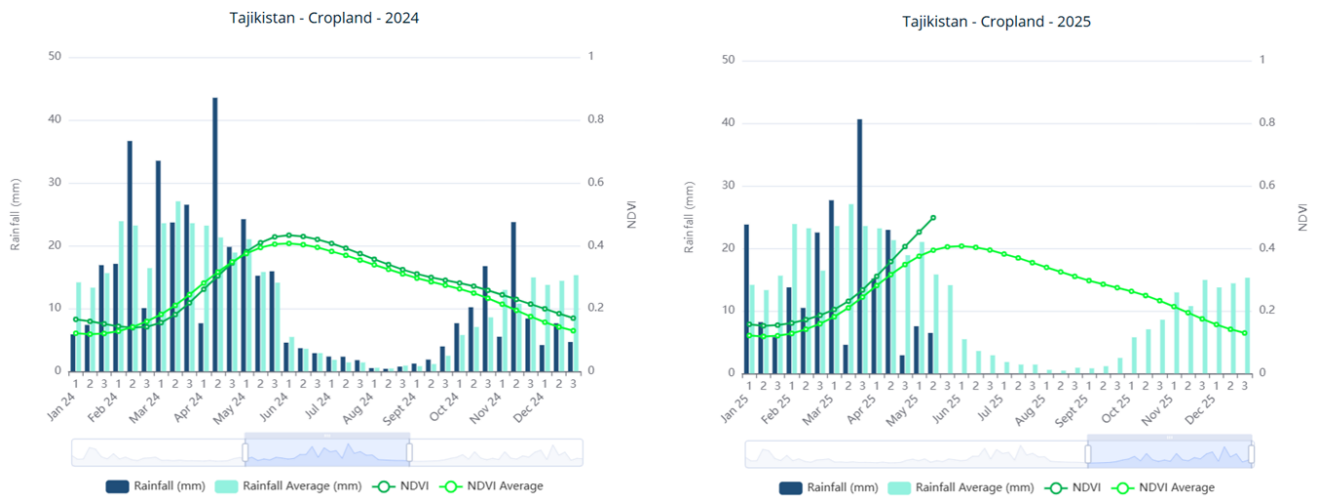


Figure 21. Rainfall and NDVI for cropland in 2024 (left) and 2025 (right), Tajikistan¹²⁷.

Agricultural production in Tajikistan experienced a marked decline during the early 1990s, largely due to the socio-economic disruptions following independence (Figure 22 and Figure 23). However, this trend reversed following the land reforms of the late 1990s, which supported the sector's recovery and restructuring. While rice and cotton production have not returned to their pre-1990 levels, the production of vegetables, potatoes, and cereals has steadily expanded over the past 25 years. Despite the country's favourable agro-ecological conditions and significant potential, fruit and grape production increases have remained limited.

¹²⁶ <https://dataviz.vam.wfp.org/asia-and-the-pacific/tajikistan/climate-explorer>

¹²⁷ <https://dataviz.vam.wfp.org/asia-and-the-pacific/tajikistan/climate-explorer>

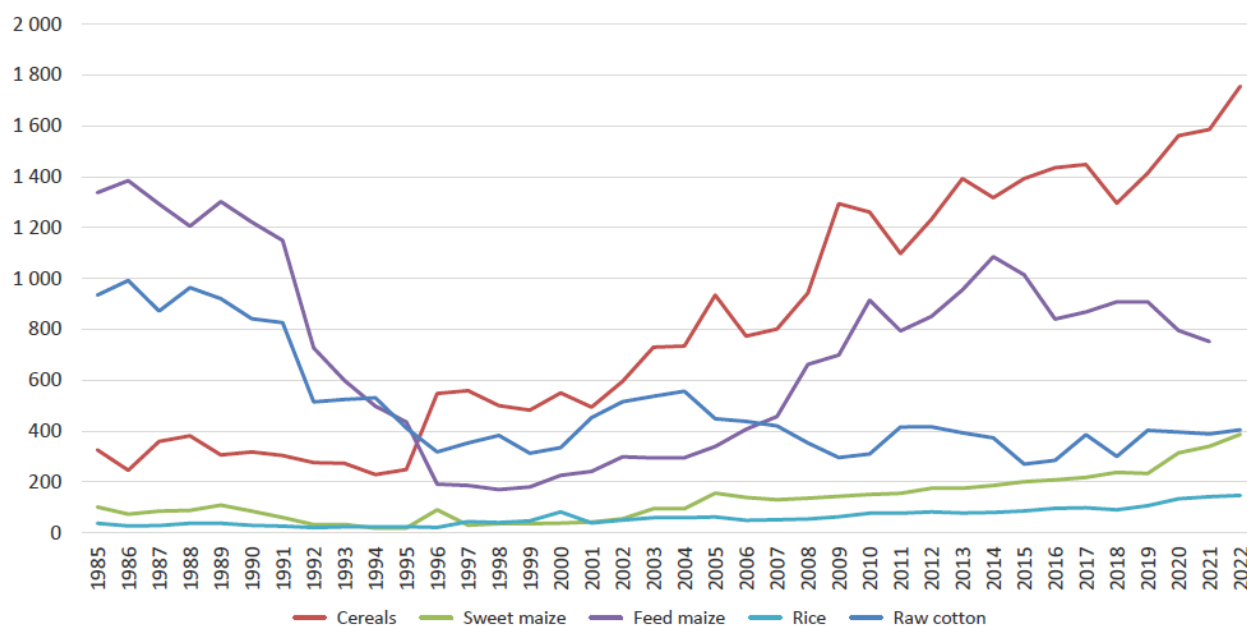


Figure 22. Cereals, sweet maize, feed maize, rice and raw cotton production, Tajikistan, 1985–2022 ('000 tonnes).

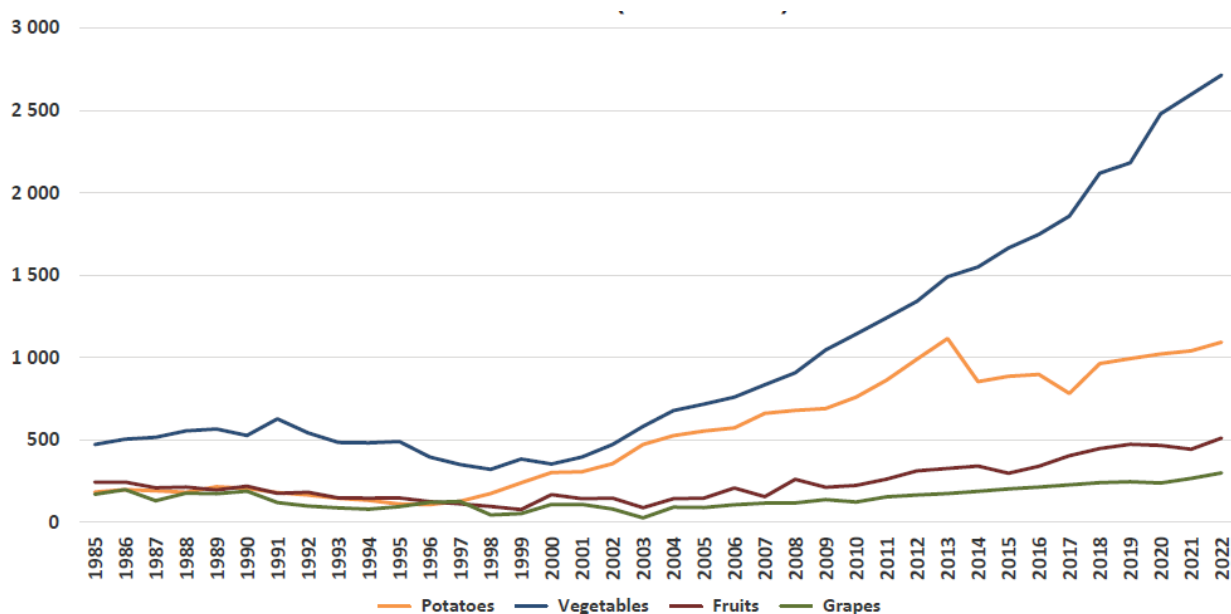


Figure 23. Potatoes, vegetables, fruits and grapes production, Tajikistan, 1985–2022 ('000 tonnes).

In 2023, the total area sown with cereals was estimated at 394,000 ha, representing a 7.2% increase compared to the five-year average (Table 5). This growth was primarily attributed to an expansion in rainfed wheat cultivation. However, reports from Khatlon Region indicate a slight decline in the area under irrigated wheat relative to the previous year. Overall, approximately 290,800 ha of wheat, both rainfed and irrigated, were planted in 2023, a 8.9% rise over the five-year average. Barley cultivation also expanded, with the area planted exceeding the average by 2.3%, mainly in rainfed regions. Paddy cultivation remained close to average levels despite elevated local rice prices. Maize planted for grain, primarily used as livestock feed, covered an estimated 18,500 ha, 8% above the five-year average. The potato-growing area also increased in 2023, reaching an estimated 58,600 ha, 9.5% higher than the average. In contrast, the area planted with cotton was estimated at 175,700 ha, 3.7% below the five-year average. Vegetable cultivation expanded as well. In 2023, the area planted with vegetables increased by 4.7%

compared to 2022, reaching an estimated 73,300 ha. This growth was driven mainly by favourable market conditions, particularly for onions, whose cultivation expanded in response to the previous year's high prices¹²⁸.

Table 5. Cereals, pulses, potatoes and cotton planted area and changes compared to the five-year average, 2018–2023 ('000 hectares).

Crop	2018	2019	2020	2021	2022	5-Year Average	2023 ¹²⁹	% Change
Wheat	255.5	264.0	269.6	274.8	271.1	267.0	290.8	+8.9%
Barley	72.3	71.8	71.1	69.9	68.2	70.7	72.3	+2.3%
Maize (grain)	15.9	17.0	17.4	17.6	17.9	17.2	18.5	+8.0%
Paddy	11.8	12.4	13.0	12.7	12.9	12.6	12.4	-1.1%
Total cereals	355.6	365.1	371.1	375.1	370.0	367.4	394.0	+7.2%
Potatoes	49.6	51.8	52.7	57.2	56.1	53.5	58.6	+9.5%
Pulses	17.0	16.3	17.2	17.3	17.5	17.1	18.0	+5.3%
Cotton	185.8	185.7	185.4	173.8	181.5	182.4	175.7	-3.7%

Total grain production for 2024 was 1,658,206 metric tonnes, including 799,408 tonnes of wheat. Cotton production stood at 229,719 tonnes. Among root and tuber crops, potato production reached 1,146,161 tonnes, while vegetables totalled 2,985,078 tonnes, with onion alone contributing 759,154 tonnes. Melon and gourd production was 1,039,362 tonnes, and fruit crops produced 746,689 tonnes, including apples (252,034 tonnes) and apricots (283,997 tonnes). Grapes accounted for 263,021 tonnes, while animal feed (converted to dry matter equivalents) totalled 1,700,908 tonnes. Year-on-year increases compared to 2023 were substantial. Grain output rose by 4.2%, driven by a 2.4% increase in wheat. Potato yields increased by 10.4%, vegetables by 8.7%, melons by 13.4%, and fruits by 23.9%. This included a 22.3% rise in apples and a 30.5% increase in apricots. Grape production rose by 50%, and animal feed output doubled, increasing by 100% over the previous year¹³⁰.

2.3.4. Livestock production in Tajikistan

The livestock sector significantly contributes to the national economy, accounting for nearly 7% of GDP, and serves as an essential source of income for rural communities, as household farms own most cattle and small ruminants. The national ruminant population is approximately 9 million head, including 2.5 million cattle and 6.5 million sheep and goats. The sector provides the primary source of protein for the population in the form of meat, milk, dairy products, and eggs¹³¹.

Natural pastures cover around 2.8 million hectares, representing 20% of the national territory. These pastures play a crucial role in supporting animal husbandry while also serving as habitats for numerous species of flora and fauna. Furthermore, they represent a valuable genetic resource for selecting and introducing new fodder varieties. The herbal cover of pasturelands contributes to conserving and enhancing soil fertility, protecting against soil erosion, and enriching the atmosphere with oxygen. Healthy pastures are also vital for regulating surface runoff, thereby helping to reduce climate-related risks such as floods and mudflows, particularly in foothill and mountainous areas¹³².

Low-herb savanna-type and desert autumn–winter–spring pastures are located in the valleys and foothills of the southern and northern regions. Tall-herb savanna pastures, which are highly productive, dominate the mid-mountain areas. Pasture productivity is closely linked to average rainfall levels. However, the area of critical winter pastures and hayfields has decreased over time due to land reclamation and conversion to arable rainfed lands. Many mountain slope

¹²⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹²⁹ 2023 values are preliminary estimates. Per cent change is relative to the five-year average 2018–2022.

¹³⁰ TAJSTAT 2025. Tempo growth in agriculture provided at the level of 110.6 %. [Available online.](#)

¹³¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹³² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

pastures have been ploughed for cereal cultivation, resulting in severe soil washout, with losses ranging from 70 to 4,000 tonnes per hectare¹³³.

2.3.5. Smallholders and family farms

Smallholders and family farms are a form of dehkan farms that are relatively recent actors in Tajikistan's post-Soviet agricultural landscape. Despite their growing importance, there remains no nationally agreed-upon definition or clear indicators distinguishing smallholders from other types of farms. This definitional gap results in varied interpretations among government bodies, development partners, and statistical agencies¹³⁴.

In early 2017, over 174,837 dehkan farms were registered in Tajikistan, with 79% concentrated in the Sughd and Khatlon regions. While men typically head these farms, increasing male migration and low profitability in the sector have contributed to a growing number of female-headed dehkan farms. Dehkan farms are central to Tajikistan's agricultural economy, contributing in 2017 to approximately (Table 6)¹³⁵:

- 34% of national agricultural production
- 7% of the national GDP

Their primary activities include cultivating cereals, legumes, potatoes, cucurbits, and cotton. By 2017, dehkan farms cultivated around 545,100 ha and were allocated a total of 5.177 million ha (37% of the total land fund), of which 2.591 million ha was designated as agricultural land. Despite their key role in crop production, dehkan farms play a relatively minor role in the livestock sector, accounting for only 3% of national output in 2017. However, their contribution to food production enhances national food security and reduces pressure on the state to meet subsistence needs. Over half of the dehkan farms, which collectively manage approximately three-quarters of all agricultural land, are operated as smallholder and family farms. On average, these farms cultivate no more than 2 hectares of land¹³⁶.

In parallel, private subsidiary farms (PSFs), often informal, family-based enterprises, are also gaining importance. These are characterised by full economic independence, reliance on family labour, and individual control over income and production. They function as micro-enterprises where the owner acts simultaneously as entrepreneur, labourer, and decision-maker¹³⁷.

Table 6. Key economic contributions by farm type in 2016¹³⁸.

Indicator	Dehkan Farms	Private Subsidiary Farms
Contribution to GDP (%)	7%	13%
Agricultural production (%)	34%	61%
Livestock sector (%)	3%	94%
Horticulture sector (%)	49%	45%

The smallholder and family farms dominate Tajikistan's agricultural landscape, operating on marginalised farmland with an average size of just 0.2 ha, yet accounting for almost 90% of all farms, cultivating more than 60% of total farmland, and providing livelihoods for nearly 48 % of the rural workforce in 2018. These small farms sustain households averaging seven people, led typically by individuals with around ten years of education, and 16% are headed by women, underscoring crucial gender dimensions¹³⁹.

Crop cultivation remains the principal economic activity for smallholders, accounting for around 40% of their income, with on-farm labour contributing 44% and non-agricultural wages 37%.

¹³³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹³⁴ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹³⁵ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹³⁶ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹³⁷ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹³⁸ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹³⁹ FAO 2018. Small Family Farms Country Factsheet Tajikistan. [Available online.](#)

Gross annual income averages US\$5,056, although more than half of all farmers remain below the national poverty line. Key crops include cotton and wheat, occupying roughly two-thirds of farmed land, alongside potatoes, onions, fruit, vegetables and rice. In addition, livestock holdings average 1.5 Tropical Livestock Units (TLU) per farm, comprising most commonly of poultry, small cattle, and horses. However, pasture degradation due to over-grazing and costly feed remains a persistent challenge¹⁴⁰.

Smallholders and family farms, particularly dehkan farms and PSFs, dominate Tajikistan's agricultural production. By 2016, these two groups produced 95% of the country's agricultural output, with PSFs contributing 61% and dehkan farms 34%. Commercial organisations account for the remaining 5%. Dehkan farms primarily focus on crop production, with a growing share in horticulture. Between 2005 and 2016, dehkan farms increased their share of total plant production from 32% to 49%. Their crop specialisation includes¹⁴¹:

- Cotton: >80% of national output
- Cereals and legumes: >60%
- Cucurbit crops: >70%
- Potatoes: >40%
- Vegetables: ~40%
- Fruits, berries and grapes: Significant share, with 69,500 ha of orchards and vineyards established by 2016, of which 52% were fruit-bearing.

Private subsidiary farms are dominant in livestock and horticulture, particularly in¹⁴²:

- Meat and milk: >90% of national production
- Wool: >80%
- Honey: >60%
- Eggs: One of the few products where PSFs and dehkan farms are not dominant
- Fruits, berries and grapes: PSFs had 13,600 ha under orchards and vineyards by 2016, 88% of which were fruit-bearing plantations.

From 2005 to 2016, fruit and grape production increased significantly, with an additional 215,700 tonnes of fruits and berries and 124,100 tonnes of grapes produced nationally. During this time, the national area under orchards and vineyards expanded from 118,100 ha to 182,400 ha, showing a strong trend towards fruit production. Regionally, the Khatlon region is the most productive regarding crop and livestock output. While cotton's share has declined, there has been substantial growth in cereals, legumes, potatoes, vegetables, and fruits, reflecting a shift toward diversified and more nutritious food production, led predominantly by smallholder systems¹⁴³.

Challenges to dehkan farm development fall into two categories¹⁴⁴:

1. Constraints within farmers' control: These relate to on-farm practices across production, storage, and marketing. Identified needs include:
 - Access to improved production techniques
 - Better storage facilities
 - Support with marketing and value addition
2. Structural constraints beyond farmers' control: These systemic barriers require institutional or policy intervention and include¹⁴⁵:
 - Weak extension systems: Limited availability of advisory services restricts farmers' knowledge of agribusiness, resource management, and regulatory compliance

¹⁴⁰ FAO 2018. Small Family Farms Country Factsheet Tajikistan. [Available online.](#)

¹⁴¹ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹⁴² FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹⁴³ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹⁴⁴ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹⁴⁵ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

- High-cost credit: Most financial services are inaccessible or unaffordable, especially for women-headed farms
- Irrigation infrastructure deterioration: Outdated systems and a lack of coordination between dehkan farms, Water User Associations, and the Agency for Land Reclamation and Irrigation reduce water security
- Gender inequality: Rising male outmigration has led to an increasing number of female-headed farms, but women continue to face significant constraints in access to resources, training, and decision-making, directly impacting productivity and income
- Climate vulnerability: Farmers carry the full risk burden of climate shocks, as no insurance mechanisms are in place. This demotivates continued engagement in farming
- Tax and processing burdens: Even when opportunities exist for scaling up or processing agricultural products, farms often lack the financial capacity or administrative readiness to meet added tax obligations and value chain requirements

The Government of Tajikistan, particularly the Ministry of Agriculture, is aware of the sector's challenges, including those affecting dehkan farms. However, limited public funding for agriculture has delayed progress in areas such as¹⁴⁶:

- Establishing financial protection systems (e.g., crop insurance)
- Ensuring fiscal sustainability for rural producers
- Implementing sectoral reforms, which currently rely heavily on support from development partners

Most sectoral reforms and investments depend on development partner support, highlighting the need for sustained international cooperation and capacity strengthening to unlock the full potential of smallholder and family farming in Tajikistan.

Only 83% of smallholder land is irrigated, yet just 2.5% of farms are motorised, limiting mechanised farming¹⁴⁷. Climate change poses increasing threats, such as glacial melt, unpredictable rainfall patterns and landslide risk, further undermining farm productivity. A range of international interventions aims to enhance resilience and productivity. In 2021, FAO and JICA distributed 100 tons of improved potato seed to smallholders, boosting yields and crop diversity¹⁴⁸. GIZ-supported Farmer Field Schools promote the adoption of climate-smart practices, including soil erosion control, orchard development, crop diversification, and improved irrigation efficiency¹⁴⁹. Digital agriculture and youth engagement are gaining traction. A 2024 FAO–Zerkalo study of 1,400 dehkan farms showed early interest in ICT tools, though adoption remains limited by cost, access and training¹⁵⁰. Subsequently, the WFP, with support from a US\$10 million KOICA grant, is assisting 200,000 farmers (including 40,000 youth) by deploying digital agribusiness platforms, facilitating asset creation, enhancing market access and integrating nutrition-sensitive strategies to promote sustainable productivity¹⁵¹.

Climate change adaptation efforts are reinforced through FAO and EU initiatives, which have installed automated agrometeorological stations and early warning systems in key horticultural areas (such as for grapes and apricots). In parallel, the WFP's cash-for-work programmes have rehabilitated irrigation canals, built terraces and implemented soil conservation structures, benefiting tens of thousands of vulnerable rural households¹⁵². Market integration and diversification have been facilitated via the World Bank's Agricultural Commercialisation Project (ACP), which disbursed US\$22 million in 2014 and US\$15 million in 2017^{153,154}. By 2022, the ACP had supported over 2,800 farmers, of which about half were women, through matching

¹⁴⁶ FAO 2019. Smallholders and family farms in Tajikistan. Country study report. [Available online.](#)

¹⁴⁷ FAO 2018. Small Family Farms Country Factsheet Tajikistan. [Available online.](#)

¹⁴⁸ UN 2021. Smallholder farmers in Tajikistan received 100 tonnes of high quality potato seed. [Available online.](#)

¹⁴⁹ Panorama 2020. Smallholder farmers taking the lead: Farmer Field Schools in Tajikistan. [Available online.](#)

¹⁵⁰ FAO 2024. FAO presents results of a comprehensive study on the digitalization of agriculture in Tajikistan. [Available online.](#)

¹⁵¹ WFP 2024. Republic of Korea provides US\$10 million to WFP's resilience-building efforts in Tajikistan. [Available online.](#)

¹⁵² WFP 2020. WFP launches cash for work projects as part of its COVID-19 response in Tajikistan. [Available online.](#)

¹⁵³ World Bank 2014. World Bank Group Supports Agriculture Commercialization in Tajikistan. [Available online.](#)

¹⁵⁴ World Bank 2017. World Bank Supports Agricultural Business Opportunities in Tajikistan. [Available online.](#)

grants totalling US\$4 million, and enabled the launch of 130 agricultural start-ups, including youth-led and women-led enterprises, with US\$1.8 million in grant financing for 90 ventures by youth, 35 by women, five by persons with disabilities¹⁵⁵. Complementing this, WFP school feeding programmes source produce from local smallholders to feed over 500,000 children, securing vital institutional market access and income stability for rural producers¹⁵⁶.

2.3.6. Agricultural extension services

Tajikistan's agricultural extension services are delivered through a combination of public institutions, NGOs, and international development partners, with increasing efforts to modernise and expand access to rural producers. The core public system remains under the Ministry of Agriculture, with extension agents at district (rayon) and sub-district (jamoat) levels. However, these services are often limited by insufficient capacity, lack of specialisation, and underfunding. In response, Tajikistan has introduced local-level agronomy officers and engaged civil society and private partners to strengthen outreach, particularly in underserved regions¹⁵⁷.

FAO has played a leading role in strengthening the technical capacity of Tajikistan's extension personnel. Regional initiatives such as the Central Asia Regional Project (2018–2020)¹⁵⁸ and the Sustainable Crop Production Project (2019) have delivered training in integrated pest management, conservation agriculture, and organic production. These programmes trained over 60 national specialists and established multiple demonstration plots across key agricultural zones, notably in Khatlon and Sughd. Demonstrated farmer knowledge and skills improvements show the potential for sustained impact when advisory services are effectively supported.

WFP, in partnership with the Ministry of Agriculture and local NGO Neksigol Mushovir, has focused on ICT-enabled advisory services under its GCF-funded "Building Climate Resilience" programme¹⁵⁹. This initiative has reached over 25,000 farmers in remote and mountainous areas, delivering timely agro-climatic information, early warnings, and crop management guidance via mobile technologies. The approach enhances farmers' ability to respond to climate variability and adopt resilient practices. In addition, USAID's Farmer Advisory Services in Tajikistan (FAST) programme, operating in Khatlon, demonstrates how targeted advisory support can improve nutrition and reduce post-harvest losses. Collectively, these initiatives highlight a shift towards more decentralised, participatory, and technology-supported extension models in Tajikistan¹⁶⁰. However, significant challenges remain, including limited coverage of public services, insufficient inclusion of women, and the need for a national strategy that integrates diverse service providers and delivery channels. Continued investment in training, infrastructure, and inclusive ICT tools will be essential for scaling up extension services to meet the needs of all farmers.

In Tajikistan, where approximately 75% of employed women work in agriculture, there is significant potential to reduce the gender gap in agricultural extension services. Traditional societal norms continue to limit rural women's participation in household and community decision-making, while also assigning them the primary responsibility for domestic duties. These cultural expectations create substantial barriers to their active involvement in agricultural training, leadership, and resource access. Addressing these challenges is essential to ensure that women benefit equally from extension services and contribute fully to agricultural development¹⁶¹.

2.3.7. Value chains

Tajikistan's agrifood system comprises interconnected value chains categorised into export-oriented, import-dependent, and less-traded domestic chains. In 2022, primary agriculture alone

¹⁵⁵ World Bank 2022. Expanding Business Opportunities for Women Farmers in Tajikistan. [Available online.](#)

¹⁵⁶ UN 2020. WFP Resumes School Feeding in Tajikistan Amidst COVID-19 Crisis. [Available online.](#)

¹⁵⁷ <https://www.fao.org/family-farming/detail/en/c/284746/>

¹⁵⁸ <https://www.fao.org/europe/news/detail/Stronger-agricultural-extensions-can-boost-crop-production-in-Central-Asia/>

¹⁵⁹ <https://mushovir.org/en/implementation-of-ict-based-delivery-mechanisms-for-afro-climate-services-in-tajikistan/>

¹⁶⁰ <https://www.taylorfrancis.com/chapters/edit/10.1201/9781315115771-16/farmer-advisory-services-tajikistan-fast-lola-gaparova-andrea-bohn>

¹⁶¹ FAO 2021. Towards gender equality in Tajikistan's extension services. [Available online.](#)

contributed 25% of the national GDP. It employed 54.9% of the labour force. At the same time, the broader agrifood system, including agroprocessing, trade, food services, and input supply, accounted for 34.7% of GDP and 58% of employment. Export-oriented chains, primarily cotton and fruits/nuts, constituted 22.6% of agrifood GDP, with 12% attributable to cotton and 16.8% to fruits and nuts. These chains maintain strong export linkages. 62% of cotton and 26.7% of fruits and nuts output are exported, underscoring their importance to foreign exchange earnings. Import-dependent chains, including wheat, maize/rice, and oilseeds, make up around 27.5% of agrifood GDP, yet feature minimal exports and high consumption of imports, especially in oilseeds (43.9%). The less-traded domestic chains, collectively, represent nearly half (49.9%) of agrifood GDP and serve primarily internal markets, producing vegetables, pulses, and livestock products with negligible trade orientation^{162,163}.

Trade patterns over the past two decades reveal pronounced imbalances. Agrifood imports grew sixteenfold between 2000 and 2023, predominantly driven by cereals and processed foods (comprising 83% of import value), while exports only doubled, heavily relying on dried fruits and nuts, which now account for 75% of agricultural export revenues. This disparity underlines persistent structural inefficiencies: processed goods dominate import volumes (90.6%), whereas exports are mainly unprocessed agricultural commodities (91.1%). Despite its scale, Tajikistan's agro-processing sector remains relatively undeveloped. Most value addition, particularly for cotton, is captured outside national borders. Producers, especially smallholders in vegetables and livestock, face fragmented supply chains, constrained logistics, and poor storage infrastructure. Input markets are dominated by monopsonies, particularly in cotton, which significantly suppress farm-gate prices and limit incentives for investment^{164,165}.

There are notable advancements in digital agriculture and institutional capacity. In 2024, FAO and the Centre for Sociological Research (Zerkalo) conducted a large-scale ICT survey and pilot interventions among 1,400 dehkan farms in Tajikistan, documenting how digital agriculture tools can boost productivity measurement and market access. In 2019, the European Union and FAO collaborated with Tajikistan's Ministry of Agriculture to embed ICT services, such as agrometeorological data and pest tracking, into institutional systems to improve data collection and extension delivery. While promising, these initiatives remain initial steps toward closing substantial infrastructure and technology adoption gaps, such as connectivity, affordable devices, digital literacy, and training or support services^{166,167,168}.

The sector also faces mounting climatic, environmental, and systemic threats. Tajikistan ranks among the world's most drought-sensitive nations, and 9–15% yield losses are projected by 2050 under current climatic trends. Recurring shocks such as floods, wildfires, and locust infestations inflict yearly losses estimated at US\$10–15 million. Irrigation inefficiencies are widespread: agriculture consumes over 90% of the country's freshwater, yet approximately 70% of irrigated land is degraded due to salinity and neglect, compounded by overgrazing and poor maintenance. Additional structural constraints hinder transformation. Average farm size remains small (~0.12 ha per person), highly fragmented production, and limited mechanisation. Livestock and fodder value chains struggle with poor pasture governance, feed shortages in winter, and inadequate access to quality veterinary and breeding inputs. Economic vulnerability is exacerbated by high dependency on remittances (28% of GDP), particularly from migrant labour in Russia; any disruption in this flow directly undermines rural investment and agricultural

¹⁶² CGIAR 2025. IFPRI Discussion Paper 02329. Tajikistan's agrifood system: The past performance and future opportunities and challenges. [Available online.](#)

¹⁶³ IFPRI 2025. Central Asia policy brief 23. Tajikistan's Agrifood System Structure. [Available online.](#)

¹⁶⁴ CGIAR 2025. IFPRI Discussion Paper 02329. Tajikistan's agrifood system: The past performance and future opportunities and challenges. [Available online.](#)

¹⁶⁵ IFPRI 2025. Central Asia policy brief 23. Tajikistan's Agrifood System Structure. [Available online.](#)

¹⁶⁶ <https://asiaplustj.info/en/news/tajikistan/economic/20241223/fao-identifies-barriers-to-digitalization-of-agriculture-in-tajikistan>

¹⁶⁷ FAO 2025. FAO surveys digitalization of agriculture in Tajikistan. [Available online.](#)

¹⁶⁸ EU 2019. EU, FAO support sustainable solutions to plant pests in Tajikistan. [Available online.](#)

resilience. Limited access to diverse export markets beyond the CIS increases the sector's exposure to regional trade shifts and policy volatility^{169,170}.

2.3.8. Threats to and challenges for agriculture

Tajikistan's agrifood sector is hampered by persistent low productivity and high dependency on imported inputs, notably seeds, seedlings, fertilisers, and animal feed, combined with traditional low-yield farming methods and limited access to mechanisation. Chronic seasonal food insecurity and malnutrition stem from volatile food prices and inadequate public systems to monitor and respond to shocks. Irrigation inefficiencies pose a major constraint: outdated infrastructure, waterlogging, poor drainage, unreliable electricity for pumping, and soil degradation severely limit yields. Additionally, limited capacity for post-harvest storage, handling, and processing, alongside a weak agri-processing and export sector, reduces value retention and market competitiveness. Livestock production is undercut by overgrazing, 85% of pastureland is eroded, with stocking rates reaching 205% of carrying capacity, and weak veterinary services and feed infrastructure further constrain the sector. Structural and institutional barriers include insecure land tenure, administrative restrictions on cultivation, policy inertia from collectivist practices, and limited extension services and awareness around improved farming techniques—challenges that have persisted for decades. External pressures such as exchange rate fluctuations, climate change, and global market volatility further undermine resilience. However, growing domestic demand driven by population and income growth offers a significant opportunity, if matched by systemic reforms, infrastructure investments, and agribusiness sector development^{171,172,173}.

Soil degradation poses a critical threat to agricultural production in Tajikistan, with nearly 70% of arable land at risk and around 10% of the population residing in areas with declining soil quality. Climate change is a key driver, with rising temperatures and shifting precipitation patterns increasing irrigation demand and exacerbating soil salinisation through higher evaporation rates. This has led to a 25% decline in cotton yields in some regions over the past five years, with average yields falling from 26–30 quintals per hectare in the 1980s to 15–20 quintals today. The number of irrigation cycles per season has increased from three to five, compounding water use and salinity issues. Approximately 8% of irrigated land is now salinised, causing annual losses of up to 100,000 tons of cotton and other crops. Soil erosion, particularly in mountainous areas, and declining humus content further reduce fertility, threatening the viability of local crop varieties and the development of climate-resilient agriculture¹⁷⁴.

The agricultural sector is a significant energy consumer, accounting for about 15% of the country's total annual energy consumption in 2015, making it the third-largest energy-consuming sector. During the summer, this share can increase to 20%. Large agricultural fields in the country's south have been left fallow for years due to salinisation and waterlogging. Drainage infrastructure is often clogged with silt and debris, and in some irrigation systems, drainage was never fully developed. Low irrigation efficiency leads to substantial water losses, and combined with the degraded drainage networks, this has raised groundwater levels. Despite rehabilitation efforts led by the Agency for Land Reclamation and Irrigation (ALRI), the irrigated arable area has declined over recent decades, dropping from 612,500 ha in 1991 to 566,250 ha in 2022. The total area affected by salinisation and waterlogging was estimated at 32,000 ha in 2022. Further, organisational, technical, and accounting capacities within WUAs remain limited, and several international and national NGOs provide training and technical assistance to strengthen WUA capacity. According to the Organisation for Economic Co-operation and Development (OECD), the water fees currently collected through the water fee system are two to six times lower than

¹⁶⁹ CGIAR 2025. IFPRI Discussion Paper 02329. Tajikistan's agrifood system: The past performance and future opportunities and challenges. [Available online.](#)

¹⁷⁰ IFPRI 2025. Central Asia policy brief 23. Tajikistan's Agrifood System Structure. [Available online.](#)

¹⁷¹ World Bank Blogs 2022. Tackling food insecurity in Tajikistan. [Available online.](#)

¹⁷² IFPRI 2025. Agriculture sector reform and sectoral programs in Tajikistan. [Available online.](#)

¹⁷³ Khakimov, Parviz & Ashurov, Timur & Goibov, Manuchehr & Aliev, Jovidon, 2024. Tajikistan's agrifood sector review. GSSP working papers 2317, International Food Policy Research Institute (IFPRI). [Available online.](#)

¹⁷⁴ Aisia Plus 2025. Tajikistan faces soil degradation amid climate change: what needs to be done? [Available online.](#)

needed to ensure the proper operation and upkeep of these systems, particularly for pump irrigation. The same analysis concludes that some lift irrigation systems are no longer economically viable under prevailing energy costs and economic conditions¹⁷⁵.

2.4. Water sector

2.4.1. Overview of the water sector

Tajikistan has 947 rivers longer than 10 km, representing approximately 60% of Central Asia's hydro resources (Figure 24). The country contains around 1,300 lakes and reservoirs of various origins, covering a combined area of about 1,200 km², with a total water volume of approximately 44 km³, of which around 20 km³ is fresh water. The largest lakes, including Karakul, Rangkul, Zorkul, Sarez, and Yashilkul, are located in the Pamir region^{176,177}.

Tajikistan is the principal glaciated country in Central Asia, home to approximately 14,000 glaciers that collectively store between 500–850 km³ of freshwater (Figure 25). These glaciers represent a substantial proportion of the region's water reserves and are of critical hydrological importance. They are primarily concentrated in Central Tajikistan and the Pamir Mountains, covering an estimated 8,476 km², or approximately 6% of the national territory. This extensive glacial coverage underscores Tajikistan's role as a regional water tower, supplying headwaters to major transboundary river systems such as the Amu Darya. Among these, the Fedchenko Glacier is the most prominent, measuring over 70 km, making it the longest glacier in Eurasia. The glacial systems regulate seasonal river flows, support the agricultural sector, and influence the local and regional climate. These cryospheric resources are not only vital for Tajikistan's ecosystems, rural livelihoods, and hydropower potential, but are also essential for the water security of downstream countries in the region^{178,179}.

The total river flow passing through Tajikistan is estimated at 65.11 km³, contributing roughly 50% of the total annual inflow to the Aral Sea¹⁸⁰. Rivers are the primary sources of fresh water, supporting irrigation, power generation, and replenishing the Aral Sea. The primary river systems include the Pyanj, Vakhsh, Syrdarya, Zeravshan, Kafirnigan, and Bartang. Approximately 80% of the country's lakes are at altitudes above 3,000 metres. Most of Tajikistan's water resources are concentrated in the Pyanj and Vakhsh river basins. During the flood season (April–August), when intensive snowmelt and heavy rainfall occur, these rivers carry substantial amounts of suspended solids. While water availability for irrigation is generally abundant, the supply system faces challenges during drought years¹⁸¹.

¹⁷⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁷⁶ Tajikistan's Fourth National Communication 2022. [Available online.](#)

¹⁷⁷ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁷⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁷⁹ <https://ca-climate.org/eng/news/ledniki-tadzhikistana-intervyu-s-ekspertom/>

¹⁸⁰ Tajikistan's Fourth National Communication 2022. [Available online.](#)

¹⁸¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

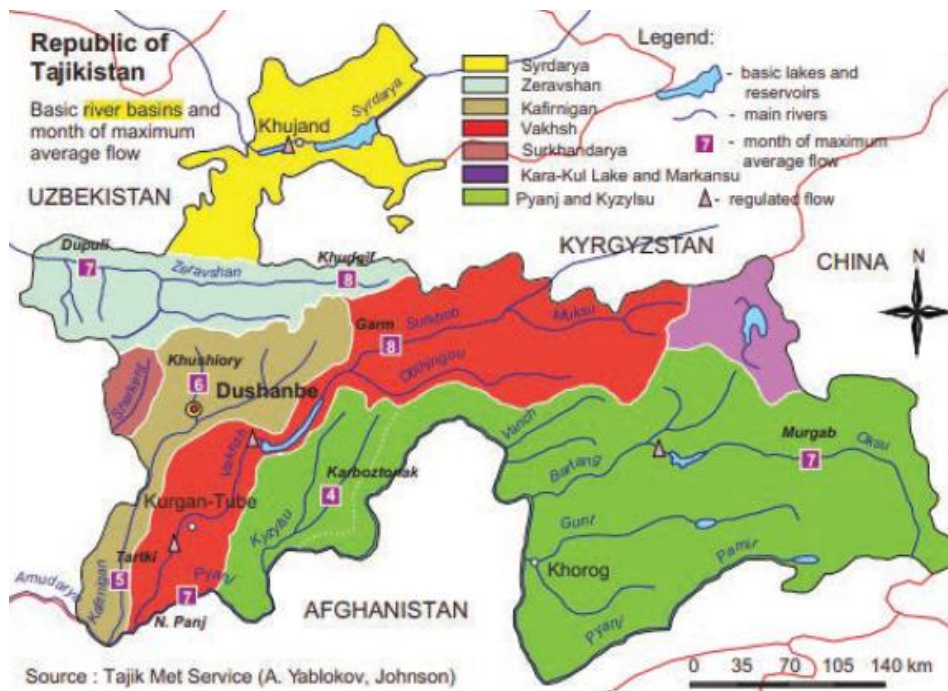


Figure 24. Primary river basins of Tajikistan¹⁸².

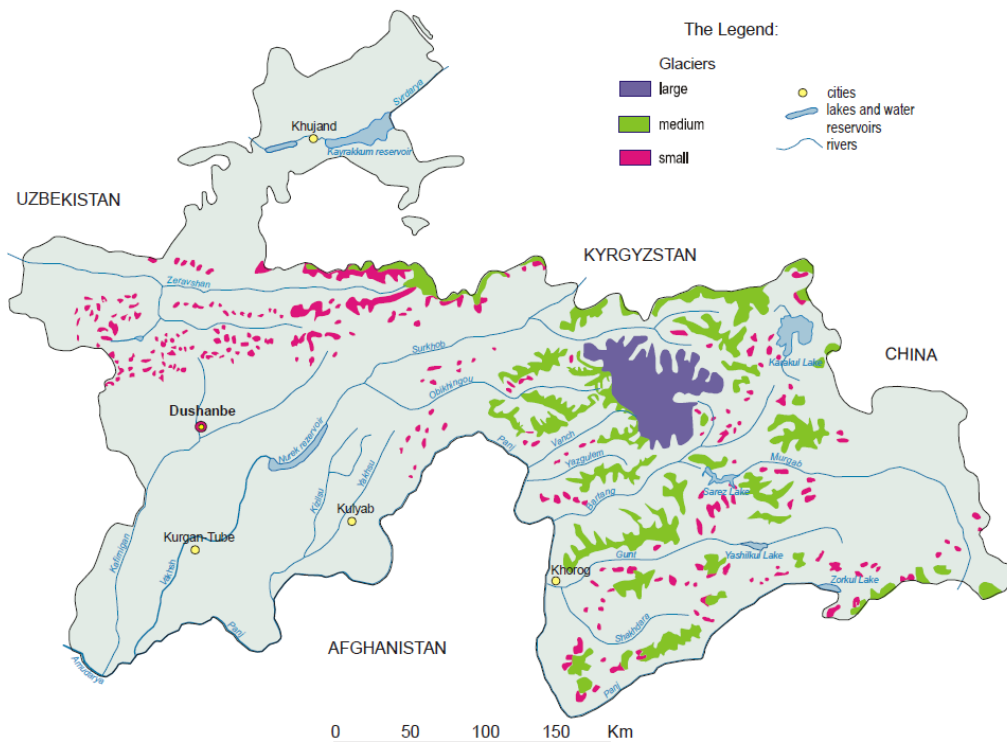


Figure 25. Glaciers of Tajikistan¹⁸³.

In 2023, the Government of Tajikistan approved its National Water Strategy to 2040, outlining a comprehensive reform agenda to enhance water security, climate resilience, and sustainable development. The strategy sets ambitious targets, including universal access to clean drinking water and 100% connection to centralised sewerage systems by 2040. Only 41% of the population has access to a centralised water supply, with 95% access in urban areas compared to just 22% in rural communities. Water losses reach up to 60% in major cities due to deteriorated

¹⁸² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁸³ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

infrastructure and insufficient investment, while water disposal coverage remains low: 64% in cities, 10% in towns, and only 0.1% in villages. The strategy aims to reduce water losses to 20% and expand centralised wastewater services to 50% of the population by 2030, with full coverage of 100% targeted by 2040¹⁸⁴.

The economic productivity of water is also a priority. In 2023, this stood at just 11 somoni per m³ (US\$1), with agricultural productivity as low as 2.5–3.1 somoni per m³ (US\$0.23–0.28). The goal is to increase water productivity to 34.9 somoni per m³ (US\$3) by 2040 by adopting water-efficient technologies, improved legal frameworks, and infrastructure upgrades. Digitalisation will play a key role, with the sector moving from 0% digital coverage today to 80% by 2040 through automation, real-time monitoring, and improved water governance¹⁸⁵.

Agriculture will benefit significantly from expanded and improved irrigation. The irrigated area will increase from 764,000 ha to 814,000 ha, with the adoption of water-saving technologies across 100,000 ha, up from 2,500 ha. Losses in irrigation systems will be reduced from 50% to 35%, and land suffering from poor melioration conditions will decline from 37,000 to 8,000 ha. A system-wide approach will ensure higher productivity and sustainability in the agricultural sector¹⁸⁶.

Hydropower capacity is also set to nearly double from 5,403 MW in 2023 to 10,951 MW by 2040, boosting clean energy generation and regional energy exports. To address seasonal water shortages, particularly under worsening climate conditions, Tajikistan plans to increase its total reservoir capacity from 15.6 km³ to 29.2 km³. Priority areas for investment include the lower reaches of the Isfara and Surkhob rivers, where modern reservoirs and updated water management systems will secure water for agriculture, industry, and households¹⁸⁷.

Meeting these targets will require sustained investment. While current public funding is significantly below needs, having fallen from US\$160 million in 1990 to just US\$10 million annually, an estimated US\$220 million per year will be required to finance infrastructure operations (US\$75 million) and capital rehabilitation (US\$50 million). The Government intends to mobilise public and private finance, expand public-private partnerships, attract international loans and grants, and improve tariff structures and subsidies. Stable, long-term financing is essential to modernise Tajikistan's water sector and meet its 2040 vision¹⁸⁸.

2.4.2. Water security at the centre of climate adaptation

Given growing pressures from irrigated agriculture, hydropower, municipal demand, and industry, water is central to Tajikistan's climate adaptation strategy. Glacial retreat and altered snowmelt patterns are expected to shift the timing and volume of surface water flows, requiring adjustments in water allocation norms and infrastructure management. Tajikistan prioritises investment in water storage infrastructure and institutional reforms to maintain water security. Existing reservoirs must be rehabilitated to support agriculture, energy, flood protection, and domestic water supply. In the longer term, rising temperatures and glacial loss could push the country toward severe water scarcity, especially as ice reserves decline. Water demand for irrigation is projected to increase by 3–7% nationally due to higher evapotranspiration. Modernising irrigation infrastructure is essential. Reducing conveyance losses by 25% and promoting efficient on-farm practices such as smart metering, laser land levelling, and climate-resilient crop choices can increase water use efficiency. Digital technologies, including remote sensing and smart irrigation systems, will also support precision management¹⁸⁹.

¹⁸⁴ CAREC 2025. Clean Water and Sewage for All: Tajikistan to Have Them by 2040. [Available online.](#)

¹⁸⁵ CAREC 2025. Clean Water and Sewage for All: Tajikistan to Have Them by 2040. [Available online.](#)

¹⁸⁶ CAREC 2025. Clean Water and Sewage for All: Tajikistan to Have Them by 2040. [Available online.](#)

¹⁸⁷ CAREC 2025. Clean Water and Sewage for All: Tajikistan to Have Them by 2040. [Available online.](#)

¹⁸⁸ CAREC 2025. Clean Water and Sewage for All: Tajikistan to Have Them by 2040. [Available online.](#)

¹⁸⁹ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

Upgrading irrigation systems could reduce energy consumption, particularly from pumped irrigation, which currently accounts for up to 20% of summer electricity use. Adaptation investments in irrigation—estimated at US\$1.6 billion (present value) until 2050—could offset projected productivity losses, especially in climate-vulnerable zones. Balancing water use between competing seasonal needs is critical. Agriculture demands water in summer, while hydropower relies on winter releases. Optimising the operation of multipurpose storage infrastructure is key, alongside US\$2 billion in additional investments to expand storage and improve water allocation across sectors. These investments will also help restore watersheds, support groundwater recharge, and reduce evapotranspiration. Strengthening institutional capacity, hydrometeorological systems, and modelling tools is vital for effective water governance. Access to safely managed water and sanitation remains limited, particularly in rural areas. Climate-resilient WASH infrastructure will require over US\$1 billion in investments by 2050, with about 30% potentially mobilised through private sector partnerships. These improvements will generate significant co-benefits, including reduced child stunting, lower infant mortality, and improved labour productivity. Tajikistan's deteriorating water infrastructure and rising economic, demographic and climate pressures will amplify regional water scarcity, particularly in the Amu Darya basin. Strengthening water management will be essential for both national resilience and transboundary cooperation with downstream neighbours such as Uzbekistan, Turkmenistan, and Kazakhstan¹⁹⁰.

2.4.3. Threats to and challenges for the water sector

Tajikistan's water sector is under growing pressure from climate change, poor infrastructure, pollution, and weak governance. These factors threaten long-term water security, disaster resilience, and regional cooperation.

Glacial retreat and hydrological risk

Tajikistan has more than 60% of Central Asia's glaciers and covers 6% of the country's territory. These vital freshwater reserves sustain the Amu Darya and Syr Darya river basins. These rivers support agriculture, energy generation, and domestic water use for millions of people across Central Asia. However, the country has lost approximately 20% of its glacier volume and 30% of its glacier area over the past 50–60 years, with projections indicating a 50% decline in glacial mass by 2050 due to rising temperatures and shifting precipitation patterns. Glaciers in Central Asia, which supply water to over 70 million people, have already declined by 8.5%, with losses in Tajikistan particularly acute. More than 1,000 of the country's 14,000 glaciers have disappeared over the past three decades, jeopardising ecosystems and water security. The Fedchenko Glacier, Eurasia's largest glacier outside the polar regions, has lost more than 2 km³ of ice since the late 20th century, reducing its volume from approximately 144 km³. Continued glacier melt is expected to reduce seasonal water flows, intensify glacial lake outburst floods (GLOFs), and increase the risk of flash floods and landslides in vulnerable mountain communities^{191,192,193}.

Water quality and sanitation challenges

Access to safe drinking water and sanitation services remains severely limited. Only one-third of Tajikistan's population receives piped water with chlorination. Approximately 30% rely on spring water, while the remainder depend on river, ditch, or open sources that are often untreated. Sewerage infrastructure covers just 5% of the population, leading to high rates of waterborne diseases and public health risks, particularly in rural areas. In rural areas, women and girls are disproportionately burdened with water collection. Nearly 90% of affected households are solely

¹⁹⁰ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

¹⁹¹ <https://www.undp.org/tajikistan/stories/undp-unites-mountain-nations-share-practices-glacier-preservation>

¹⁹² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

¹⁹³ <https://ca-climate.org/eng/news/ledniki-tadzhikistana-intervyu-s-ekspertom/>

responsible for fetching water, often from distant and unsafe sources, at significant cost to their health, education, livelihoods and family well-being¹⁹⁴.

Ageing infrastructure and inefficient water use

Tajikistan's water supply and irrigation systems are outdated and chronically underfunded. Irrigation systems are either non-functional or highly inefficient, losing up to 65% of water pumped to cultivated lands due to leakages and inefficient agricultural water use. Urban areas also face substantial water losses due to leaking distribution networks, ageing treatment facilities and irregular maintenance. Low tariffs prevent utilities from recovering operational costs, hindering reinvestment and system upgrades^{195,196}.

Although Tajikistan is water-rich, only 55% of the population can access safely managed water services, the lowest in Central Asia, with rural areas particularly underserved. Just 24% of rural residents have a piped water supply, and where systems exist, they are often dilapidated and inadequate to meet growing demand. Poor sanitation and limited access to safe water impose steep economic costs, estimated at 4.25% of GDP, more than three times the investment needed to ensure adequate water and sanitation services, which would require 1.25% of GDP¹⁹⁷.

Pollution from agriculture, industry and mining

Water pollution is increasing due to unregulated agricultural runoff such as fertilisers and pesticides, industrial effluents, and legacy and recent mining contamination. In particular, heavy metals and radioactive waste from past uranium mining and aluminium production continue to pollute rivers and groundwater sources, especially in the Vakhsh and Zeravshan basins, and current gold mining is reported to have degraded land, poisoned the air, and polluted the Romit river^{198,199,200}.

Climate-induced drought and resource stress

While flooding is not a primary concern for Tajikistan's poorest communities, drought seriously threatens agricultural livelihoods (Figure 26). In a 1-in-40-year drought scenario, around one-third of districts could face severe impacts (such as agricultural production loss, water scarcity, land degradation, orchard and perennial crop failure, food insecurity and water use conflict), affecting over 34% of their populations. Such events could compromise at least half of the agricultural land in these areas. Districts most exposed to drought, GBAO, Region of Republican Subordination (RRS) and Khatlon Province, often overlap with high poverty areas. In RRS and Khatlon, the scale of rural populations makes drought mitigation particularly complex. In GBAO, the primary challenge lies in managing large land areas under persistent drought stress^{201,202,203}.

¹⁹⁴ <https://www.worldbank.org/en/news/feature/2023/03/22/expanding-access-to-safe-water-in-rural-tajikistan>

¹⁹⁵ OSCE Technical Report. Energy and Agriculture Water Management in Tajikistan. [Available online.](#)

¹⁹⁶ <https://www.worldbank.org/en/news/press-release/2022/06/23/tajikistans-water-sector-to-benefit-from-additional-world-bank-support>

¹⁹⁷ <https://www.worldbank.org/en/news/feature/2023/03/22/expanding-access-to-safe-water-in-rural-tajikistan>

¹⁹⁸ UNECE 2025. Benefits and opportunities of setting up an Inter Institutional Working Groups on Tailings Safety and the Prevention of Accidental Water Pollution. [Available online.](#)

¹⁹⁹ Business & Human Rights Resource Centre 2024. Dead fish and polluted air: How Chinese companies extract gold in Tajikistan. [Available online.](#)

²⁰⁰ RFE/RL 2025. Fertile Land And Clean Air At Risk: Chinese Mining Alarms Villagers In Serbia And Tajikistan. [Available online.](#)

²⁰¹

World Bank Group 2021. Tajikistan Climate Risk Country Profile. [Available online.](#)

²⁰² World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁰³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

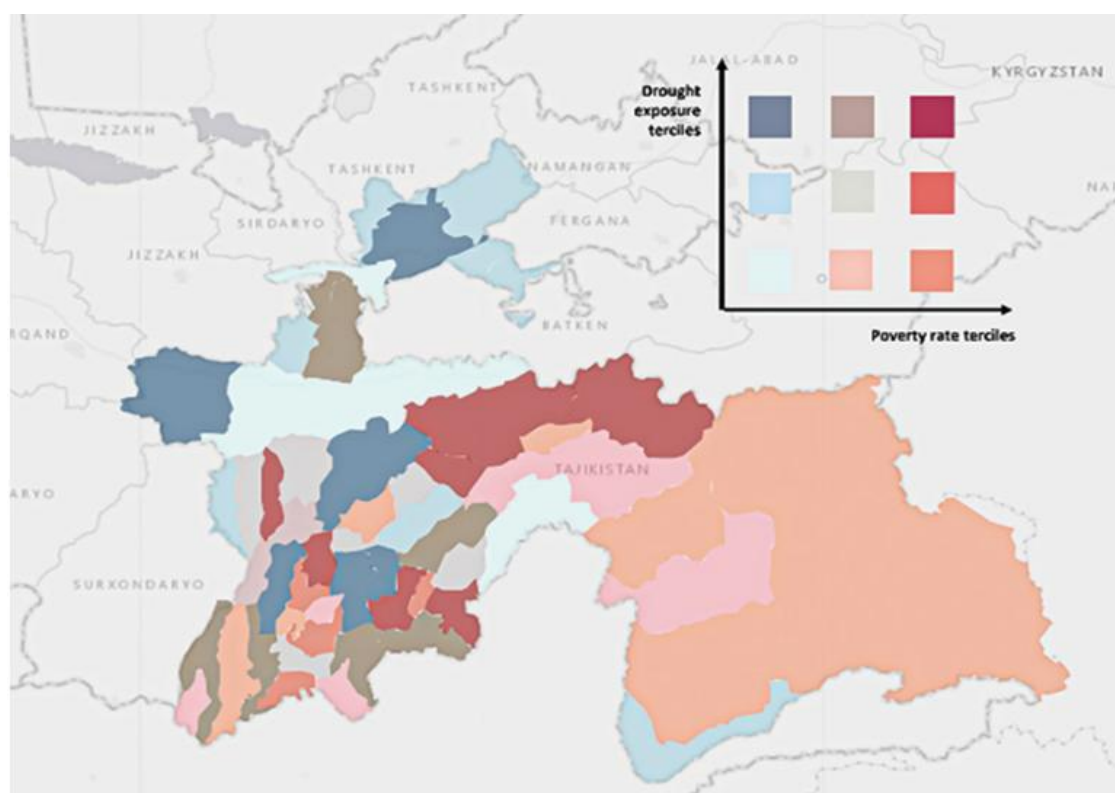


Figure 26. Population with more than half of their land affected by drought risk²⁰⁴.

Governance and financing gaps

Institutional fragmentation, weak regulation, limited data systems, and underfinancing undermine water sector governance. Public investment remains low, with annual allocations to the sector at ~0.2% of GDP, far below the regional average of 1.5–2% in Europe and Central Asia. To meet SDG 6 (Clean Water and Sanitation) targets by 2030 (Table 7), Tajikistan will require at least US\$800 million in new investment to achieve universal access to safe water and sanitation services. Additionally, historic transboundary tensions, particularly with downstream countries such as Uzbekistan, existed over large-scale hydropower projects and reduced flow volumes, underscoring the need for strengthened regional cooperation and joint management frameworks. More recently, efforts have been made to improve relationships and enter into mutually beneficial agreements^{205,206}.

Table 7. Tajikistan's Performance on SDG 6 Indicators²⁰⁷.

Target	Indicator	Latest Data (Year)	Tajikistan Performance
6.1	Safely managed drinking water services	55% (2022)	Over half have access to safe drinking water
6.2	Sanitation and hygiene (handwashing facility)	73% handwashing facility access (2022)	Significant gaps in safe sanitation services
6.3	Wastewater safely treated	Not available	Indicates limited wastewater infrastructure
6.3	Water quality in monitored bodies	Not available	Monitoring capacity for water quality remains low
6.4	Water-use efficiency (value added per m ³)	US\$1 per m ³ (2021)	Low resource productivity per water used
6.4	Water stress (withdrawal/share)	70% (2021)	Very high water stress level
6.5	IWRM implementation level	54% (2023)	Moderate progress on integrated water management

²⁰⁴ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁰⁵ <https://www.worldbank.org/en/news/feature/2023/03/22/expanding-access-to-safe-water-in-rural-tajikistan>

²⁰⁶ The Tribune 2025. Uzbekistan, Tajikistan to build hydropower plants on Zarafshan river. [Available online.](#)

²⁰⁷ <https://www.sdg6data.org/en/country-or-area/Tajikistan>

Target	Indicator	Latest Data (Year)	Tajikistan Performance
6.5	Transboundary basin coverage	Not available	Limited formal water cooperation across shared basins
6.6	Rapid change in surface water extent	6% of basins (2020)	Some degradation of water-related ecosystems evident
6.a	ODA for water and sanitation	US\$99 M (2022)	Significant external support flows reported
6.b	Local community participation	High in several subsectors (2021)	Community engagement exists but limited scale

2.5. Food Security

2.5.1. Overview

According to a national household survey conducted in August 2023, approximately 16% of households, or approximately 1.56 million people, were estimated to face acute food insecurity, including nearly 50,000 individuals experiencing severe acute food insecurity. The prevalence of food insecurity varies across regions, with Khatlon registering the highest proportion of acutely food insecure households (20%), followed by the DRS (Figure 27). In contrast, the GBAO reported the lowest levels at 10%. The majority of the population (55–65%) is classified as marginally acute food secure, meaning they are applying coping strategies to meet their food needs. Nationally, 21% of households are considered food secure, with the highest percentage observed in the capital, Dushanbe, at 32%²⁰⁸.

Food insecurity is more pronounced in rural areas, where 17% of households are food insecure, compared to 13% in urban settings. Rural households tend to have slightly larger average household sizes than the national average of six members, and the proportion of household heads aged 60 years or above is notably higher in rural areas (39%) compared to urban areas (28%)²⁰⁹.

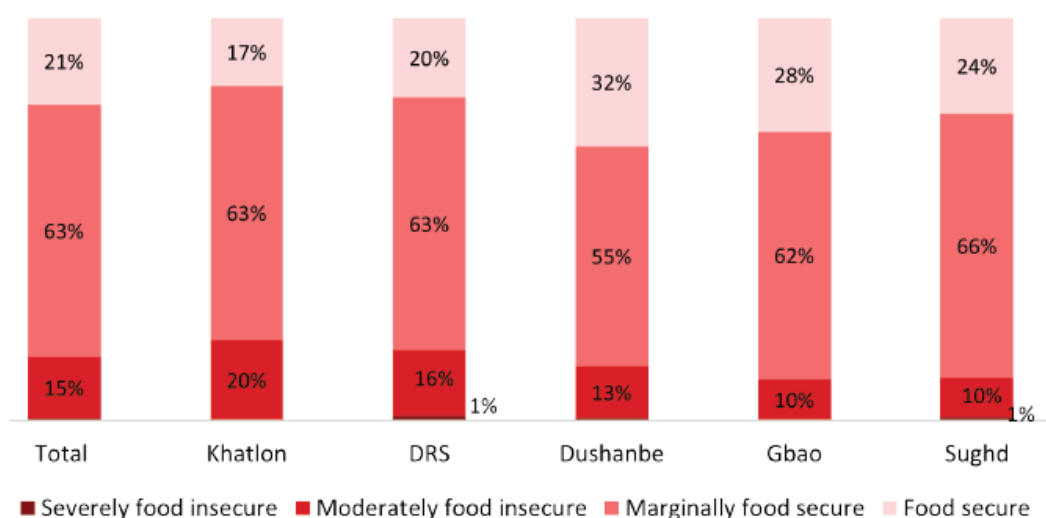


Figure 27. Proportion of households categorised into food security status according to region, Tajikistan.

Analysis by gender of household head reveals that food security is lower among female-headed households (18% food secure), compared to male-headed households (22% food secure) (Figure 28). Notably, the higher proportion of female-headed households in urban areas (24%) compared to rural areas (14%) may mask the vulnerability of rural women-headed households²¹⁰.

²⁰⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²⁰⁹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²¹⁰ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

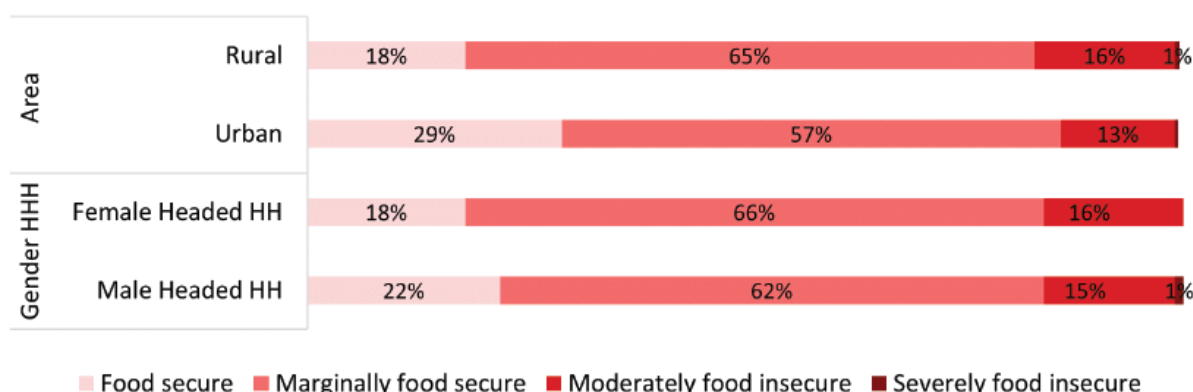


Figure 28. Proportion of households categorised according to food security status, by area and gender of household head. Tajikistan.

2.5.2. Household food consumption

The analysis of the Food Consumption Score (FCS) indicates that approximately 750,000 people, or 7.6% of Tajik households, had inadequate food consumption at the national level, including 110,000 people classified as having poor food consumption. Regional variability is low, with the proportion of households with insufficient food consumption ranging from 7% to 9%, except in GBAO, which stands at 3%²¹¹.

The average number of days each food group was consumed at the household level during the seven days prior to the survey shows that cereals, oil/fats, and vegetables were consumed almost daily (Figure 29). Sugar was consumed on average six days per week, while meat, fish, eggs, fruits, and milk/dairy products were consumed five days per week. Pulses and legumes were the least consumed food group, with an average of two days per week²¹².

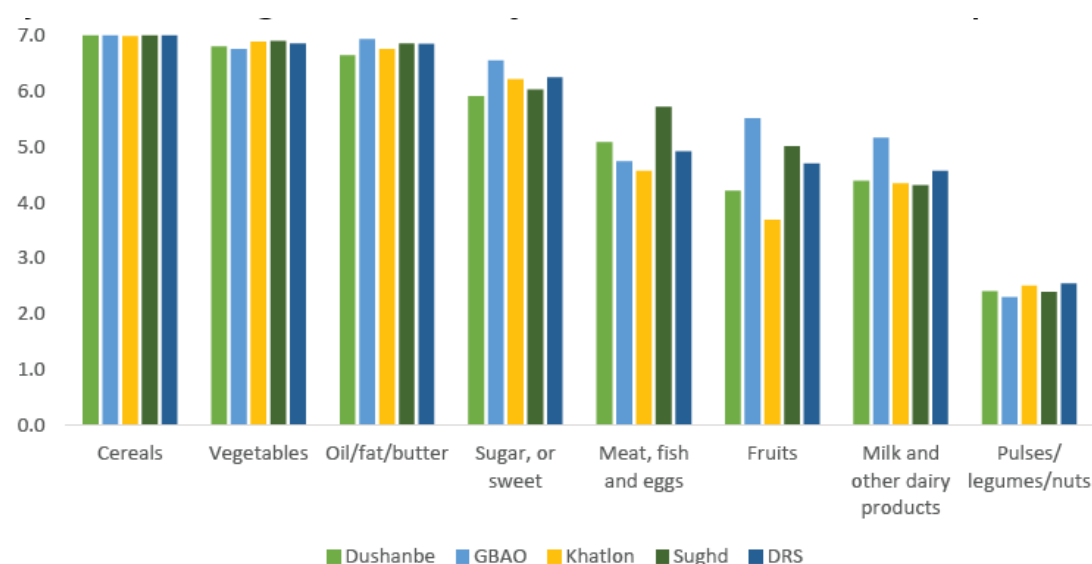


Figure 29. Average number of days food items were consumed per week, by region, Tajikistan.

Consumption patterns for key food groups such as cereals, vegetables, and oil/fats/butter were similar across regions, indicating relatively consistent dietary habits nationwide. However, regional differences were evident for meat, fish, eggs, fruits, and dairy, suggesting disparities in food access; for example, fruit consumption in Khatlon is lower than in other regions. Overall, no

²¹¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²¹² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

significant differences were observed between urban and rural areas or by the gender of the household head²¹³.

Trend analysis between Q2 2022 and Q3 2023 reveals improvements in food consumption (Figure 30). The Food Security Monitoring System (FSMS) round conducted in August 2023 shows the highest percentage of households with acceptable food consumption (92%) and the lowest proportion of households with poor (1%) or borderline (7%) food consumption. By gender of household head, the percentage of households with insufficient food consumption is 2% higher among households headed by women compared to those headed by men²¹⁴.

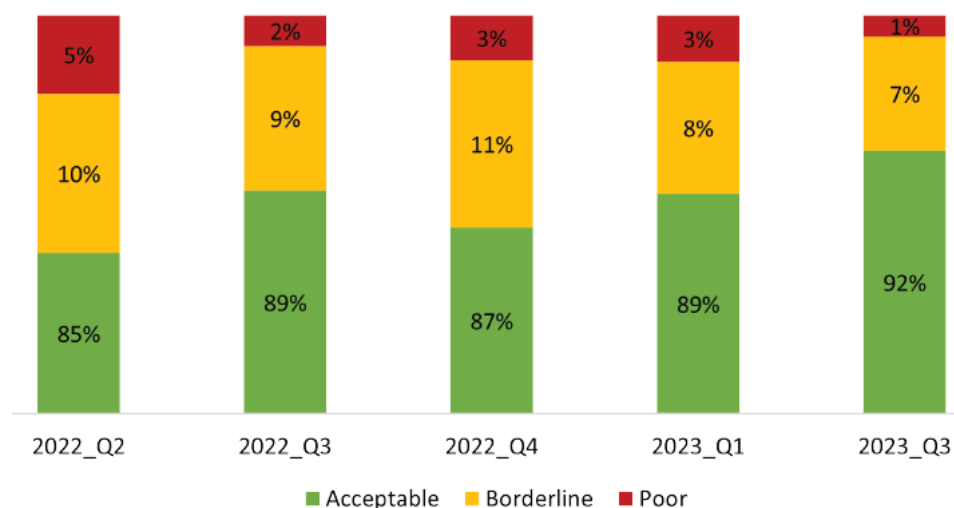


Figure 30. Trend proportion of households in different consumption groups, Tajikistan.

The frequency of consumption of nutrient-rich food groups shows that most households reported daily consumption of protein-rich (84%) or vitamin A-rich (94%) foods, placing them at lower risk of undernutrition and micronutrient deficiencies (Figure 31). However, 59% of households did not consume any iron-rich foods on one or more days during the previous week, and 15% reported not consuming any iron-rich foods on any day of the week. These households are at high risk of iron deficiency anaemia, with serious implications for children, adolescent girls, and pregnant or lactating mothers. In 2019, WHO estimated that 35% of non-pregnant women aged 15–49 years were anaemic across Tajikistan²¹⁵.

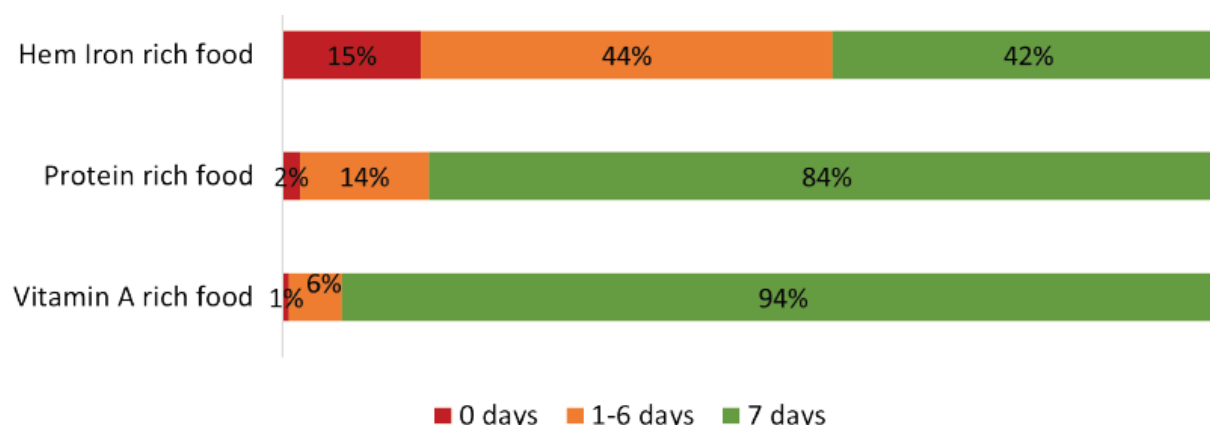


Figure 31. Proportion frequency consumption of protein, Vitamin A and hem-iron rich foods.

Analysis by FCS category shows that no households with poor or borderline food consumption reported daily consumption of protein- or iron-rich food groups, and only 57% had daily vitamin A-rich foods (Figure 32). Nearly half of the households with poor or borderline consumption did

²¹³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²¹⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²¹⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

not consume any iron-rich food group during the week, and one in four did not consume any animal protein. Even among households with acceptable FCS, 57% did not consume iron-rich foods daily²¹⁶.

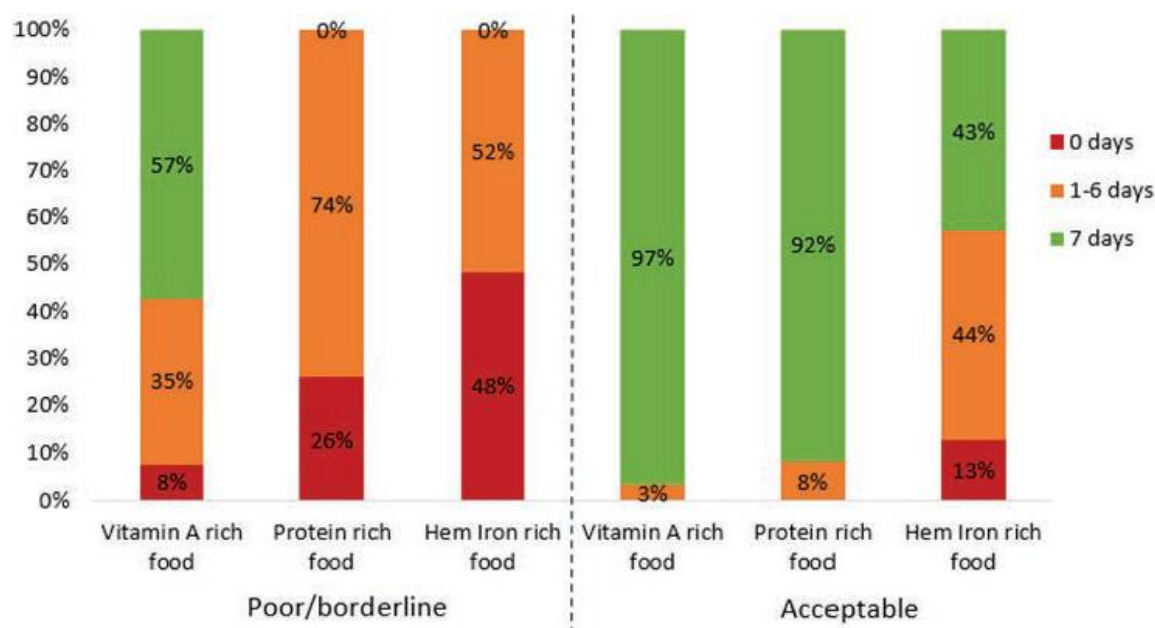


Figure 32. Consumption of Vitamin A, protein and hem-iron rich food groups by poor/borderline grouped and acceptable FCS.

2.5.3. Household expenditure patterns

Households were asked about their total expenditure on food and non-food items over the 30 days preceding the survey, based on which the share of total expenditure on food was calculated, a critical indicator of economic well-being and food security (Figure 33). Households were classified into four categories based on their food expenditure share. Nearly half of the households (48%) spend more than 65% of their monthly budget on food, without significant differences between urban and rural areas or by the gender of the household head. High food expenditure shares above 65% imply likely difficulties for the household in covering non-food essential needs²¹⁷.

²¹⁶ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²¹⁷ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

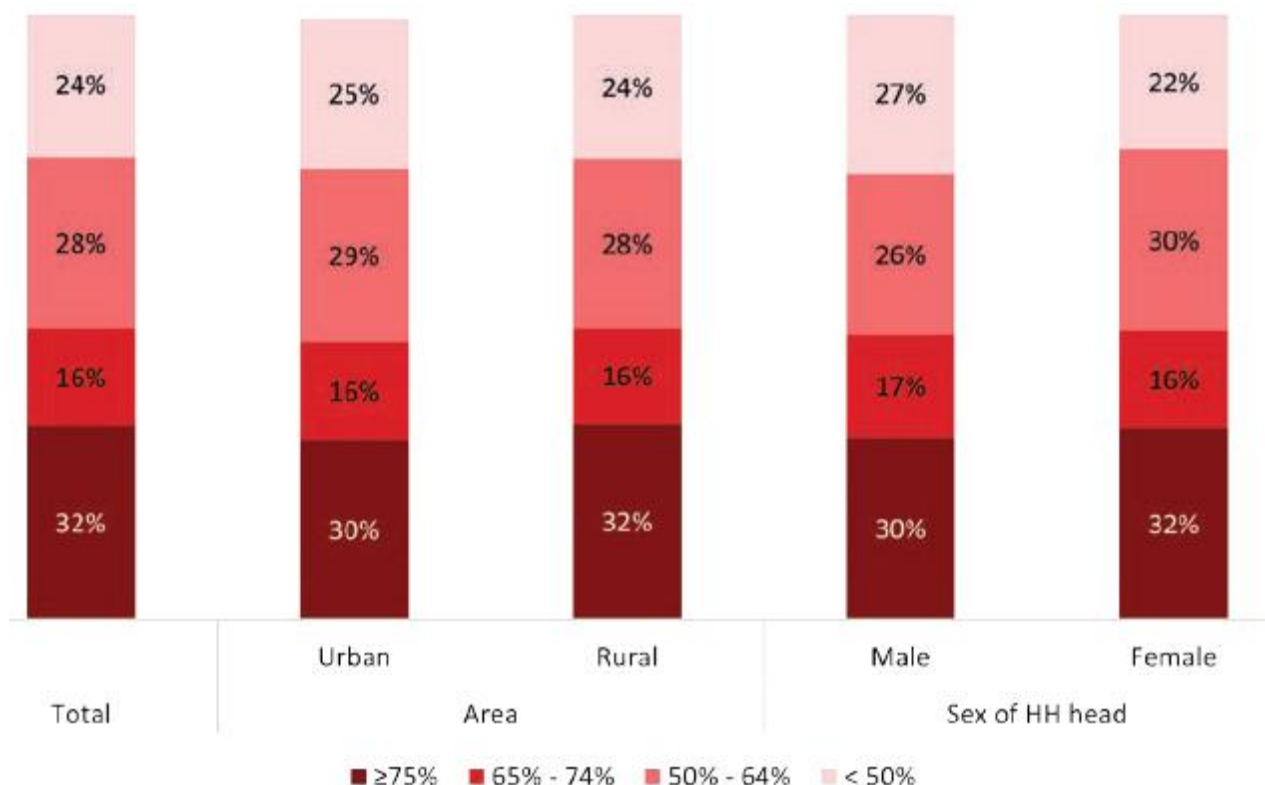


Figure 33. Food Expenditure share categories by urban/rural area and gender of household head.

By region, the average food expenditure share is lowest in Dushanbe (57%) and highest in GBAO (64%) (Figure 34). The August 2023 FSMS results were compared with 2021 and 2022 figures extracted from the Statistical Agency under the President of the Republic of Tajikistan report, serving as historical reference points. The trend analysis reveals a consistent upward trend in food expenditure share across all regions over the three-year period, but with significant differences among regions. From 2021 to 2023, the increase in food expenditure share ranged from 6–7 percentage points in Dushanbe, Sughd, and Khatlon to 21 percentage points in GBAO²¹⁸.

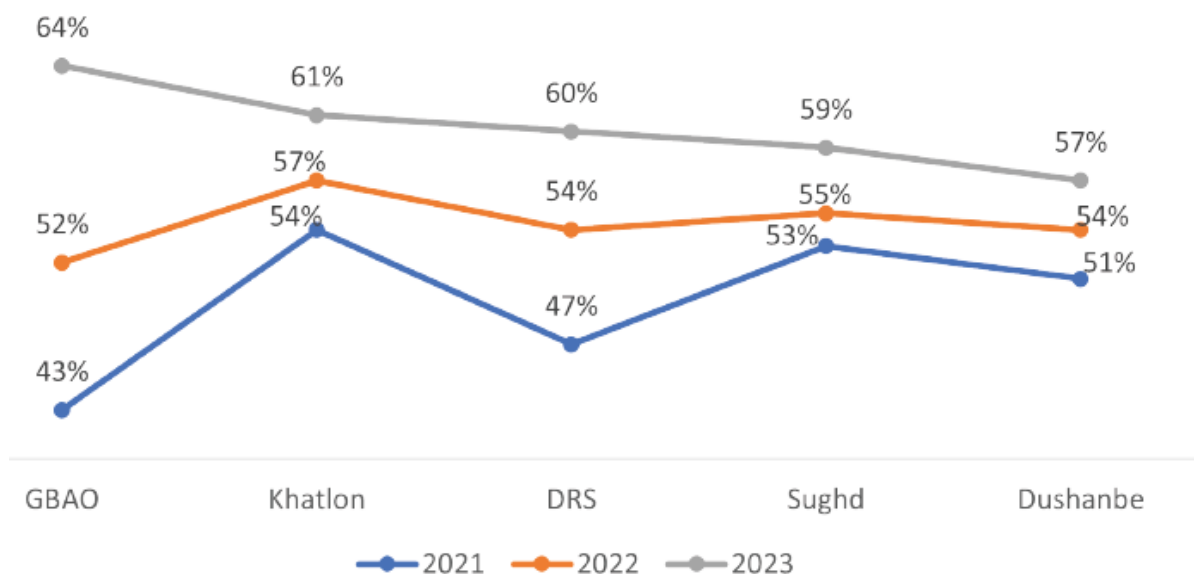


Figure 34. Share of total household expenditure on food, by urban-rural and gender of household head.

²¹⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

These results provide insights into the evolving economic conditions and consumption patterns across the various regions of the country, with GBAO and DRS showing signs of more deterioration in household economic access compared to other regions. Notably, in 2021, the average food expenditure share in GBAO was the lowest among all regions, whereas in 2023 it shows the highest value. These trends likely reflect a combination of factors, including food inflation, changes in dietary preferences, and shifts in household income. The data underscores the importance of monitoring food expenditure patterns to assess household well-being and food access adequacy. It also serves as a valuable resource for policymakers and national and international organizations to tailor interventions and programmes that address the specific needs and challenges faced by different regions of the country²¹⁹.

2.5.4. Food consumption–related coping strategies

More than half of Tajik households (58%) applied food consumption–related coping strategies in the seven days prior to the survey. Consuming less preferred and less expensive food was the most frequently applied strategy (42%), followed by limiting portion size of meals (23%) and borrowing food or relying on friends and relatives (20%) (Figure 35). Reducing the number of meals or restricting adult consumption so children could eat was reported by 16% of households. The percentage of households with high and medium coping levels was highest in Khatlon and lowest in Dushanbe. However, the most severe strategies were more frequently applied in GBAO (13%) (Figure 36)²²⁰.

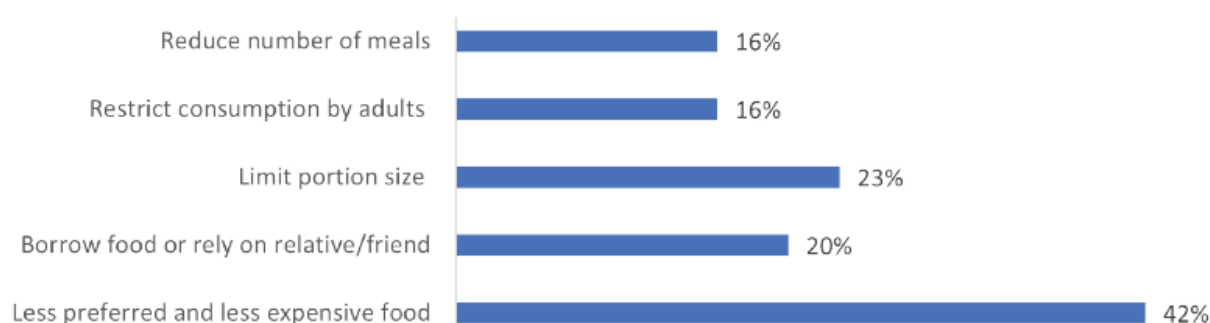


Figure 35. Proportion of households adopting food consumption-related coping strategies, Tajikistan.

²¹⁹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²⁰ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

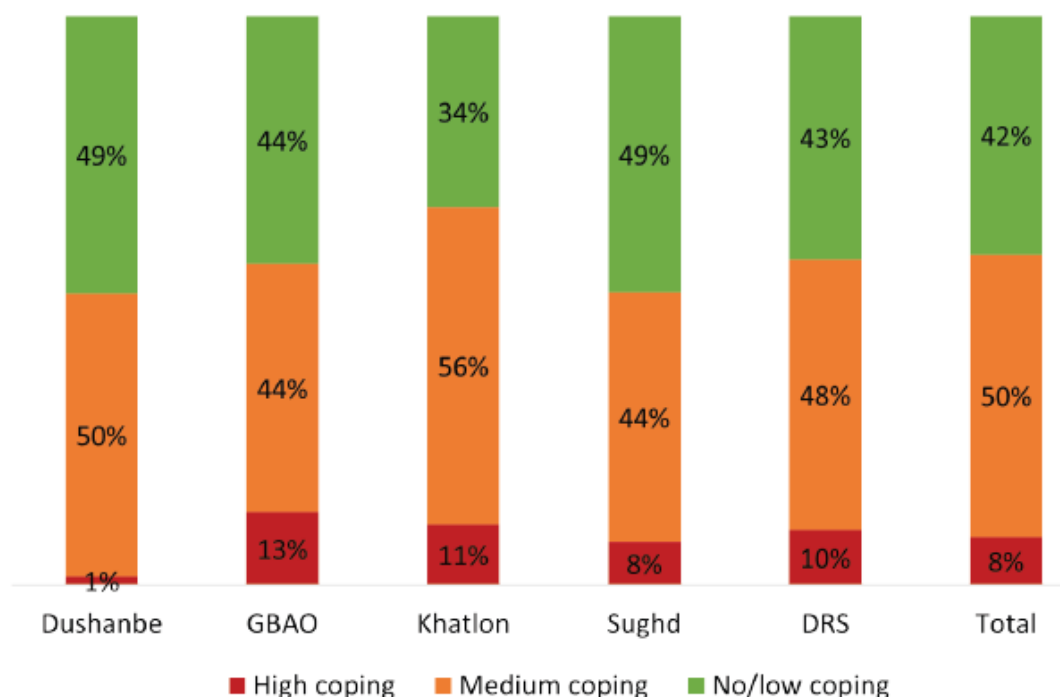


Figure 36. Food-based coping by region, Tajikistan.

2.5.5. Livelihood-based coping strategies

The degree of vulnerability to food insecurity in any community can be measured by the negative coping strategies households adopt, which often result in the erosion of livelihood resources and carry long-term consequences. The most common coping strategy, reported by 42% of households, is reducing expenses on essential health (Figure 37). This highlights the difficult choices families make when financial constraints force them to prioritize immediate needs over long-term well-being. A substantial 35% of households reported spending their savings, reflecting the economic strain they face. Additionally, 30% borrowed money to cover food needs, underscoring the financial precarity many experience²²¹.

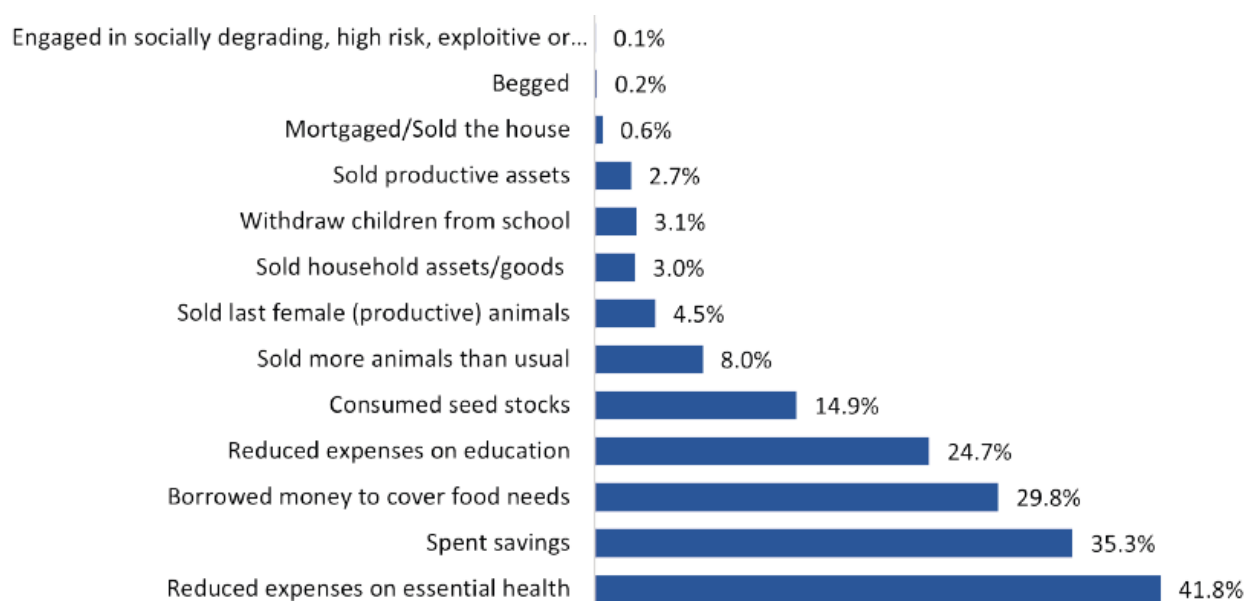


Figure 37. Proportion of households adopting different types of livelihood-based coping strategies, Tajikistan.

²²¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

The impact on education is also evident, with 25% of households reducing expenses on education — a choice that could jeopardize their children’s future opportunities. Other strategies include consuming seed stocks (14%), selling animals (8%), and selling productive assets (3%), all of which erode vital livelihood resources and threaten long-term food security and economic stability. More concerning, although reported by only a small percentage, are extreme high-risk coping mechanisms such as mortgaging or selling homes, begging, or engaging in socially degrading, exploitative, or life-threatening work. These desperate measures highlight the challenges some families face in meeting their basic needs²²².

These results emphasize the urgency of implementing sustainable interventions to reduce household vulnerability to food insecurity. There is a critical need for social safety nets, financial support systems, and livelihood diversification programmes to help families withstand economic shocks without resorting to strategies that damage their long-term resilience. Coping strategies were classified by severity into stress, crisis, and emergency strategies. Results show that²²³:

- 50% of households were adopting crisis coping strategies such as reducing health expenses, consuming seed stocks, or selling productive assets; and
- 24% were adopting stress coping strategies such as spending savings, borrowing money to cover food needs, reducing education expenses, or selling more (non-productive) animals than usual.

Compared to previous FSMS rounds, the percentage of households applying crisis or severe livelihood coping strategies (59%) in August 2023 is the highest since Q1-2022 (Figure 38). Similarly, the proportion of households that did not engage in any livelihood coping strategy dropped to 18% in August, nearly half the level of the previous round (Q1-2023: 35%). This increase in the use and severity of coping strategies reflects households’ growing difficulties in covering basic needs, forcing them to compromise future productivity and resilience capacity. Analysis also shows that households in rural areas are more likely to employ livelihood coping strategies that are more severe. Additionally, households headed by women are more likely to use coping strategies, particularly those in the crisis category²²⁴.

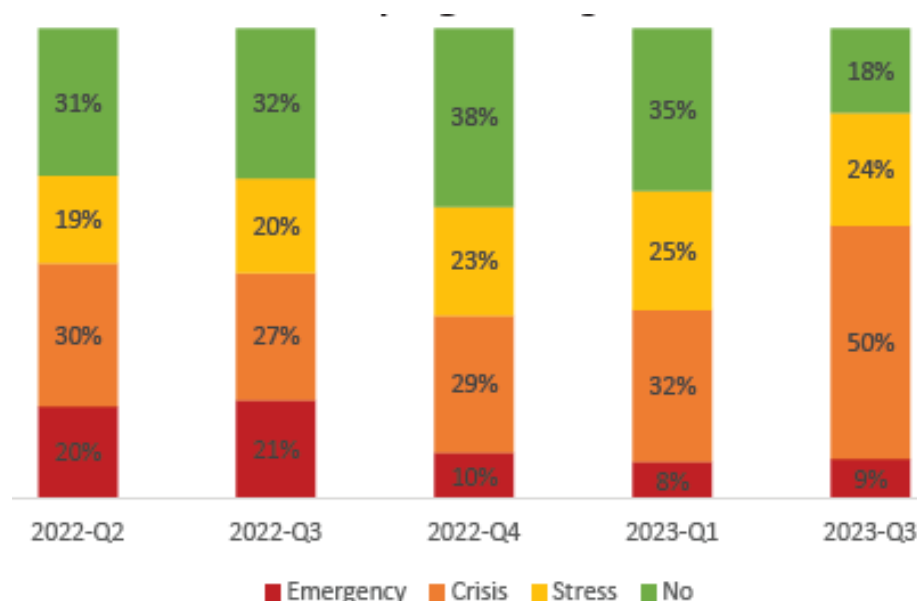


Figure 38. Proportion of households adopting livelihood-based coping strategies by quarter, Tajikistan.

²²² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

2.5.6. Shocks and resilience

In the three months preceding the survey, most surveyed households did not face significant shocks that contributed to the deterioration of their well-being (Figure 39). Among the notable shocks reported²²⁵:

- Natural disasters (e.g., floods, storms) affected 4.9% of households, with immediate and often severe impacts on well-being and livelihoods; and
- Sickness, accidents, or deaths in the family accounted for 4.3% of cases, highlighting the emotional and financial challenges households face and the importance of healthcare access and social support.

A minimal percentage of households cited shocks related to lack of job opportunities (0.2%) or pest outbreaks/plant and animal diseases (0.2%) as contributing factors. While the percentages for some shocks are small, they highlight the diverse range of challenges households can face. This data underscores the need for comprehensive strategies that address both immediate impacts (e.g., natural disasters, health crises) and longer-term factors (e.g., job opportunities, agricultural resilience). Building household resilience and strengthening social safety nets are critical to protecting households from the diverse shocks that threaten their well-being²²⁶.

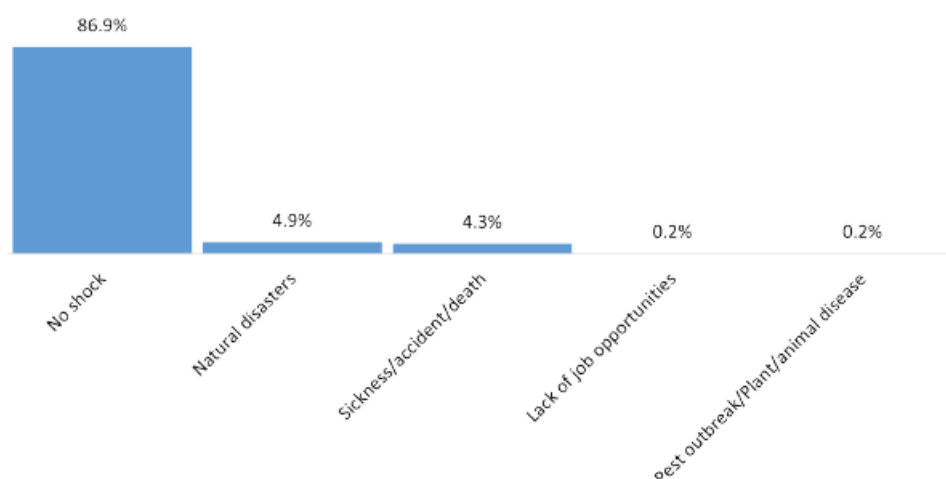


Figure 39. Proportion of households facing shocks in the last three months before the survey, Tajikistan.

2.5.7. Sources of income

Household livelihood strategies play a pivotal role in determining access to food. Generally, households engaged in sustainable livelihood activities enjoy better physical and economic access to food, essential for a healthy and active life²²⁷.

Based on survey findings (Figure 40)²²⁸:

- Regular salaried employment emerged as the primary livelihood strategy, with one-third of the population relying on regular income;
- Seasonal migration and overseas remittances accounted for the main income source for one-fourth of households; and
- Daily casual labour supported about 23% of households.

²²⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²⁶ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²⁷ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²²⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

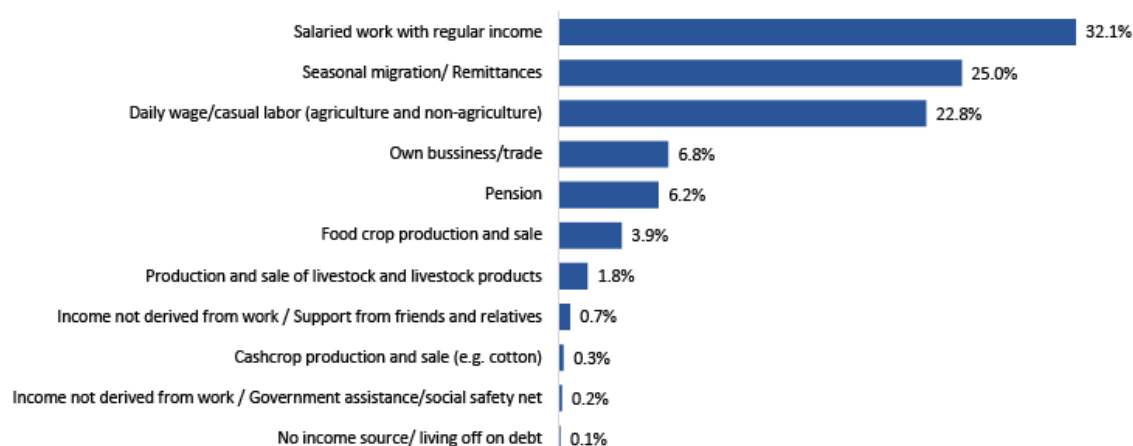


Figure 40. Households' primary sources of income in the last six months, Tajikistan.

Regional disaggregation shows an over-reliance on seasonal migration/remittances in DRS and Khatlon, where over 30% of households depend primarily on these sources, followed closely by salaried work (Figure 41). This heavy dependence on external income flows exposes vulnerable households to risks from fluctuations in remittances or disruptions in migration patterns²²⁹.

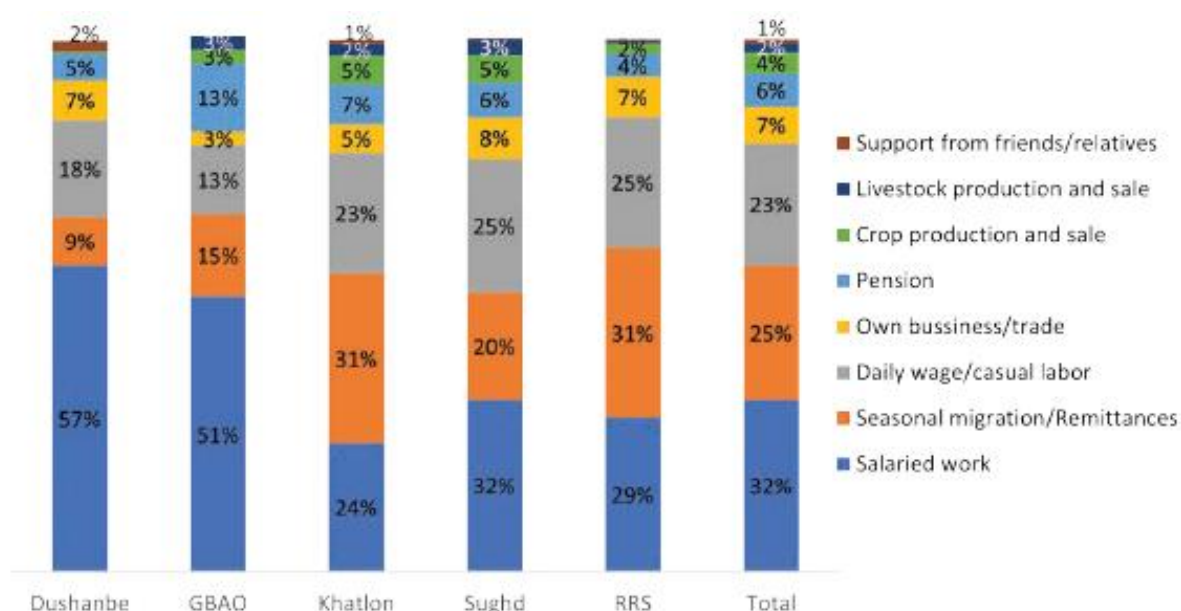


Figure 41. Households' primary sources of income in the last six months by region, Tajikistan.

To strengthen resilience and food security, it is essential to diversify income streams, promote local economic development, and create training and income-generating opportunities within these regions. Such measures can reduce dependency on external income and help build stronger, more self-reliant communities²³⁰.

2.5.8. Changes in household income

Overall, 28% of households reported a decrease in household income compared to the same month the previous year (Figure 42). This percentage was slightly lower in Dushanbe and GBAO. Conversely, the proportion of households reporting an increase in household income over the last year was higher than the national average (27%) in GBAO and DRS. In rural areas, the percentage of households experiencing income changes over the last year (whether increases

²²⁹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²³⁰ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

or decreases) was higher than in urban areas, reflecting greater income instability in rural households (Figure 43)²³¹.

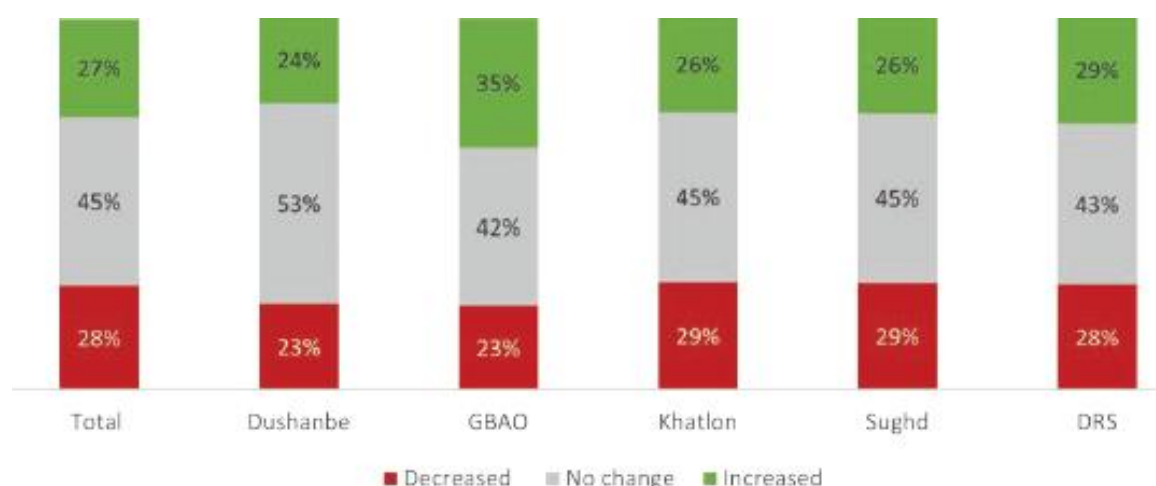


Figure 42. Proportion of households reporting income changes by region, Tajikistan.

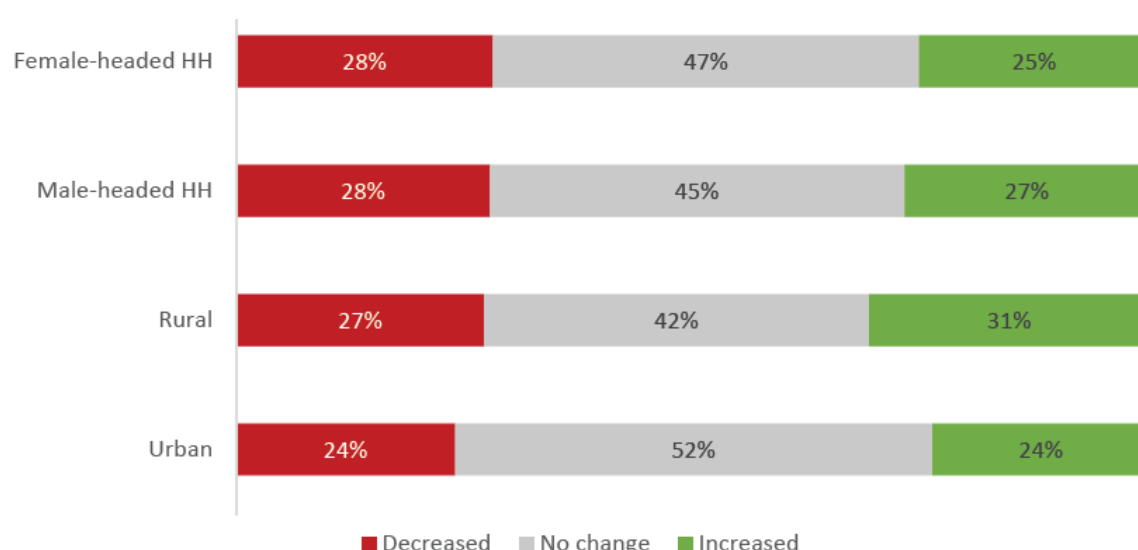


Figure 43. Proportion of households reporting income changes by gender of household head and area type.

Among households reporting reduced incomes over the past year (Figure 44)²³²:

- 42% reported reduced access to food, including difficulties buying enough food or stocking up for the winter, underscoring the strong link between income and food security, especially considering seasonal factors;
- 31% reported limited capacity to meet non-food needs, including health and education; and
- 6% reported reduced livelihood investments, such as in agriculture.

Other impacts were reported by 17% of households with reduced incomes, showing the diversity of effects. Notably, one in four households reported no major impact despite income reductions.

²³¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²³² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

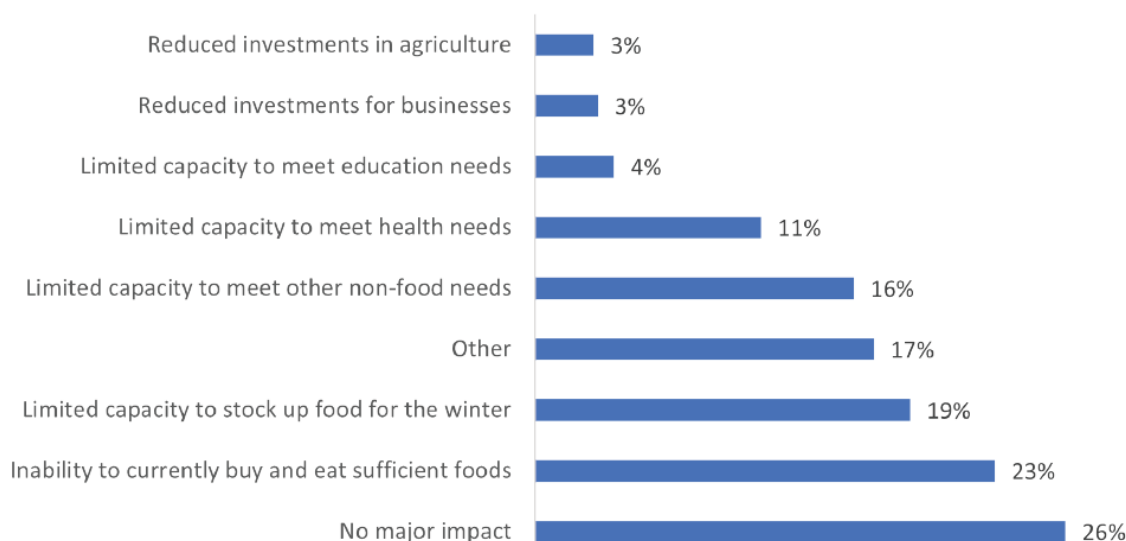


Figure 44. Type of impact of income reduction among households.

2.5.9. Access to credit

More than half of the interviewed households (54%) borrowed money in the 12 months prior to the survey, with no significant difference between male- and female-headed households. The main sources of credit were (Figure 45)²³³:

- Banks and credit institutions (52%);
- Relatives (28%); and
- Traders or shopkeepers (14%).

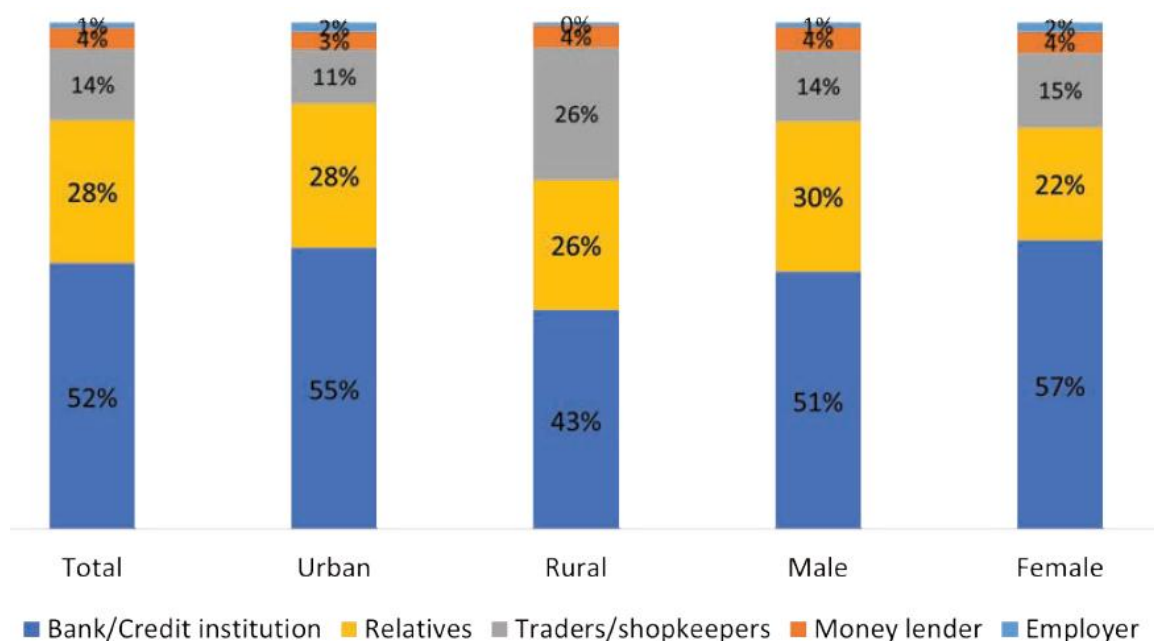


Figure 45. Proportion of households by sources of credit, Tajikistan.

In rural areas, borrowing from traders and shopkeepers was significantly more frequent than in urban areas, where formal credit sources predominated. By gender of household head, formal credit sources were relatively more common among female-headed households (57%) than male-headed households (51%), whereas borrowing from relatives was more common among male-headed households. This unusual gender pattern may be linked to the significantly higher

²³³ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

proportion of female-headed households in urban areas, where formal credit is more accessible²³⁴.

The main reasons reported for borrowing money were to (Figure 46):

- Buy food (26%);
- Buy non-food items (22%); and
- Cover health-related expenses (16%).

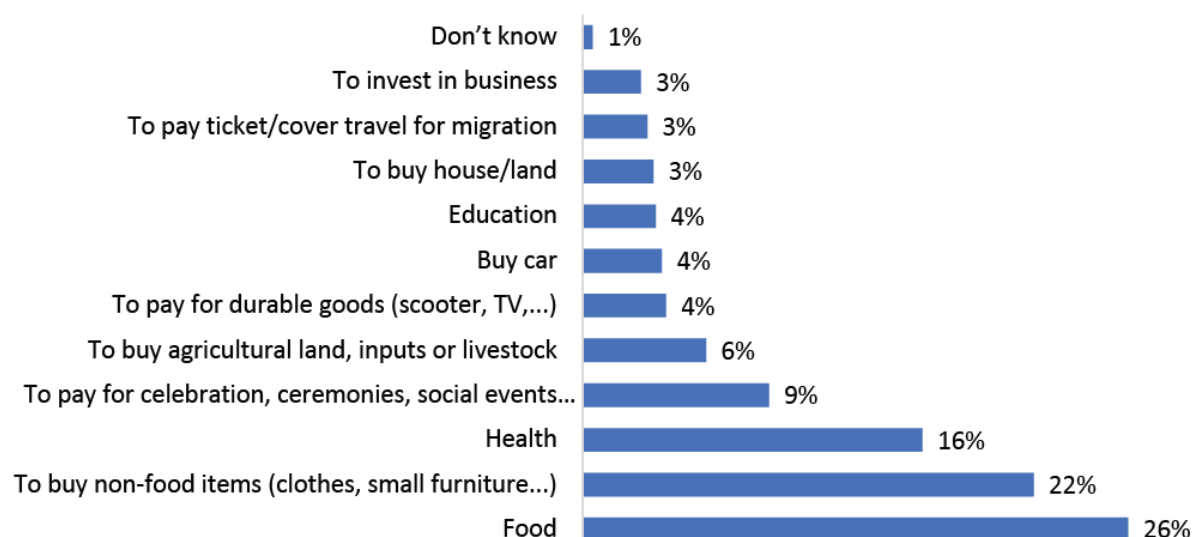


Figure 46. Proportion of households by main reason to borrow money, Tajikistan.

2.5.10. Migration and remittances

Remittances from both seasonal and permanent migration constitute a substantial portion of household income. In 2023, 48% of households reported that one or more immediate family members had migrated for work abroad — the highest percentage since 2022 and a significant increase from the previous survey round (Figure 47). Migration was more common in rural areas, with 54% of households having at least one migrant member, compared to 35% in urban areas²³⁵.

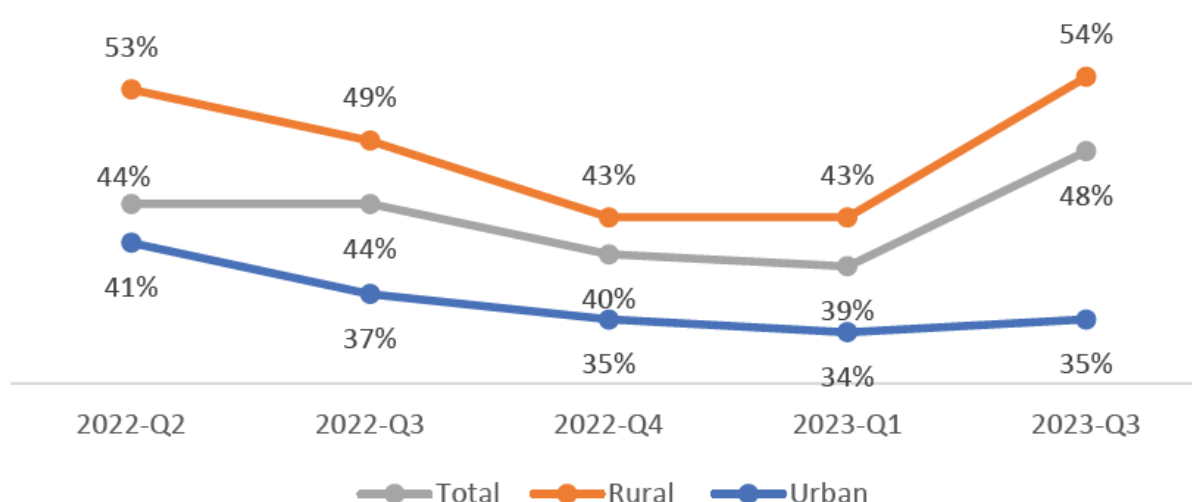


Figure 47. Proportion of households with immediate family members migrated, by quarter 2022–2023, Tajikistan.

²³⁴ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²³⁵ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

Most households in Khatlon and DRS regions rely heavily on seasonal migration and remittances (Figure 48). About 50% of households in both regions reported that one to three family members had migrated abroad, highlighting migration's critical role as a livelihood strategy. These regions face unique challenges and opportunities associated with labour migration, which require tailored interventions to harness the benefits of remittances while addressing vulnerabilities linked to family separation²³⁶.

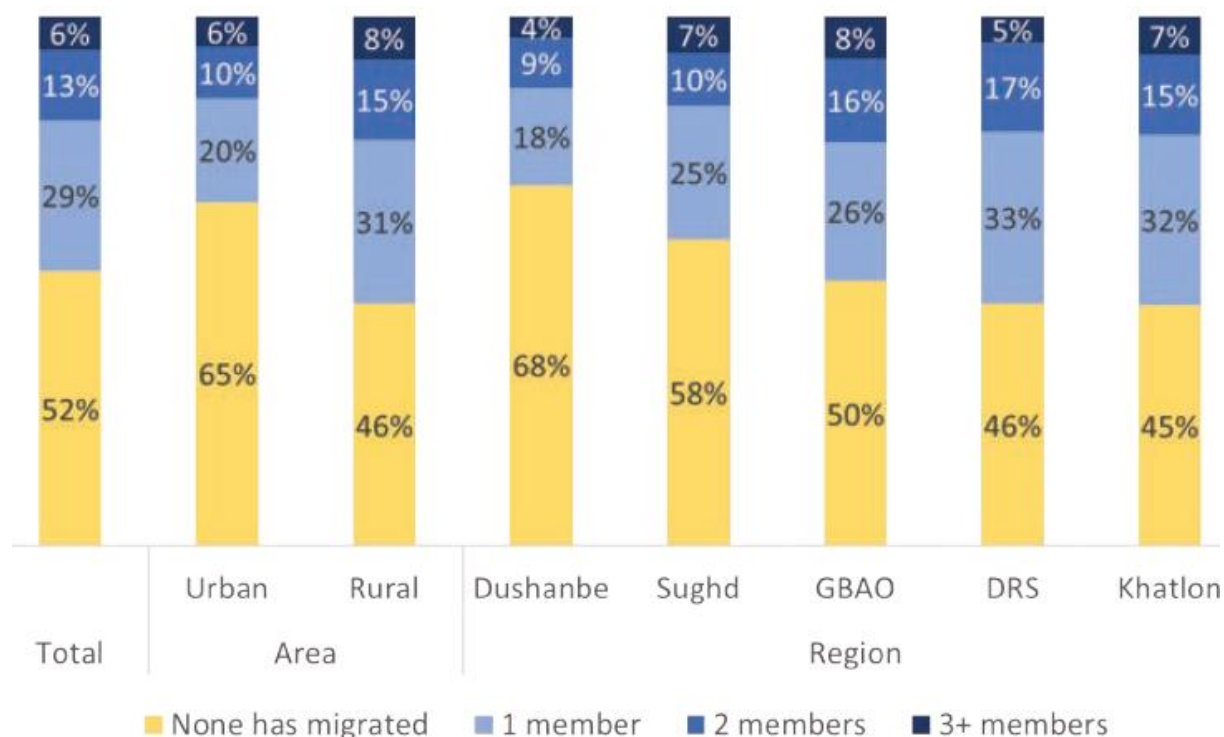


Figure 48. Proportion of households by number of migrated family members, by area and region.

Ensuring the well-being of both migrants and their families should be a priority. This includes initiatives to support local skill development and job creation, reducing dependence on migration as the sole income source. Over 90% of surveyed households confirmed receiving remittances in 2023. The average annual remittance amount was TJS 19,425.39, with a median amount of TJS 7,000. Typically, households sent only one member abroad for work (reported by 57% of households). Among these migrants, the majority (94%) went to the Russian Federation, with the remainder in Germany, Kazakhstan, the United Kingdom, Türkiye, and the United States. The migrant population was predominantly male, comprising over 85% of all migrants²³⁷.

2.5.11. Household concerns

Understanding household concerns is key to designing effective assistance programs. When asked about their greatest current concern, 48% of households reported having at least one concern (Figure 49). The most frequently mentioned were²³⁸:

- Food access and availability (20%);
- Financial concerns (12%); and
- Medical concerns (9%), emphasising the importance of accessible healthcare.

²³⁶ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²³⁷ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²³⁸ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

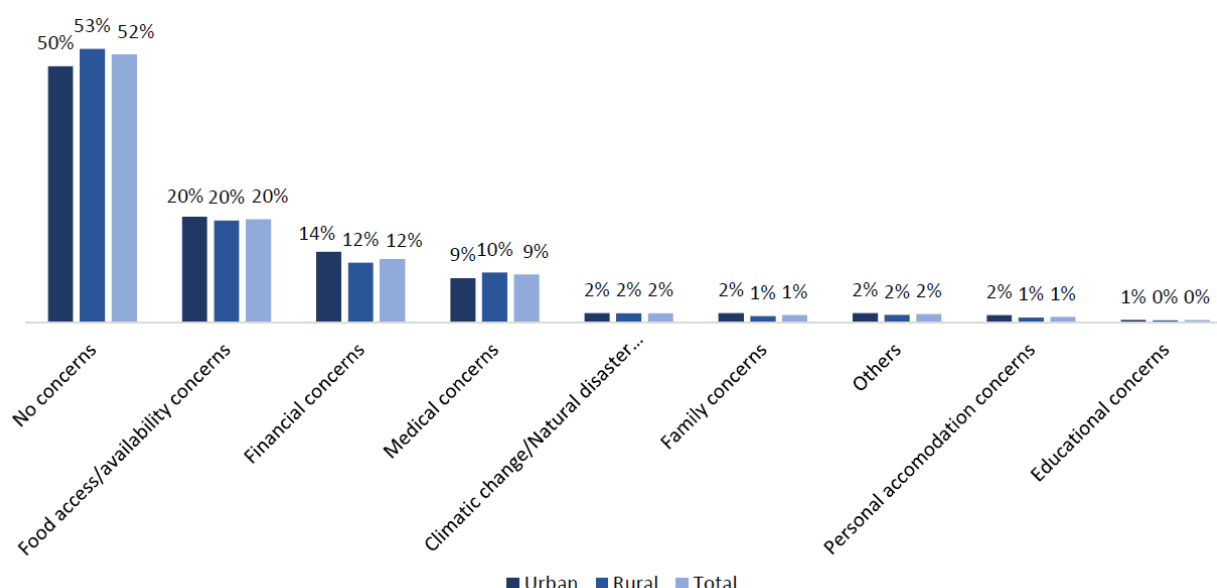


Figure 49. Proportion of households reporting concerns, Tajikistan.

Other less frequently reported concerns included climate change, natural hazards, family issues, accommodation, and education. Urban and rural concerns were broadly similar, though financial concerns were slightly more common in urban areas, while medical concerns were reported more often in rural areas. This snapshot highlights households' diverse challenges, providing valuable policy and programme development insights²³⁹.

2.5.12. Household assistance

The survey also explored access to social protection by asking if households had received assistance in the past three months. Only 8% of households reported receiving some form of assistance, mainly in the form of cash (4%) and food (3%), while 92% reported no assistance (Figure 50). Given that 16% of households face acute food insecurity, these results suggest that, assuming perfect aid targeting, approximately half of food-insecure households may not benefit from regular assistance²⁴⁰.

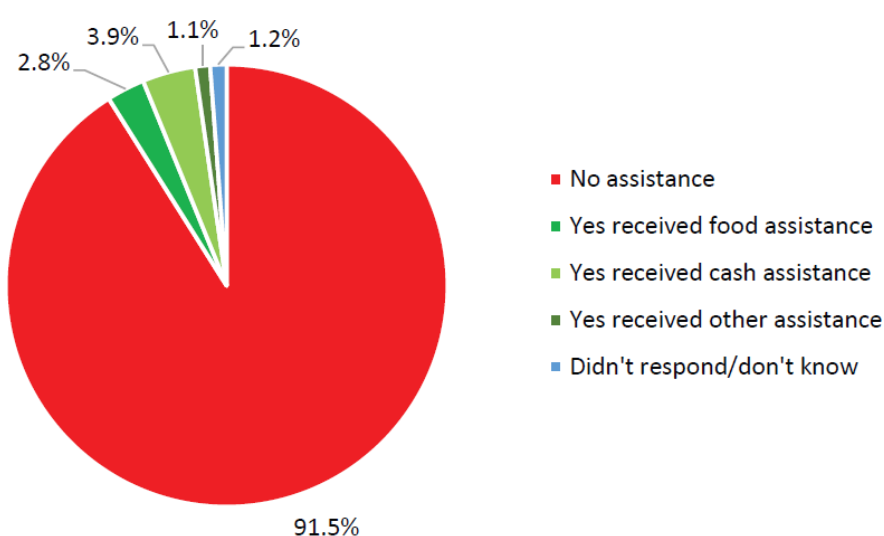


Figure 50. Proportion of households reporting receiving assistance, Tajikistan.

²³⁹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²⁴⁰ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

2.5.13. Food insecurity status and recommendations

Based on the household survey, it is estimated that 1.58 million people in the country were facing acute food insecurity, including approximately 50,000 individuals who were severely food insecure and in urgent need of food assistance. In light of those findings, the recommendations below were proposed²⁴¹.

- Ensure effective targeting and support for the severely food-insecure.
The 50,000 individuals identified as severely food insecure, particularly in Khatlon and DRS, should be prioritised for food assistance and nutritional interventions. Timely and efficient distribution of food aid, coupled with measures to improve access to livelihood opportunities and social safety nets, is essential to alleviate their acute needs and ensure their well-being.
- Scale up resilience-building activities for food-insecure households.
Implement context-specific strategies that promote livelihood diversification, income-generating activities, and other resilience measures to strengthen household capacities and reduce vulnerability to future shocks.
- Promote economic diversification and income stability at the policy level.
Reducing household dependency on remittances and irregular income sources requires national programmes that foster income-generating activities, vocational training, and access to microfinance services. These initiatives can enhance economic stability, lower exposure to income fluctuations, and support the creation of local employment opportunities and sustainable livelihoods.
- Maintain continuous monitoring of household food security and market prices.
Given the country's high dependency on remittances and irregular incomes and the volatile international context, robust systems for monitoring household food security conditions and market dynamics are crucial to inform timely interventions and prevent further deterioration.

In World Bank community-level surveys conducted in 2021, 80% of rural respondents reported experiencing irregular temperatures, 66% observed irregular rainfall, and 47% had faced a natural disaster in the previous two years. Additionally, 59% reported that climate change had negatively affected their household's economic well-being, often forcing them to rely on savings to cope. These impacts are felt most acutely by women, women-headed households and youth with limited adaptive capacity and access to resources. As climate risks intensify, the need for targeted social protection systems to support rural communities, particularly concerning labour, income and housing, continues to grow²⁴².

2.6. *Climate information and data management systems in Tajikistan*

2.6.1. Current climate research, scientific capacity, and knowledge development

Tajikistan has a long history of scientific research on climate, hydrology, and natural phenomena, as well as reference materials and atlases developed during the Soviet period. Over the past decade, research has shifted towards climate change trends, river flows, natural disaster risk, and vulnerability assessments, including pioneering studies for UNFCCC National Communications²⁴³.

The Academy of Sciences of Tajikistan, under the national Science and Technology Strategy 2007–2015, has led research on²⁴⁴.

- Impacts of climate change and anthropogenic pressures on biodiversity, ecosystems and crops.

²⁴¹ FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

²⁴² World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁴³ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁴⁴ Tajikistan's Fourth National Communication 2022. [Available online.](#)

- Physiological and biochemical adaptation of organisms to stress.
- Climate-induced impacts on wheat growth and productivity, through the Institute of Botany, Plant Physiology and Genetics.
- Plant adaptation to changing climatic conditions in the Pamir highlands, through the Pamir Biological Institute.

Sectoral ministries and institutes have also initiated climate-related research. For example, the Ministry of Health (Order №449 of 2008) mandated studies on the impacts of climate change on reproductive health. In 2017, the Center for Glacier Research was established within the Academy of Sciences. Since 2019, it has applied remote sensing and drone technology to monitor glaciers with high-resolution imagery (5–7 cm), producing accurate mapping and assessments. A 12-volume Atlas of Glaciers of Tajikistan is in preparation²⁴⁵.

Significant scientific expeditions have been undertaken²⁴⁶:

- 2008–2009: First Tajik Antarctic Expedition (International Polar Year).
- 2011: First international expedition on glaciers in the Vakhsh and Panj headwaters with Central Asian and Russian partners.
- 2019: Twelve glacier and hydrological expeditions across Tajikistan and Kyrgyzstan, including Zulmart, Didal, Kamarob, Kuliken, Karakul Lake, Siyoma, Gunt, Patkhur, Abramov, Golubin, Zerafshan and Yakarcha.

Tajikistan joined the Global Glacier Monitoring System (WGMS) in 2019. Expedition results, including the 2011 Medvezhiy Glacier surge (800 m advance), have been presented to WMO and the UN, underscoring the global significance of Tajikistan's cryospheric research. Complementary initiatives include²⁴⁷:

- Research on glacier retreat trends by “Tojikkoinot” (2001–2006), showing losses of 5–30% in glacier area since 1949.
- The TajHaz project (2003–2010) assessed glacial lakes in Pamir-Alai, with GIS data transferred to the Committee of Emergency Situations.
- Paleoclimate studies in Lake Karakul (2008–2013), through German–Tajik collaboration.
- Participation in Global Land Ice Measurements from Space (GLIMS; USGS-led), mapping Pamir glaciers using 2000–2010 satellite data.
- Regional climate modelling (REMO) under the CAWa project 2010–2014, which built national technical capacity for climate modelling.

2.6.2. Systemic gaps in climate data and information management

Tajikistan faces significant climate data collection, management, and dissemination constraints due to limited institutional capacity and a shortage of specialised expertise. Existing digital systems are fragmented and lack integration, which hampers access to reliable climate and sectoral information for decision-making. Current data hosting practices are vulnerable to climate-related shocks, increasing the risk of data loss during extreme weather events. Furthermore, climate-relevant legal, policy, and technical documents are dispersed across multiple government websites without a central repository. For example, the Committee on Environmental Protection's official platform does not provide a structured or comprehensive archive of such materials, creating barriers to climate impact and vulnerability assessments, as well as the identification of adaptation priorities²⁴⁸.

Digital public infrastructure is not yet equipped to support climate-resilient data management or interoperability between systems critical for adaptation and mitigation planning. There is also no formal framework governing independent expert advice on climate-related matters. These systemic weaknesses limit Tajikistan's ability to develop robust evidence-based strategies for

²⁴⁵ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁴⁶ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁴⁷ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁴⁸ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

managing climate risks across key sectors, including agriculture, water, and disaster risk management²⁴⁹.

2.6.3. Disaster risk information and multi-hazard exposure

Shifts in disaster risk governance

In Tajikistan, as across Central Asia, disaster management in the early 21st century was largely response-oriented, with limited risk information at national and local levels and weak mechanisms for cross-sectoral governance. The Central Asia Initiative (CAI), implemented from August 2019 to February 2023, addressed these gaps by strengthening disaster resilience and accelerating the implementation of the Sendai Framework for Disaster Risk Reduction (2015–2030). The CAI marked a critical shift from disaster response towards proactive risk management for Tajikistan. It supported the development of disaster loss databases and national strategies while enhancing cooperation across borders and scales. The CAI directly engaged women and other vulnerable groups at the community level through resilience assessments, risk communication, and participation in local disaster management committees. This strengthened community preparedness and increased women's access to resources, skills development, and decision-making. Capacity-building activities in Tajikistan, including workshops for national partners and training for women leaders, expanded technical expertise in risk-informed planning. Moreover, the CAI's support for sex-, age-, and disability-disaggregated data collection strengthened the country's reporting under the Sendai Framework Monitor. These interventions have laid the groundwork for embedding a sustainable risk reduction culture, ensuring that investments and livelihoods are increasingly risk-informed. Overall, the CAI has had a transformative impact in Tajikistan, catalysing a transition towards more sophisticated disaster risk governance. Recognised as "well-designed and effectively implemented" by the European Commission's Results-Oriented Monitoring review, the initiative has provided a durable foundation for future investments in resilience, supporting sustainable development and improved quality of life for communities nationwide²⁵⁰.

Disaster trends and emerging risks

Tajikistan is highly disaster-prone, with the Committee of Emergency Situations and Civil Defense reporting 3,460 disasters 1997–2018, equivalent to one every two days. The most frequent and deadly hazards are mudflows (70 events and 35 deaths per year), avalanches (27 events, six deaths per year), and earthquakes (23 events, two deaths per year). Reported damages exceeded US\$589 million over this period, with mudflows causing the highest annual losses (US\$15 million), followed by drought (US\$5.4 million) and earthquakes (US\$3.3 million). While overall disaster frequency declined, mudflows have shown an increasing trend²⁵¹. In 2023, avalanches, mudflows, earthquakes, rockfalls, landslides, floods and severe weather events resulted in 51 fatalities and displaced thousands of people, severely affecting lives and livelihoods. The associated economic damage exceeded US\$7 million. While risk reduction measures such as river bank protection and watershed management have reduced exposure, approximately 15,000 people reside in high-risk areas. Annual economic losses from disasters are estimated to reach up to 1.3% of national GDP²⁵².

National platforms and risk assessment tools

In early 2021, the UNDP and CoESCD launched Tajikistan's first Countrywide Multi-Hazard Risk Assessment Platform, providing a visual, GIS-based tool for integrated risk-informed development planning. The platform consolidated data from 2018–2020 covering 58 districts and seven key hazards, including floods, mudflows, earthquakes, droughts, windstorms, landslides, and snow avalanches. It identified community and infrastructure vulnerabilities, exposure levels, and potential future risks, enabling decision-makers and planners to integrate disaster risk reduction into development processes. At the time, only around 20% of district development

²⁴⁹ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁵⁰ UNDRR 2023. Strengthening disaster resilience and accelerating implementation of Sendai Framework for Disaster Risk Reduction in Central Asia 2019–2023, Final Report. [Available online.](#)

²⁵¹ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019–2030. [Available online.](#)

²⁵² <https://www.undrr.org/news/integrated-approaches-addressing-disaster-climate-and-environmental-risks-enable-impactful-un>

plans incorporate DRR measures. The platform aims to mainstream risk prevention and mitigation across all levels of governance. Future use includes informing socioeconomic development plans and sectoral programmes to enhance resilience and safeguard vulnerable communities²⁵³. Gaps need to be addressed to improve platforms and data management. National data archiving, open central repositories, weak interoperability standards, climate-relevant policy and technical documents are dispersed across sites, and Tajikhydromet and other authorities have limited centralised e-archive capacity. The most recent national communication recommends digitisation, archive management, and interoperable databases²⁵⁴.

Regional cooperation and capacity-building

The Central Asia Emergency Situations and Disaster Risk Reduction Centre (CESDRR), based in Almaty, is a permanent intergovernmental organisation established in 2016 and accredited by Kazakhstan's Ministry of Foreign Affairs. Its core mandate is to strengthen regional cooperation, emergency preparedness, and disaster risk reduction (DRR), including climate change adaptation (CCA), through hazard assessment, risk mitigation, coordinated response, and promotion of international collaboration. Supported by UNDRR through the Central Asia Initiative (CAI), CESDRR serves as a regional hub providing risk information, technical support, and capacity-building to member countries. CESDRR has played a pivotal role in advancing regional DRR governance, including the development and adoption of the Regional Strategy on Disaster Risk Reduction, and in institutionalising the annually held Regional Forum Meeting of Heads of Emergency Management Authorities of Central Asian Countries, which facilitates policy dialogue, coordination, and responses to emerging crises.

At the national level in Tajikistan, CESDRR has supported capacity-building to mainstream DRR and CCA within government institutions. In mid-2021, CESDRR experts delivered training through the National Disaster Risk Management Project (NDRMP), implemented by EPTISA with ADB support and conducted jointly with the Asian Disaster Preparedness Centre (ADPC). The training, held at the Republican Training and Methodological Centre of CoESCD in Dushanbe, involved 25 senior personnel from line ministries, including Health, Agriculture, Education, Transport, the Agency on Hydrometeorology, and the Committee for Environmental Protection. Participants strengthened knowledge of DRM and CCA concepts, learned how to mainstream these into national policies and programs, and developed skills to promote government-wide awareness. CESDRR and ADPC continued capacity-building activities through October 2021 to further support DRR and CCA integration across Tajikistan's institutions. Through its regional and national engagement, CESDRR demonstrates the value of coordinated technical and political exchange for improving disaster risk governance and resilience in Central Asia^{255,256}. Tajikistan participates in regional initiatives to share data and tools such as the Central Asian Flood Early Warning System (CAFEWS), CARFFGS flash-flood guidance, and Meteorological, Climatological and Hydrological (MCH) database, to improve transboundary forecasting and flood guidance. These platforms are being installed and integrated under CAHMP and related programmes²⁵⁷.

Disaster mapping and spatial risk analysis

Tajikistan further advanced disaster risk reduction by adopting its National Strategy for Disaster Risk Reduction in 2019 and establishing a National Platform for Disaster Risk Reduction. The Committee of Emergency Situations and Civil Defence (CoESCD) has introduced and tested the DesInventar Sendai system, enabling systematic collection and analysis of disaster loss data across 22 hazard types, disaggregated by housing, health, education, infrastructure, services, and agriculture. Since July 2022, the system has recorded 56 disaster loss data cards from 1990–

²⁵³ UNDRR 2021. UNDP and Committee of Emergency Situations and Civil Defense to launch Tajikistan's first online countrywide multi-hazard risk assessment platform. [Available online.](#)

²⁵⁴ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁵⁵ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

²⁵⁶ CESDRR 2021. Personnel of the Committee for Emergency Situations and Civil Defense and other state institutions of the Republic of Tajikistan enhanced knowledge in disaster risk management. [Available online.](#)

²⁵⁷ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

2022, capturing 342 deaths, 161,979 people affected, 4,885 houses damaged or destroyed, and approximately US\$2.7 million in economic losses. Mudflows (26%), floods (17%), landslides (12%), flash floods (8%), and earthquakes (8%) account for 71% of recorded events. Although data entry is ongoing, DesInventar is strengthening Tajikistan’s capacity for disaster risk profiling, loss accounting, and Sendai Framework reporting²⁵⁸. UNDRR has strengthened regional capacity for Sendai Framework implementation by training Technical Focal Points in all Central Asian countries, including Tajikistan, on the Sendai Framework Monitor (SFM). This included a training-of-trainers course at CESDRR, enabling sustained refresher training and technical support. In 2022, UNDRR delivered capacity-building workshops to ensure interoperability between SFM, DesInventar-Sendai, and SDG reporting. Between 2020–2022, 20 online training and consultation sessions were held, along with regional training on practical SFM use²⁵⁹.

Disaster mapping in Tajikistan (Figure 51), developed using the Database of Global Administrative Areas (GADM), illustrates the spatial distribution of disaster events across regions and provinces, ranging from more than 14 to fewer than four events per region (Figure 52). The provinces most affected are Tursunzoda in the Districts of Republican Subordination, Asht in Sughd region, and Khuroson and Vose in Khatlon region, underscoring the uneven but widespread exposure to natural hazards across the country.



Figure 51. Geographical distribution of events by region²⁶⁰.

²⁵⁸ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)
²⁵⁹ UNDRR 2023. Strengthening disaster resilience and accelerating implementation of Sendai Framework for Disaster Risk Reduction in Central Asia 2019–2023, Final Report. [Available online.](#)
²⁶⁰ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

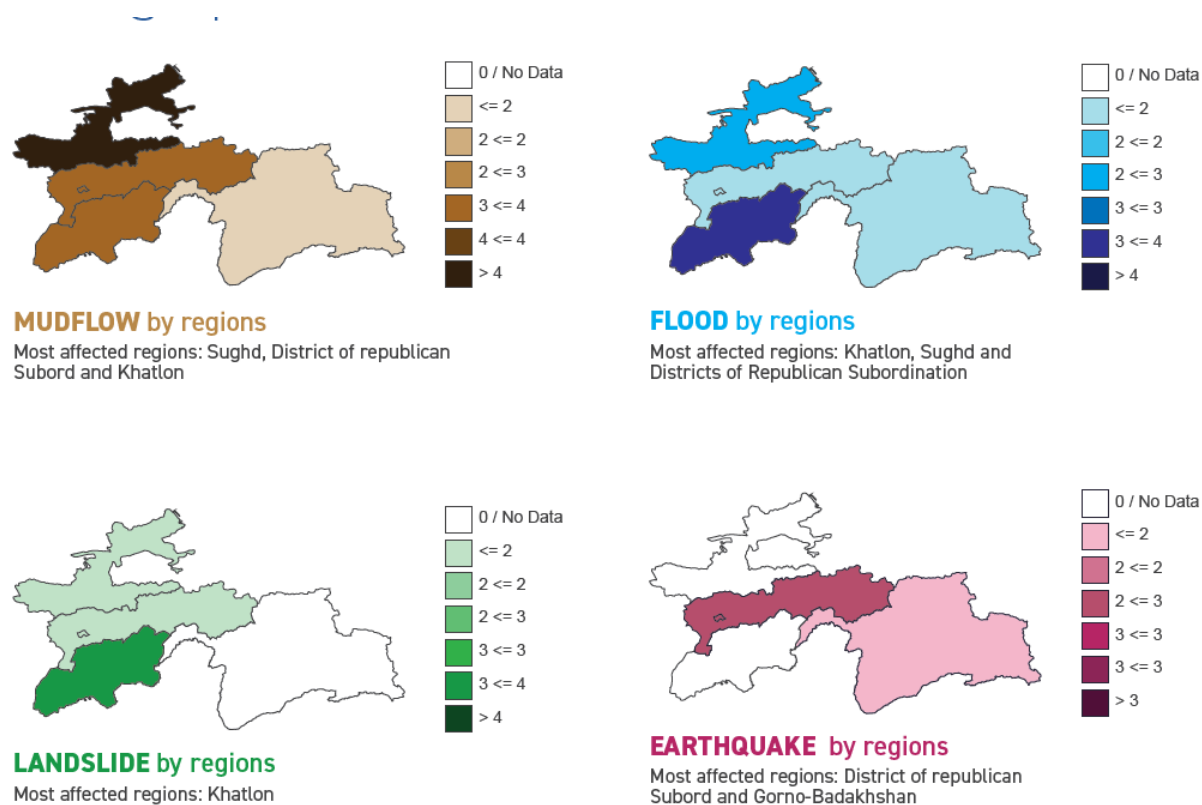
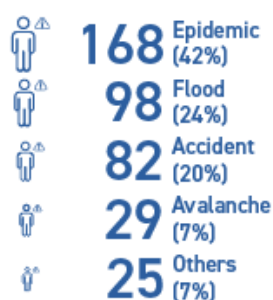


Figure 52. Geographical distribution of main hazards²⁶¹.

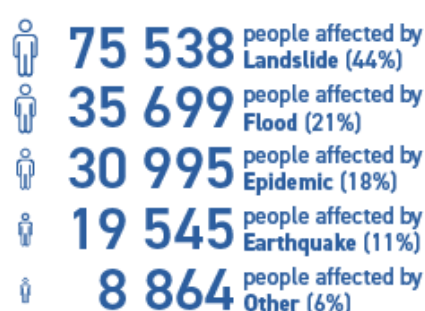
²⁶¹ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

NUMBER OF DEATHS AND MISSING BY HAZARD (TARGET A)*

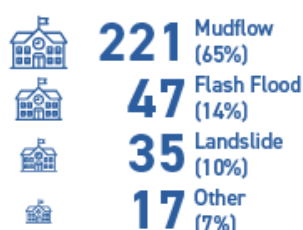


* The number of deaths is augmented by the inclusion of the number of missing persons.

NUMBER OF PEOPLE AFFECTED BY HAZARD (TARGET B)

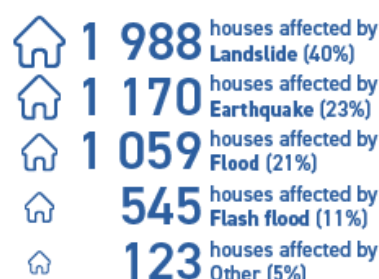


DAMAGE TO INFRASTRUCTURE BY HAZARD (TARGET D)*



* list of infrastructures: education, health, agriculture, water supply, sewerage, industries, communication, transportation, power and energy, relief.

NUMBER OF HOUSES AFFECTED BY HAZARD*



* according to currently available data 63% of damages to houses are caused by Landslides and Earthquakes.

TOTAL ECONOMIC LOSS (US dollars) BY HAZARD (TARGET C)



Figure 53. Statistics related to the Sendai Framework 1992–2022²⁶².

Sectoral exposure and vulnerabilities

Tajikistan's disaster risk reduction (DRR) efforts encompass critical sectors such as agriculture, water, energy, and infrastructure, each addressed through national strategies and sector-specific initiatives. The National Disaster Risk Reduction Strategy 2019–2030 identifies climate-related agriculture threats, including soil erosion and water scarcity. The FAO's comprehensive analysis highlights institutional strengths and capacity gaps in DRR for agriculture, emphasising the need

²⁶² UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

for improved early warning systems and climate-resilient practices^{263,264}. The National Water Strategy 2040 outlines integrated water resource management principles, focusing on flood control, irrigation, and climate adaptation. The World Bank's water security assessment underscores vulnerabilities to glacial lake outburst floods and droughts, recommending enhanced infrastructure and governance²⁶⁵. The Energy Brief 2025 by UNECE discusses Tajikistan's energy sector challenges, including infrastructure resilience and climate impacts. The World Bank's Energy Loss Reduction Project has supported the development of strategies to enhance energy infrastructure resilience^{266,267}. The National Disaster Risk Management Project, supported by the Asian Development Bank, aims to reduce economic losses from natural hazards and integrate DRR into development planning. The project supports the National Development Strategy 2016–2030 and the Midterm Development Program 2016–2020²⁶⁸.

Tajikistan's road network is highly exposed to natural hazards and climate change impacts due to its mountainous geography, with 93% of the territory covered by mountains and extreme seasonal temperature variations. Floods, mudflows, rockfalls, landslides, avalanches and earthquakes frequently damage roads and bridges. These disruptions extend beyond physical damage, cutting off communities from essential services, markets and livelihood opportunities, while impeding trade and emergency response. Successive events compound these challenges, with annual losses already reaching an estimated US\$45 million, or 0.5% of national GDP, and projected to rise to US\$80 million per year within the next decade. Climate change is expected to intensify these risks further. Projected increases in temperature, extreme precipitation, and shifts in snowfall and thaw patterns will drive more frequent and severe floods, mudflows, avalanches, landslides and rockfalls. Thawing mountain permafrost poses an additional long-term risk to road stability. These processes will accelerate the deterioration of transport infrastructure, erode pavement and bridge integrity, and overload drainage systems. Over 2,000 km of road assessment identified more than 330 highly exposed sites, with mudflows (36%) and avalanches (31%) as the predominant threats. The cost of a full suite of resilience investments, including avalanche galleries, snow barriers, flexible rockfall and debris flow barriers, strengthened bridges, realignments and improved drainage, is estimated at US\$400 million. While not all measures are economically viable, targeted interventions along critical corridors, complemented by low-cost measures such as improved hazard monitoring, forecasting, and temporary closures, can yield significant benefits.

Cost-benefit analysis confirms that eliminating losses associated with road disruptions would deliver strong socioeconomic returns, particularly in ensuring continued access to health, education and income-generating opportunities. International support, including from the World Bank and GFDRR, has already strengthened critical infrastructure, such as rebuilding 17 destroyed bridges in Gorno-Badakhshan under “build back better” principles. However, the scale of climate-related risks requires a comprehensive approach that combines resilient infrastructure, effective early warning systems, and enhanced emergency preparedness and response. Such measures are essential to safeguard lives, sustain connectivity, and reduce economic losses²⁶⁹.

National preparedness and institutional resources

Integrated governance and institutional frameworks

The Government of Tajikistan and United Nations organisations are advancing an integrated approach to managing disaster, climate and environmental risks. This approach is anchored in the United Nations Sustainable Development Cooperation Framework (2023–2026) and coordinated through Outcome 3 on integrated risk management. Under the leadership of the UN

²⁶³ The World Bank 2021. Tajikistan Preparedness and Resilience to Disasters Project. [Available online.](#)

²⁶⁴ FAO 2022. Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Tajikistan. [Available online.](#)

²⁶⁵ National Water Strategy of The Republic of Tajikistan for the Period up to 2040. [Available online.](#)

²⁶⁶ UNECE 2025. Tajikistan Energy Brief 2025. [Available online.](#)

²⁶⁷ World Bank 2020. Tajikistan Energy Loss Reduction Project. IEG Project Performance Assessment Report. [Available online.](#)

²⁶⁸ Republic of Tajikistan: National Disaster Risk Management Project (Additional Financing). Semi-Annual Social Safeguard Monitoring Report. Reporting Period: July to December 2024. [Available online.](#)

²⁶⁹ <https://www.preventionweb.net/news/resilient-roads-protecting-critical-lifelines-mountainous-tajikistan>

Resident Coordinator, the United Nations Country Team (UNCT) is reinforcing national institutional capacities and promoting an all-of-society approach to disaster risk reduction (DRR). The National Platform for DRR, led by the Government with support from the UNCT and a wide range of national and international partners, provides the institutional mechanism for coordination. The UNCT supports Tajikistan's National Strategy for DRR, which is aligned with the Sendai Framework. An assessment of the strategy in 2021 identified priority areas for implementation, while a Midterm Review of the Sendai Framework in 2022 highlighted progress in mainstreaming DRR into development and gaps requiring further action. Based on these findings, the Government and UNCT jointly developed the Midterm Programme and Action Plan for 2023–2028, consolidating national and international DRR activities into a single framework. Regular three-year action plans enable systematic monitoring, adjustment, and the introduction of new measures. In parallel, a participatory assessment of the national disaster risk management system led to the development of a capacity-strengthening Action Plan, endorsed by the National Platform. In August 2023, Tajikistan and UN partners launched the United Nations Secretary-General's *Early Warnings for All* initiative to enhance risk knowledge, forecasting, communication and preparedness across four interlinked pillars. Anchored in the National Platform, the initiative is co-chaired by the Deputy Prime Minister and the UN Resident Coordinator, with implementation led by UN agencies (UNDRR, WMO, ITC), IFRC and national institutions. A draft roadmap for 2024–2027 has been developed through broad consultation and is expected to ensure inclusive participation and adequate resourcing²⁷⁰.

Community-level preparedness and resilience

The UNCT supported over 67,000 vulnerable people in 2023 at the community level through integrated solutions for climate change adaptation, DRR and sustainable natural resource management. Activities included support to smallholder farmers, cash assistance for food-insecure households to build assets such as greenhouses and irrigation systems, preparation of 14 watershed action plans, measures to prevent water pollution from mine tailings, and ecosystem-based interventions. The Rapid Emergency Assessment and Coordination Team (REACT) was also strengthened to enhance preparedness, response and recovery. Co-chaired by the Government and the UN Resident Coordinator, REACT brings together sectoral coordination groups, technical working groups, regional teams and rapid response units. In 2023, two national simulation exercises tested emergency preparedness for refugee inflows and evacuation procedures. The 2024 REACT workplan includes coordinated assessments, preparedness measures, early actions and alignment with the *Early Warnings for All* initiative. Together, these efforts are ensuring stronger national leadership, inclusive participation and coherent links between disaster risk reduction, climate adaptation and emergency response²⁷¹.

Advancing risk knowledge and early warning coverage

On 3–4 October 2024, Dushanbe hosted a workshop under the joint UNDRR–Government of Switzerland project *Strengthening Resilience to Disasters and Climate Change in Tajikistan*, complementing the global *Early Warnings for All* (EW4All) initiative (Figure 54). The workshop, titled *Advancing Risk Knowledge to Improve Tajikistan's Disaster Early Warning System*, brought together government authorities, UNDP, OCHA, CIMA Research Foundation, Microsoft, and other partners under the leadership of the Government of Tajikistan. Tajikistan, exposed to over 4,000 disaster events in recent decades with estimated damages of US\$500 million, faces significant gaps in early warning coverage. The workshop focused on improving risk knowledge, identifying populations most vulnerable to hazards such as floods and earthquakes, and assessing potential impacts. Participants reviewed current systems, received targeted training, and explored new tools, including AI-powered exposure mapping, to enhance monitoring, evaluation, and dissemination of timely warnings. These efforts support the national roadmap endorsed in July 2024 to close early warning gaps and ensure inclusive coverage nationwide. By strengthening risk knowledge and the effectiveness of early warning systems, Tajikistan is advancing community-level preparedness, reducing disaster impacts, and building resilience to

²⁷⁰ <https://www.undrr.org/news/integrated-approaches-addressing-disaster-climate-and-environmental-risks-enable-impactful-un>

²⁷¹ <https://www.undrr.org/news/integrated-approaches-addressing-disaster-climate-and-environmental-risks-enable-impactful-un>

climate and disaster risks, aligning with global EW4All objectives to achieve universal coverage by 2027²⁷².



Figure 54. Workshop Advancing Risk Knowledge to Improve Tajikistan's Disaster Early Warning System, Dushanbe, October 2024.

Monitoring and information system development

On 15 March 2025, the National Platform for DRR of Tajikistan convened the first meeting of the Working Group on Monitoring and Information System Development, supported by UNDRR and the Government of Switzerland through the *Strengthening Resilience to Disasters and Climate Change in Tajikistan* project (Figure 55). The Working Group, composed of experts from relevant ministries and agencies, aims to track the implementation of the National DRR Strategy and the Mid-term State Program for Protection of Population and Territories from Emergency Situations. This initiative, prioritised under the Mid-term Program and Action Plan 2023–2025, represents a key step in strengthening national disaster risk management, enhancing resilience, and promoting transparency and accountability across sectors. The Monitoring and Information System will enable the National Platform to systematically capture DRR efforts, assess progress against defined indicators, and engage stakeholders, including communities, in resilience-building activities. This approach is recognised as unique in Central Asia and is expected to significantly improve the effectiveness of strategy implementation. The Working Group has agreed to meet quarterly to coordinate activities, develop indicators, and oversee system development. The National Platform meeting also highlighted broader DRR governance and coordination, including the implementation of the Early Warnings for All (EW4ALL) initiative, financial protection strategies, private sector engagement, and the preservation of glaciers. Leadership by the Deputy Prime Minister as National Platform Chair ensures high-level oversight, while active participation from UN agencies, international partners, and relevant government entities strengthens cross-sectoral collaboration. The initiative underlines Tajikistan's commitment to risk-informed development, international cooperation, and people-centred approaches that minimise losses to life, property, and livelihoods²⁷³.

²⁷² <https://www.undrr.org/news/enhancing-risk-knowledge-stronger-early-warning-systems-tajikistan>

²⁷³ <https://www.undrr.org/news/strengthening-tajikistans-efforts-disaster-risk-reduction-through-international-cooperation>



Figure 55. First meeting of the Working Group on Monitoring and Information System Development, March 2025.

Community-based disaster risk management and partner contributions

The Aga Khan Agency for Habitat (AKAH) has been active in Tajikistan since 1997, supporting the government of Tajikistan in strengthening DRR and DRM. AKAH's approach combines risk anticipation, prevention and preparedness with response and recovery, while embedding risk management into long-term development planning. Working closely with the CoESCD, Department of Geology, Committee of Environmental Protection and other partners, AKAH implements community-based DRR and DRM. Core interventions include Hazard and Vulnerability Risk Assessments (HVRAs) in over 828 communities benefitting nearly 400,000 people, disaster preparedness training in more than 600 villages, and the establishment of Early Warning Systems and emergency communication networks across Gorno-Badakhshan Autonomous Oblast (GBAO) and other high-risk regions. Over 134 Community Emergency Response Teams (CERTs) and 173 Avalanche Preparedness and Response Teams have been established and trained, with over 4,000 members, almost half women, equipped to respond locally to emergencies. AKAH has implemented more than 450 small-scale structural mitigation projects to reduce exposure and vulnerability, including flood protection, debris-flow channels, seismic retrofitting of schools, and avalanche terracing. Awareness programmes have reached over one million schoolchildren and adults on seismic safety. Emergency preparedness is reinforced by pre-positioning supplies for nearly 98,000 people in at-risk settlements and installing 25 weather monitoring posts and automated stations to enhance hazard prediction²⁷⁴.

AKAH plays a leading role in emergency coordination, co-facilitating the REACT platform in GBAO and partnering with international actors such as UN agencies, IFRC and bilateral donors. Its rapid response capacity has been demonstrated in significant events, including the 2015 Bartang earthquake and recurrent avalanches, mudflows and rockfalls. AKAH mobilised emergency stockpiles, supported evacuations, deployed trained volunteers and provided humanitarian assistance. AKAH's DRM work is reinforced through institutional partnerships and technical capacity-building. This includes training government counterparts in GIS and remote sensing, joint hazard assessments, and establishing open spatial data platforms for risk information sharing. Partnerships with agencies such as SDC, USAID, WFP, UNICEF, UNHCR, OCHA and others have expanded the reach and sustainability of these interventions. By integrating disaster risk reduction with natural resource management in fragile ecosystems,

²⁷⁴ <https://the.akdn/en/where-we-work/central-asia/tajikistan/disaster-preparedness-and-response-tajikistan>

where 40% of water systems are at risk and forest cover has declined to 3%, AKAH contributes to climate resilience, ecosystem protection and carbon reduction, while safeguarding lives and livelihoods in hazard-prone communities²⁷⁵.

*Strategic coherence for DRR and climate action in Tajikistan*²⁷⁶

A UNDRR report 2025 highlights gaps, presents emerging good practices, and offers practical recommendations to strengthen policy coherence, enabling governments to prevent maladaptation, optimise resource use, and advance resilience-building across sectors. Tajikistan demonstrates partial coherence in integrating disaster risk reduction (DRR) and climate change adaptation. The National DRR Strategy 2019–2030 and the National Climate Change Adaptation Strategy 2030 provide strong conceptual foundations and some operational alignment, but institutional and financial coordination remain limited. Similarly, the 2023–2025 Action Plan of the Mid-Term State Programme (2023–2028) outlines climate-relevant actions yet suffers from weak institutional coordination. The 2021 NDC offers the strongest basis for coherence, highlighting four priority adaptation sectors: energy, water resources, transport, and agriculture, with emergencies as a cross-cutting area. Operational overlap exists in early warning systems, critical infrastructure, resilient agriculture, and health, reflecting intersectoral consensus across national strategies. The main challenge is advancing from strategic alignment to implementation, requiring clear institutional ownership and adequate resourcing. Enhanced coordination between the Committee for Emergency Situations and Civil Defence, the Committee for Environmental Protection, and the Agency for Hydrometeorology, alongside engagement of climate action stakeholders in platforms such as the National Platform for DRR and the Rapid Emergency and Assessment Coordination Team, can support harmonised action. Recommendations made by the UNDRR include:

- Leveraging intersectoral consensus to form joint implementation teams in priority sectors.
- Strengthening institutional coordination and integration of climate action stakeholders.
- Advocating for sustainable domestic investment in risk reduction using risk modelling and addressing funding gaps.

In the report, Coherence Levels were rated as:

- Conceptual: Partial
- Institutional: Limited
- Operational: Partial
- Financial: Limited

Early warning systems (EWS) and risk information

Current monitoring and forecasting capacity

Tajikistan is among the first 30 countries to implement the United Nations Secretary-General's *Early Warnings for All* (EW4ALL) initiative, launched globally at COP27 in 2022 and nationally in August 2023. The Government demonstrated strong leadership by appointing the Deputy Prime Minister as National Focal Point and designating responsible agencies for each of the initiative's four pillars. In April 2024, three local-level EW4ALL workshops were held in Khujand, Khorog and Bokhtar, engaging national and local government representatives, UN agencies, civil society and international partners. These consultations marked a critical step in localising the initiative, fostering inclusivity, and empowering communities to strengthen preparedness against avalanches, earthquakes, floods, mudflows and landslides. The workshops highlighted both progress and gaps in early warning coverage and emphasised the need to translate risk information into actionable early response. The insights gathered informed the finalisation of a comprehensive national EW4ALL Roadmap, endorsed under the leadership of the Deputy Prime Minister. Anchored in the National Platform for Disaster Risk Reduction, this process ensured coordination across government institutions, development partners and communities. The EW4ALL initiative calls for universal early warning coverage by 2027. Evidence shows that early warning systems, combined with preparedness and early action, save lives and generate a

²⁷⁵ <https://the.akdn/en/where-we-work/central-asia/tajikistan/disaster-preparedness-and-response-tajikistan>

²⁷⁶ UNDRR 2025. Disaster Risk Reduction and Climate Change Adaptation: Coherence Pathways in Europe and Central Asia. Available online.

tenfold return on investment. In Tajikistan, the lead agencies of the four pillars are UNDRR, WMO, ITU and IFRC in partnership with the Government, supporting national priorities to strengthen disaster risk management, enhance climate resilience and advance the Sustainable Development Goals²⁷⁷.

Climate Information Services (CIS)

Strengthening climate information systems for water and agriculture

Effective climate adaptation in Tajikistan's water and agriculture sectors requires modern, integrated information systems capable of monitoring and modelling water flows, soil moisture, and watershed health. Existing water infrastructure is outdated, contributing to inefficiencies and exacerbating risks such as sedimentation, declining groundwater recharge, and watershed degradation. Hydrometeorological services require urgent upgrades to provide accurate, real-time data for forecasting and water resource planning. In the short term, investments are needed to strengthen hydrometeorological networks and information platforms, while in the longer term, the focus must include climate-resilient infrastructure, improved water storage capacity, and the promotion of climate-smart agriculture²⁷⁸.

Recent initiatives, such as developing a mobile application providing emergency alerts and educational content, demonstrate early progress in using digital tools for climate information dissemination. However, public awareness of climate change impacts and adaptation measures remains low, as confirmed by Tajikistan's Fourth National Communication under the UNFCCC. Enhancing public access to scientific and sector-specific information is essential to foster behavioural change and community-level climate action²⁷⁹.

Current climate data and information systems

Tajikistan has an operational national hydrometeorological service (Tajikhydromet) and several multi-hazard data platforms, and the country has benefitted from regional modernisation support from organisations such as the World Bank, GFDRR, WMO and UNDP. However, station density, automation, cryosphere monitoring, data archiving and interoperable national data platforms remain incomplete, limiting timely forecasts, sectoral services (agro-, water, energy) and resilience planning^{280,281,282}. Regarding national hydrometeorological operations, infrastructure and coverage, Tajikhydromet is the national hydrometeorological agency and the WMO focal point for Tajikistan²⁸³. Historical and recent station counts show limited density and partial operation. The National Communication of 2022 reports 59 meteorological stations (52 operational) and 96 hydrological gauging stations that, as of May 2020, 89 measured water level and 44 measured flow discharge. The report sets targets to reach 70 conventional weather stations and 100 automated stations by 2025²⁸⁴. As part of the World Bank Central Asia Hydromet Modernisation Project (CAHMP), Tajikhydromet received automatic station equipment (for example, 54 automatic Stymax units and 26 container-type stations installed under project activities), improving automated observations at selected sites^{285,286}. The country hosts sectoral monitoring units (hydrology, agrometeorology, glaciology) inside the Agency. However, many networks are ageing and require technical retrofitting or replacement to meet WMO-recommended density and reliability^{287,288}. Tajikistan's capacity to generate climate-relevant data spans meteorological, hydrological, cryospheric and agrometeorological domains, yet coverage remains below international standards and significant gaps persist. While recent investments under CAHMP and related initiatives have introduced new automatic stations and pilot

²⁷⁷ <https://www.undrr.org/news/tajikistan-advances-early-warnings-all-initiative-through-local-level-workshops>

²⁷⁸ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁷⁹ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

²⁸⁰ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁸¹ <https://www.meteo.tj/en/agency/about-us>

²⁸² Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁸³ <https://www.meteo.tj/en/agency/about-us>

²⁸⁴ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁸⁵ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁸⁶ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁸⁷ <https://www.meteo.tj/en/agency/about-us>

²⁸⁸ Tajikistan's Fourth National Communication 2022. [Available online.](#)

approaches, national observation networks require further rehabilitation, expansion and integration to provide reliable, sector-specific information for adaptation planning and risk management. This is discussed below under each area of focus.

- Meteorological: national synoptic and climatological observations exist, including automatic stations introduced under CAHMP, but the overall observation density is below recommended thresholds, and several stations require rehabilitation^{289,290}.
- Hydrological: a network of gauging stations covers river levels and, at fewer sites, discharge; routine hydrological observations remain incomplete for transboundary basins and high-altitude catchments. The CAHMP and related regional efforts include improvements to river monitoring and flash-flood guidance systems^{291,292}.
- Cryosphere and glacier monitoring: glacier and permafrost monitoring are limited and considered a priority gap in the Fourth National Communication (4NC). The document calls for a modern glacier inventory, systematic glaciological monitoring, automated snow measurement and improved sharing of glaciological data²⁹³.
- Agrometeorology: Tajikistan operates agrometeorological posts and some automatic agro-met (PHS) units; the 4NC and project documents note the need to increase the number, automation and integration of agromet stations to deliver actionable services for farmers. Community / farmer-hosted low-cost stations are already piloted by WWCS initiatives, which offer a model to increase spatial coverage^{294,295}.

Forecasting and modelling capacity^{296,297}

Central Asia has adopted regional modelling products such as the Consortium for Small-Scale Modelling–Central Asia (COSMO-CA). This is a regional numerical weather prediction (NWP) system adapted from the COSMO model originally developed by a European consortium. Under CAHMP, COSMO was configured for the Central Asian region to:

- Provide higher-resolution regional weather forecasts;
- improve accuracy for mountainous terrain like Tajikistan;
- support national services such as Tajikhydromet in producing daily and medium-range forecasts; and
- serve as a shared regional forecasting backbone that individual countries can downscale and refine.

Project reporting shows Tajikhydromet meeting or approaching targeted accuracy improvements for weather and river-flow forecasts. Tajikhydromet now produces operational forecasts and has improved service delivery, but routine access to high-resolution satellite data, high-performance computing (HPC) or dedicated national NWP servers is limited and cited as a priority. The Fourth National Communication recommends supercomputers, servers and better telecommunication for data reception and processing. Hydrological routing, snowmelt and glacier-runoff models are progressing, primarily through regional flash-flood and snowmelt guidance (CARFFGS/CAFEWS), but local high-resolution hydrological modelling and cryospheric mass-balance modelling are still underdeveloped and require increased observational inputs. Lastly, regarding human capacity, CAHMP and regional partners delivered forecaster and ICT trainings, but long-term staff capacity, retention and funding for O&M remain constraints. The 4NC lists training and staffing as urgent capacity development needs.

Gaps and limitations in CIS

Station density and automation are insufficient for high-resolution services across mountainous terrain, contributing to forecast uncertainty and limited local applicability. Cryosphere monitoring

²⁸⁹ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁹⁰ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁹¹ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁹² Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁹³ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁹⁴ <https://adaptationataltitude.org/solutions-portal/weather-water-climate-services-for-tajikistan/>

²⁹⁵ Tajikistan's Fourth National Communication 2022. [Available online.](#)

²⁹⁶ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁹⁷ Tajikistan's Fourth National Communication 2022. [Available online.](#)

for glacier inventories, permafrost, and automated snow gauges is sparse, weakening water security and glacier-lake outburst flood (GLOF) risk assessment. Data management and archiving are fragmented, and no single, well-managed national climate data repository with interoperability for sectoral users exists. Computing and telemetry infrastructure is limited for operational NWP, hydrological routing and near-real-time dissemination, especially in remote mountainous areas. Sectoral (agro-, water-, energy-) tailored climate products and the last-mile dissemination to farmers, water managers and infrastructure agencies remain limited despite promising pilots. These include Weather, Water and Climate Services (WWCS) initiatives such as those supported by Caritas Switzerland, WMO, and MeteoSwiss, that have piloted farmer-hosted low-cost weather stations and tailored services like soil temperature monitoring, irrigation guidance, and crop rotation advice to support climate-resilient agriculture^{298,299,300}.

Circular water, weather, and climate services (circular WWCS)

Caritas Switzerland, in partnership with MeteoSwiss, WMO, SLF, ICARDA, and national agencies including Tajik Hydromet, the Ministry of Agriculture, and the Committee of Emergency Situations and Civil Defence, implemented a project (Jun 2021–May 2025) to improve the resilience of rural communities in Tajikistan to natural hazards, climate change, and climate variability. The initiative addresses limited weather forecasts, early warning systems, and weather, water, and climate services (WWCS) by developing a circular value chain that links farmers, hydromet services, and government (Figure 56). Farmers host and maintain low-cost weather stations and provide citizen observations, which feed into Tajik Hydromet for improved forecasting, while receiving payments and tailored WWCS in return. The project introduces services such as soil temperature measurement for planting, crop-specific irrigation advice, frost and heatwave warnings, and guidance on crop rotations. Early pilots demonstrated substantial benefits, including tripling chickpea yields through adjusted planting dates and increasing potato yields by 25–40% while reducing water use through WWCS-based irrigation. The approach emphasises cost-effectiveness, fee-for-service models, and strong collaboration across government, local advisory services, and international partners. Over the next 18 months, the project will refine dissemination systems, strengthen national ownership, and expand WWCS applications, including avalanche risk monitoring and livestock protection from extreme weather³⁰¹.

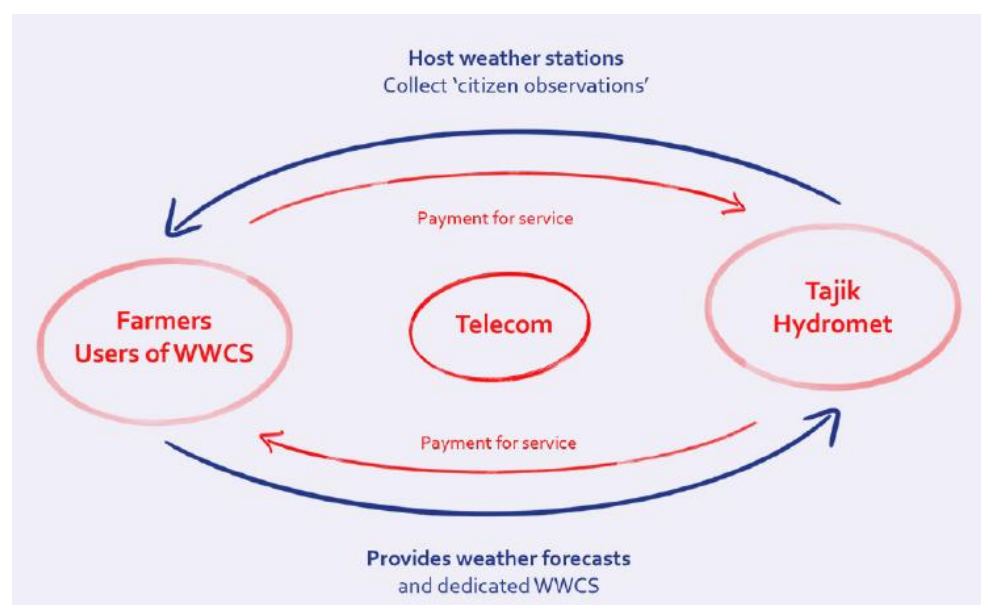


Figure 56. A circular value chain of data and services that support the project³⁰².

²⁹⁸ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

²⁹⁹ <https://adaptationataltitude.org/solutions-portal/weather-water-climate-services-for-tajikistan/>

³⁰⁰ Tajikistan's Fourth National Communication 2022. [Available online.](#)

³⁰¹ Swiss Agency for Development and Cooperation 2021. Weather, Water and Climate Services in Tajikistan. [Available online.](#)

³⁰² Swiss Agency for Development and Cooperation 2021. Weather, Water and Climate Services in Tajikistan. [Available online.](#)

Tajikistan is highly exposed to hydrometeorological hazards, which are increasing in frequency and intensity due to climate change. The Committee of Emergency Situations and Civil Defence (CoESCD) is mandated to coordinate disaster risk reduction and response, but its capacity is severely constrained by limited technical and financial resources. As a result, resources are often diverted to immediate emergency response at the expense of long-term risk reduction measures. Critical gaps include the absence of a robust network of crisis management centres, limited analytical capabilities, and insufficient investment in search and rescue capacities. Strengthening CoESCD's information systems, including real-time hazard monitoring and forecasting tools, is critical for reducing climate-related disaster risks³⁰³.

Regional cooperation is also essential, as climate and hydrological hazards often transcend national borders. Tajikistan requires enhanced meteorological, hydrological, and climatological data for early warning systems, disaster preparedness, and adaptation planning in sectors such as energy, agriculture, and water. Partnerships with initiatives such as EUMETSAT and its Satellite Data for Central Asia project are vital in improving access to satellite-based climate observations. Similarly, the EU-led Digital Connectivity Initiative offers opportunities to expand digital infrastructure, establish green data centres, and enhance cybersecurity—key prerequisites for resilient climate information systems³⁰⁴.

Priority actions to strengthen CIS^{305,306}

Recommended priority actions to strengthen CIS in Tajikistan include:

- Accelerating automation and telemetry by expanding automated meteorological, hydrological and agrometeorological stations to meet the targeted network density, with robust telemetry to central servers. CAHMP experience demonstrates high impact when automation is paired with training and O&M planning.
- Establishing a central, interoperable data repository and archive to digitise historical records, create an open/climate data portal with WMO/FAIR standards and clear data-sharing protocols for sectoral users. The 4NC explicitly recommends archive management and database building.
- Scaling cryosphere monitoring and glacier inventories by implementing a national glacier inventory, automated snow monitoring and systematic glaciological sites to improve GLOF and seasonal water-security forecasts. The 4NC prioritises glacier and permafrost observation.
- Investing in forecasting infrastructure and modelling that includes secure HPC / server capacity for NWP downscaling, operational hydrological routing and seasonal forecasting, and integrating regional products (COSMO-CA, CAFWEWS) into national operational workflows. CAHMP shows that regional modelling plus national computing and operations is effective.
- Improving sectoral climate services and last-mile dissemination by scaling agromet and WWCS pilots, developing user-specific products for agriculture, water management and transport, and expanding warning communication channels.
- Sustaining capacity building and O&M financing by embedding recurrent O&M costs and staff retention measures into national budgets and business models. CAHMP emphasises business planning to ensure sustainability.

2.6.4. Social protection and climate resilience

Tajikistan's social protection framework is not currently adapted to address climate-related shocks. While electronic payment systems and nascent information platforms present an opportunity for scalability, the social registry remains underdeveloped and lacks interoperability. Strengthening adaptive social protection systems will require reforms in legal frameworks,

³⁰³ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

³⁰⁴ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

³⁰⁵ World Bank 2022. Central Asia Hydrometeorology Modernization Project. [Available online.](#)

³⁰⁶ Tajikistan's Fourth National Communication 2022. [Available online.](#)

improved data systems, and mechanisms for targeting vulnerable groups, especially female-headed households, which are disproportionately impacted by climate shocks. Expanding access to financial services through microfinance and entrepreneurial support can further enhance resilience and promote inclusive economic opportunities³⁰⁷.

3. Climate change in Tajikistan

3.1. Climate trends

3.1.1. Precipitation

Tajikistan has experienced significant variability in precipitation patterns over recent decades. Since 1951, records show a general increase in annual precipitation, accompanied by a broader rainfall distribution (Figure 57). This reflects a rise in the frequency and intensity of extreme events, leading to both wetter and drier conditions than previously observed³⁰⁸. The Third National Communication to the UNFCCC reports an average increase of approximately 5%–10%, primarily driven by more intense rainfall events rather than an increase in rainy days. Some areas have seen a decline in rainfall frequency. Notably, 2000, 2001, and 2008 experienced severe droughts, with precipitation falling 30–50% below average. These dry conditions are part of a broader regional trend in Central Asia, closely linked to El Niño–Southern Oscillation (ENSO) patterns³⁰⁹.

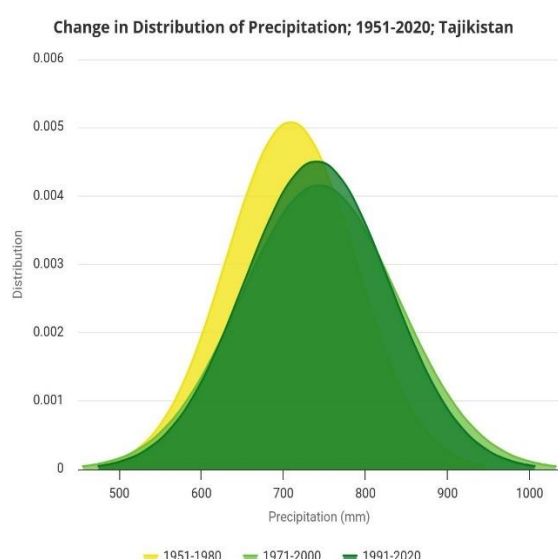


Figure 57. Observed change in distribution of precipitation from 1951–2020, Tajikistan³¹⁰.

Additionally, from 1990 to 2020, annual precipitation in many areas dropped below 700 mm, compared to higher levels in previous decades—suggesting a possible shift in climatic patterns (Figure 58). Tajikistan has also seen a concerning increase in the maximum number of consecutive dry days between 1991 and 2020, indicating prolonged dry spells. Meanwhile, consecutive wet days have remained stable or declined slightly (Figure 59). These trends highlight the complex spatial and temporal variability of precipitation in the country, shaped by both microclimates and larger-scale climate systems³¹¹.

³⁰⁷ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical)

³⁰⁸ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³⁰⁹ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³¹⁰ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³¹¹ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

Precipitation Annual Trends with Significance of Trend per Decade; 1951-2023; Tajikistan

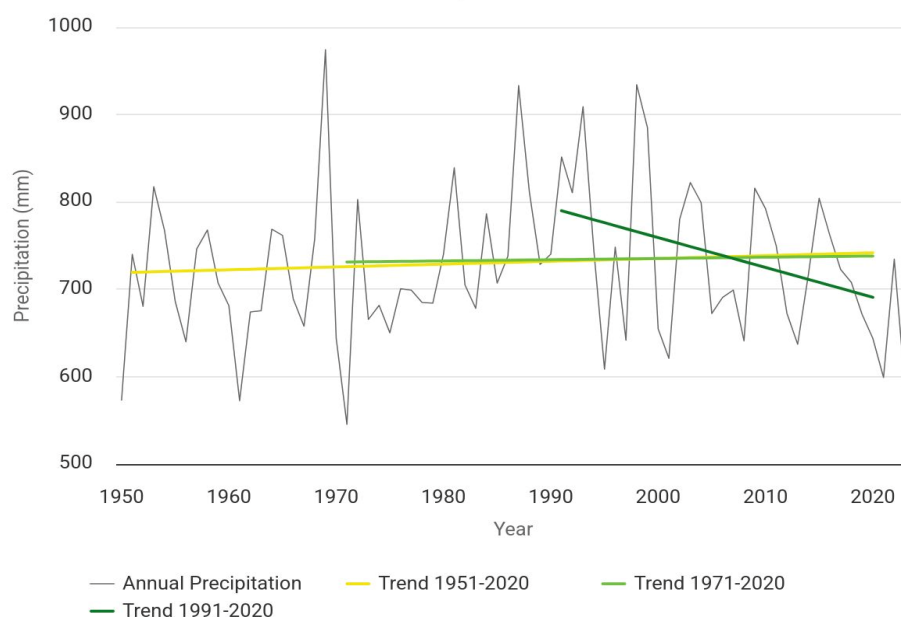
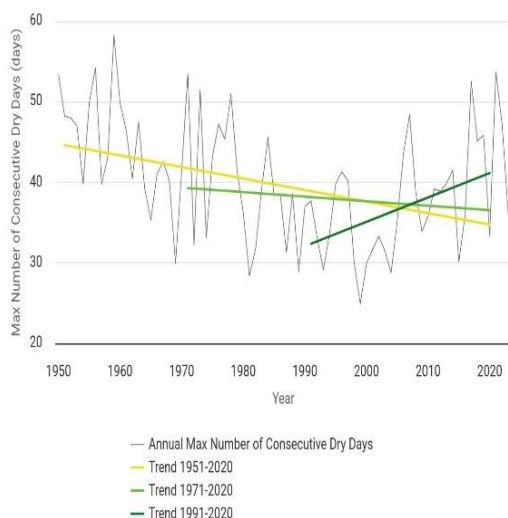


Figure 58. Observed annual precipitation trend per decade from 1951–2023, Tajikistan³¹².

Max Number of Consecutive Dry Days Annual Trends with Significance of Trend per Decade; 1951-2023; Tajikistan



Max Number of Consecutive Wet Days Annual Trends with Significance of Trend per Decade; 1951-2023; Tajikistan

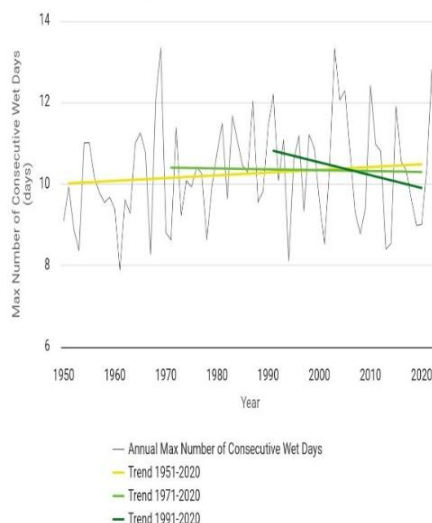


Figure 59. Observed maximum annual number of consecutive dry days (left) and wet days (right) from 1951–2023, Tajikistan³¹³

3.1.2. Temperature

Observed Temperature

Over the period from 1951 to 2023, Tajikistan has experienced a clear and accelerating warming trend. Analysis of the average mean surface air temperature distribution reveals a total increase of approximately 1.4°C, with the mean temperature rising by about 0.7°C from 1951–1980 to 1971–2000, and a further 0.7°C from 1971–2000 to 1991–2020. This shift in distribution toward higher temperatures reflects an increasing frequency of warmer conditions (Figure 60). Further, annual trend analysis shows that temperatures have increased, and the warming rate has

³¹² <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³¹³ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

intensified in recent decades. The long-term trend from 1951–2020 indicates gradual warming, but the trends for 1971–2020 and 1991–2020 show progressively steeper slopes (Figure 60). This means the temperature rise has accelerated significantly, particularly since the 1990s³¹⁴.

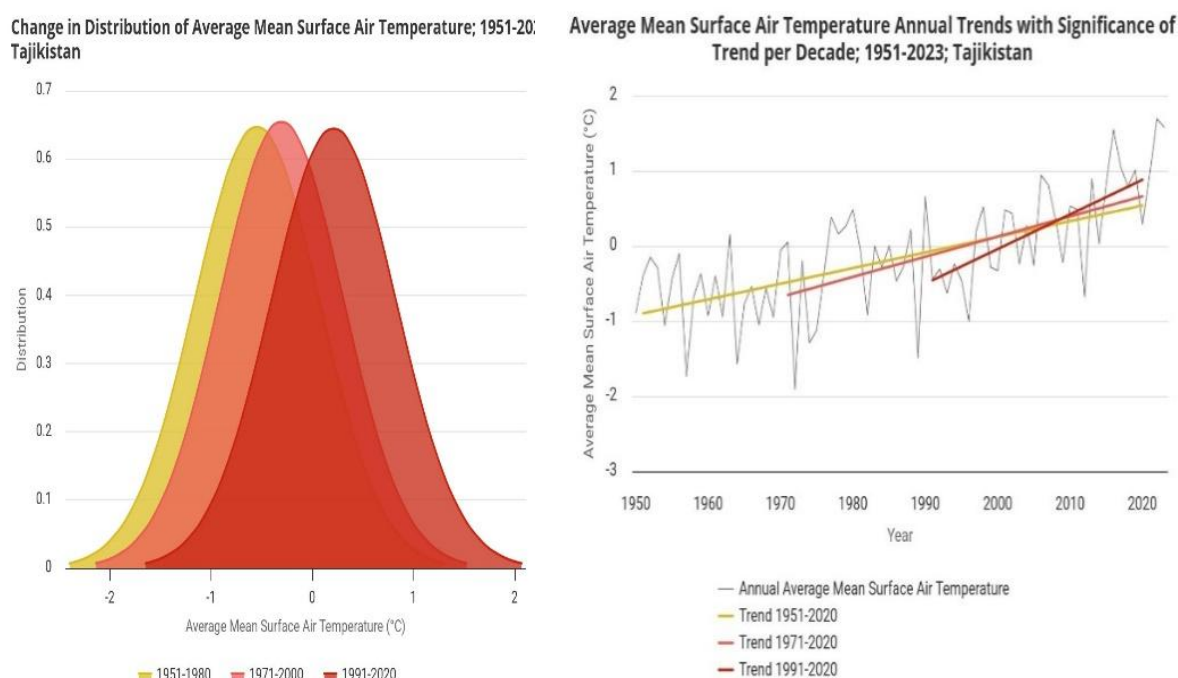


Figure 60. Observed change in mean temperature distribution (left) and annual mean surface air temperature per decade (right), 1951–2023; Tajikistan³¹⁵.

Geographically, the warming has been uneven: lowland areas experienced a temperature rise of approximately 1°C over the long-term average, mid-altitude regions warmed by 0.8°C, and uplands by 0.2°C. Between 1930 and 2010, the average rate of temperature rise was about 0.1°C per decade. Seasonal and interannual variability also play a role; weather remains highly unstable yearly due to atmospheric circulation processes that bring anomalously hot or cold air masses. Temperature increases have been most pronounced during the autumn and winter months, driven mainly by rising minimum temperatures, while spring and summer have seen more modest increases³¹⁶. In addition, there has been a notable rise in the intensity and frequency of extreme heat events. During the 2010s and 2020s, extreme heat events have exceeded 2.5 standard deviations above the historical records. Such anomalies were rare before 2000 but have become more common and intense in recent decades³¹⁷. The annual number of days exceeding a 35°C heat index, particularly accelerating from the 1970s onwards and peaking dramatically around 2020. Concurrently, the annual number of tropical nights (where the minimum temperature stays above 20°C) indicates that hot days are becoming more frequent, and nights are experiencing significantly less cooling over the decades, leading to more prolonged periods of heat stress (Figure 61)³¹⁸.

³¹⁴ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³¹⁵ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³¹⁶ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³¹⁷ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³¹⁸ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

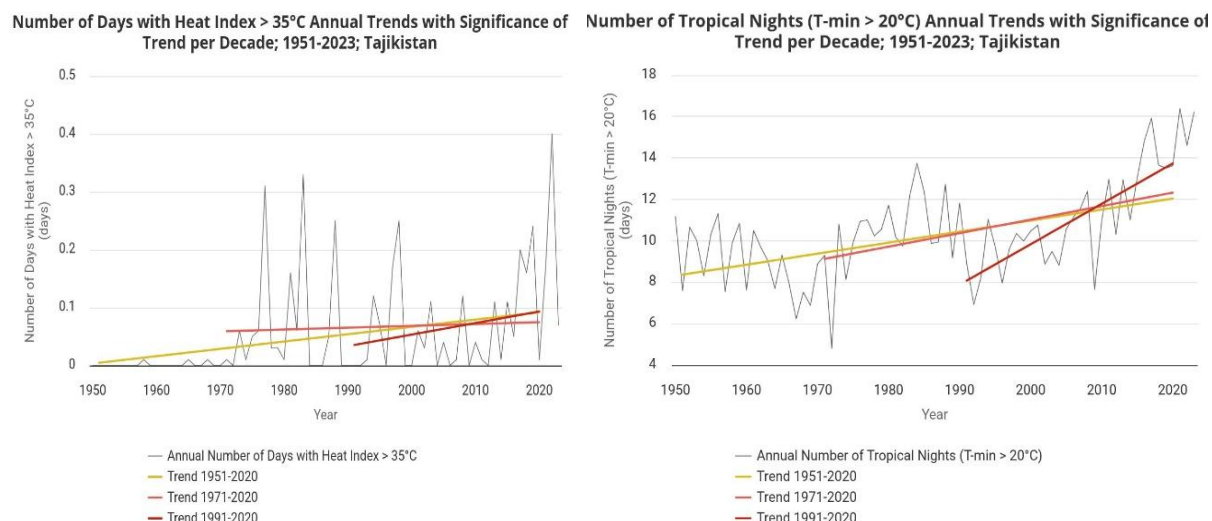


Figure 61. Observed annual number of days with heat index $>35^{\circ}\text{C}$ (left) and tropical nights ($T\text{-min} >20^{\circ}\text{C}$, right), 1950–2020, Tajikistan³¹⁹.

3.1.3. Hazards

More than 90% of Tajikistan is mountainous, with over half lying above 3,000 metres. These geological and climatic conditions make the country highly susceptible to earthquakes, floods, landslides, and avalanches, which regularly damage infrastructure, disrupt economic activity, and affect social well-being. Between 1992 and 2016, natural hazards caused economic losses exceeding US\$1.8 billion and affected almost seven million people. With support from the Agency on Statistics, the Committee of Emergency Situations and Civil Defence (CoESCD) records emergencies of natural, technogenic, and biological origin. Between 2010 and 2020, 1,148 natural hazard events were recorded, causing 271 deaths. From 2012 to 2020, the number of natural hazard events resulting in economic losses declined, a trend attributed to strengthened preventive and warning measures implemented by the Government of Tajikistan³²⁰.

Year	Number of emergencies of natural character	Number of deaths.
2010	236	61
2011	121	11
2012	308	26
2013	83	11
2014	67	31
2015	90	38
2016	55	20
2017	94	31
2018	23	12
2019	46	22
2020	25	8
Total Number	1,148	271

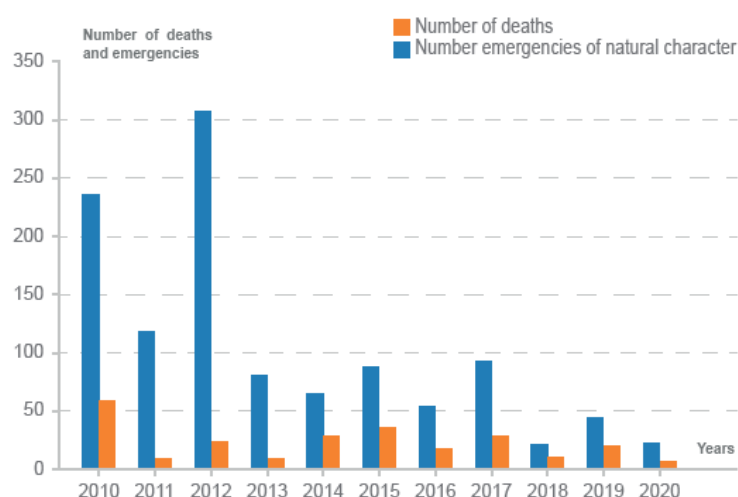


Figure 62. Emergency statistics 2010–2020, Tajikistan³²¹.

Figure 63 presents data on the distribution of observed natural hazards in the country from 1980 to 2020. Floods are the most frequently recorded hazard, followed by landslides, earthquakes,

³¹⁹ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

³²⁰ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

³²¹ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

and epidemics³²². Although droughts appear less often in the historical record, they remain a major hazard due to their significant effects, as reflected in the INFORM Index, which assigns Tajikistan a drought hazard score of 7.6 from 2016 to 2025. In the INFORM Risk Index 2025, Tajikistan is ranked 79th out of 191 countries with a hazard and exposure score of 3.8, further emphasising the presence of multiple natural hazards across the country. The Index also notes moderate levels of flood exposure³²³. As of 2010, assuming protection for up to a 1-in-25-year flood event, an estimated 20,000 people are affected annually by river flooding, with US\$39 million in expected annual GDP impact³²⁴.

In addition to river flooding, flash floods and glacier lake outburst floods (GLOFs) are significant hazards. GLOFs occur when moraine dams in high-altitude glacial regions are breached, often releasing large volumes of water that can trigger or coincide with landslides and mudflows. Tajikistan also experiences high temperatures, especially in lowland areas. Despite cooler national averages due to high elevations, many regions see multiple days above 35°C each year. The median annual probability of a heatwave, defined as three or more consecutive days above the long-term 95th percentile of daily mean temperature, is currently around 3%³²⁵.

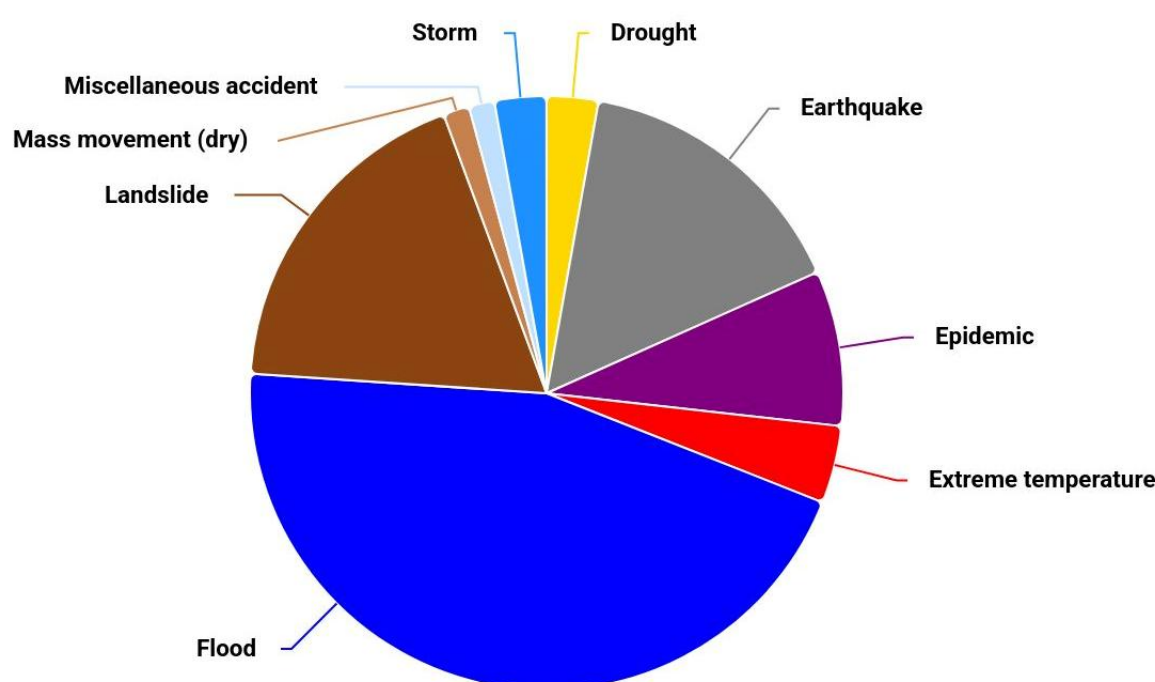


Figure 63. Average annual natural hazard occurrence for 1980–2020, Tajikistan³²⁶.

3.2. Predicted climate trends

3.2.1. Precipitation

Tajikistan is projected to experience significant shifts in precipitation and an increase in drying events. The projected precipitation % change suggests a general increase in average precipitation rates (Figure 64). This is expected to be offset by higher evaporation rates, leading to decreased available freshwater. More recent studies indicate a likely reduction in summer precipitation and a slight increase in winter rainfall. Furthermore, the average Largest 1-day

³²² <https://climateknowledgeportal.worldbank.org/country/tajikistan/vulnerability>

³²³ <https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk/Country-Risk-Profile>

³²⁴ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³²⁵ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³²⁶ <https://climateknowledgeportal.worldbank.org/country/tajikistan/vulnerability>

Precipitation shows an increasing trend in the intensity of single-day extreme rainfall events across all SSP scenarios. Concurrently, the maximum number of consecutive dry days is projected to increase, with historical averages of 40–45 consecutive dry days potentially rising to approximately 45–50 days across all SSPs by 2100 (Figure 65). This combination suggests a future regime of more intense but potentially less frequent rainfall, alongside longer dry spells^{327,328}.

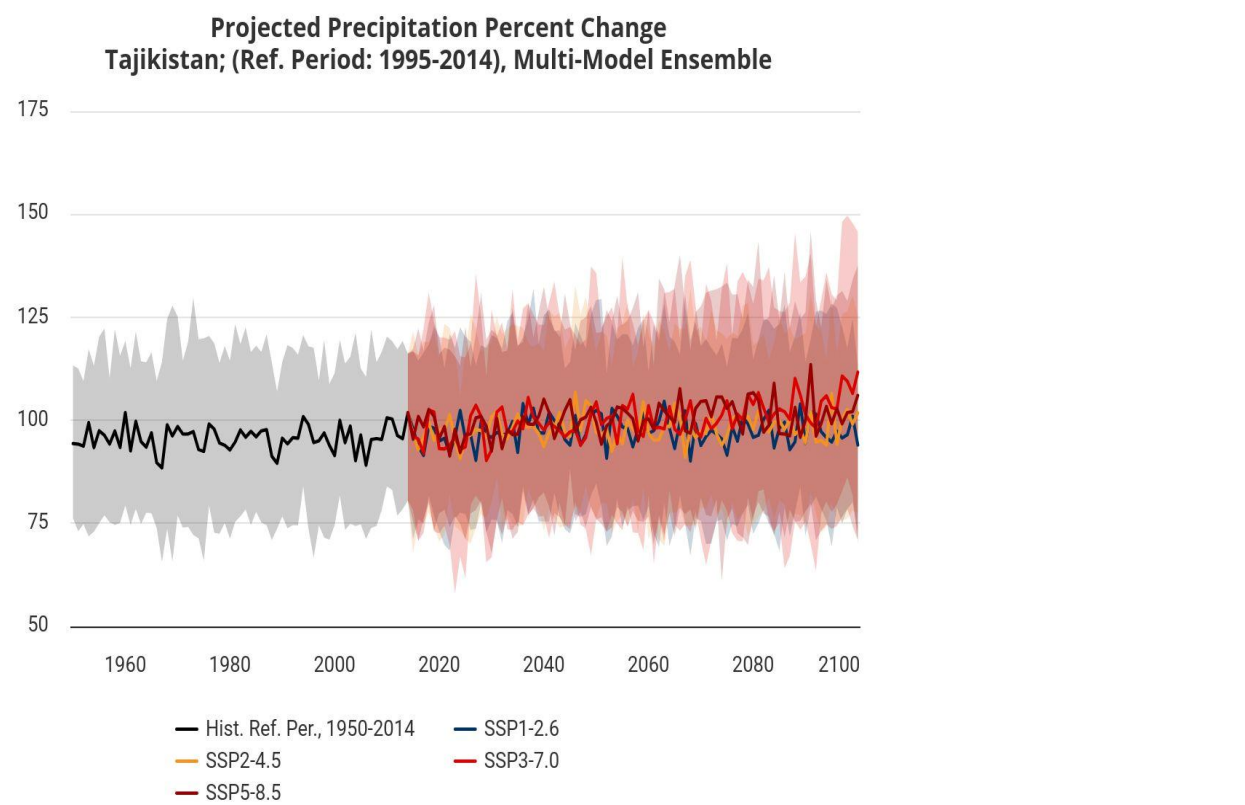


Figure 64. CMP6 Projected Precipitation % change by 2100, relative to 1995–2014, Multi-Model Ensemble, Tajikistan³²⁹.

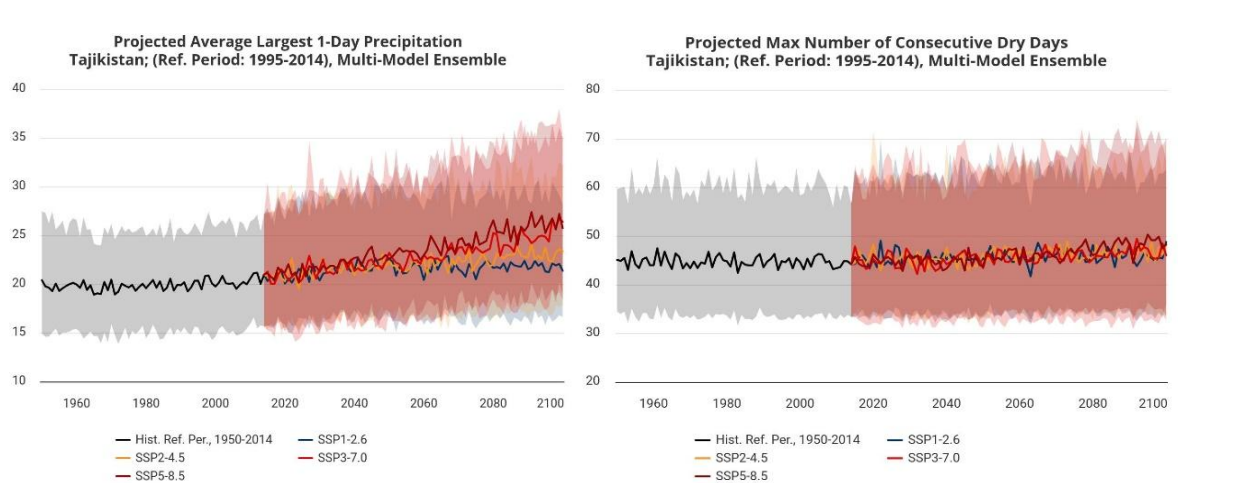


Figure 65. CMP6 Projected Largest 1-day precipitation (left)and maximum number of (right) by 2100, relative to 1995–2014, Multi-Model Ensemble, Tajikistan³³⁰.

³²⁷ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>
³²⁸ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf
³²⁹ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>
³³⁰ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

3.2.2. Temperature

Tajikistan is facing a future of escalating climate change impacts, with the severity largely dependent on future global greenhouse gas emissions pathways. Using a 1995–2014 baseline, projections indicate a significant warming trend across all scenarios. The Projected Average Mean Surface Air Temperature shows potential increases ranging from 1.5°C to 2°C under SSP1-2.6 to a severe 6°C to 7°C under SSP5-8.5 by 2100 (Figure 66). This translates to a dramatic rise in extreme heat events, whereby the Number of Days with Heat Index > 35°C could increase from near zero historically to around 1–2 days annually in SSP1-2.6, 5 days in SSP2-4.5, 10 days in SSP3-7.0, and nearly 20 days in SSP5-8.5 (Figure 67). Concurrently, the projected number of tropical nights (T-min > 20°C) is set to substantially increase, from historical levels of 5–10 nights to approximately 15 nights under SSP1-2.6, 20–25 under SSP2-4.5, 30–35 under SSP3-7.0, and potentially exceeding 40 nights per year under SSP5-8.5 (Figure 67). These combined projections show Tajikistan's high vulnerability to more frequent and intense heat events and prolonged heat stress, with the most severe impacts occurring if significant mitigation efforts are not undertaken globally³³¹.

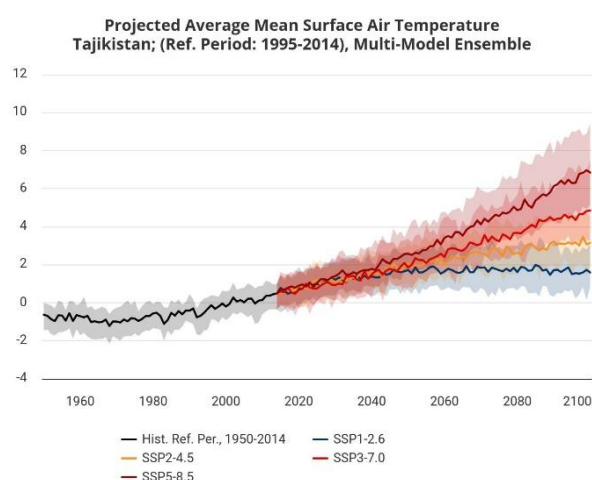


Figure 66. CMP6, Projected average mean surface air temperature by 2100, relative to 1995–2014, Multi-Model Ensemble, Tajikistan³³².

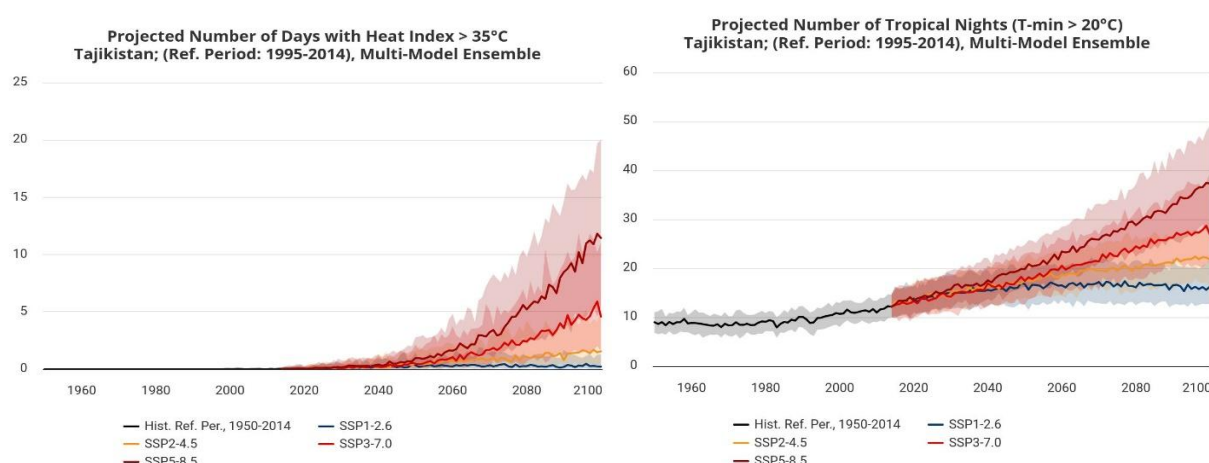


Figure 67. CMP6 Projected annual number of days with heat index >35°C (left) and tropical nights (T-min >20°C, right) by 2100, relative to 1995–2014, Multi-Model Ensemble, Tajikistan³³³.

³³¹ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

³³² <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

³³³ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

3.2.3. Hazards

Projections indicate that Tajikistan will face intensifying natural hazards due to climate change. Heatwave probability, currently around 3% annually, is expected to rise to 7%–23% by the 2090s, with national maximum temperatures increasing from 30°C to over 35°C and days above 40°C becoming common in lowland regions. Severe meteorological drought, now occurring with a 3% annual probability, could exceed 25% by the 2050s, with historically rare droughts (1-in-100 years) occurring every 15 years under 2°C of global warming. Flood risk is also expected to grow, with climate change projected to increase the number of people affected by river flooding by 5,000 and raise annual GDP losses by US\$30 million by 2030 under high emissions scenarios³³⁴. Global Facility for Disaster Reduction and Recovery (GFDRR) projections indicate a high risk of urban flooding and river flooding, especially along major river basins, with some central areas at medium risk (Figure 68)³³⁵. These records collectively reflect a clear shift toward more frequent and intense flooding, heat, and drought events across the country.

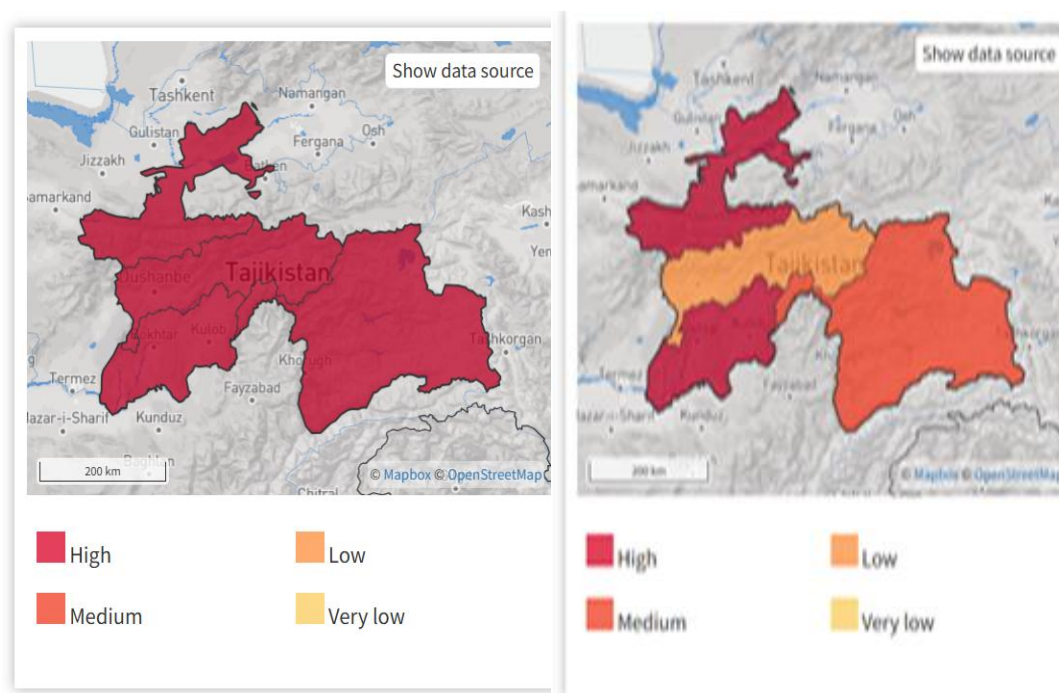


Figure 68. Projected Urban flooding (left), river flooding (right) in the next 10 years, Tajikistan³³⁶.

3.3 Climate change vulnerability

Exposure, sensitivity, and adaptive capacity are three core components determining a system's vulnerability to climate change. Exposure refers to the extent to which a system is subject to significant climate-related hazards such as droughts, floods, or temperature extremes. Geographical location, socio-economic conditions, and physical proximity to climatic threats influence it. Sensitivity describes how severely a system is affected when exposed to such hazards, which depends on inherent characteristics like infrastructure quality, technological capacity, and socio-economic resilience. In contrast, adaptive capacity is the ability of the system to adjust, cope, or recover from climate impacts through institutional, technological, or financial means³³⁷.

³³⁴ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³³⁵ <https://thinkhazard.org/en/report/239-tajikistan/UF>

³³⁶ <https://thinkhazard.org/en/report/239-tajikistan/UF>

³³⁷ Thomas, K. et al. 2018. Explaining differential vulnerability to climate change: A social science review. *Wiley Interdisciplinary Reviews: Climate Change*. 10 (3): e565

According to the ND-GAIN Matrix for 2023, Tajikistan demonstrates low readiness and low vulnerability, reflecting its ongoing exposure to climate-related risks alongside limited adaptive capacity. Tajikistan is the 150th most vulnerable country and the 149th most ready country out of 187 assessed globally, with a vulnerability index of 3.56. These indicators highlight Tajikistan's significant challenges in effectively responding to climate change, particularly due to institutional, economic, and social constraints that limit its ability to adapt and build resilience³³⁸.

The overall INFORM risk index Republic of Tajikistan risk score for 2022 was defined as high at 6.2 (Figure 69). The Hazard and Exposure Index for Tajikistan highlights significant risks across multiple natural hazards, including earthquakes, floods, landslides, and droughts (Figure 70). Overall hazard and exposure risk at the administrative level is listed as high for Sughd and Dashunbe city, and very high for all other regions. Earthquake risk is classified as very high in the Districts of Republican Subordination (9.5), Khatlon region (9.3), and Dushanbe city (9.3). Flood risk is very high in the Mountain Badakhshon Autonomous Region (GBAO) (9.1) and Khatlon (7.2). Landslide risk is particularly severe, with very high values for GBAO (10.0), the Districts of Republican Subordination (9.8), and the Sughd region (9.9). Drought risk is very high in Khatlon (9.0). These values demonstrate the high multi-hazard exposure across Tajikistan's regions, with mountainous and agriculturally dependent areas facing the most significant vulnerability.



Figure 69. Regional INFORM Risk Index³³⁹.

³³⁸ <https://gain.nd.edu/our-work/country-index/rankings/>

³³⁹ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

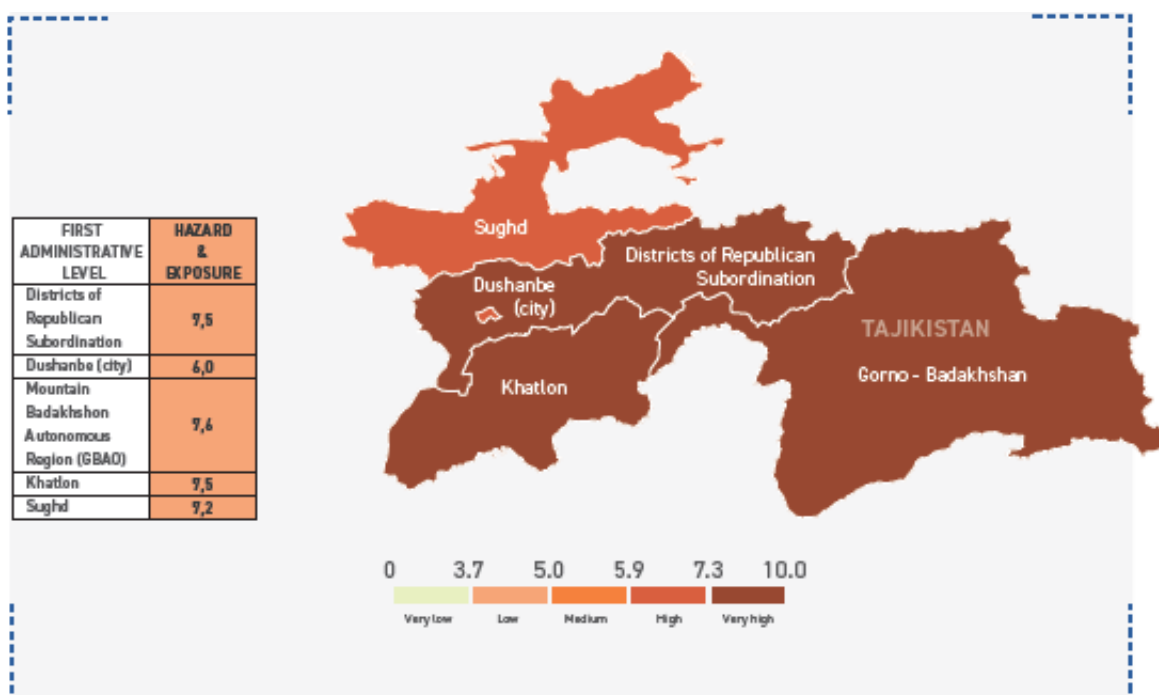


Figure 70. Hazard and exposure, Tajikistan³⁴⁰.

The Vulnerability dimension at the administrative level is medium for Sughd at 4.4, high for Districts of Republican Subordination (5.6), Khatlon region (5.3), and Dushanbe city (5.2) and very high for GBAO at 6.5 (Figure 71). The Lack of coping capacity dimension at the administrative level is high for all regions, ranging from 6.1 to 6.3 (Figure 72).

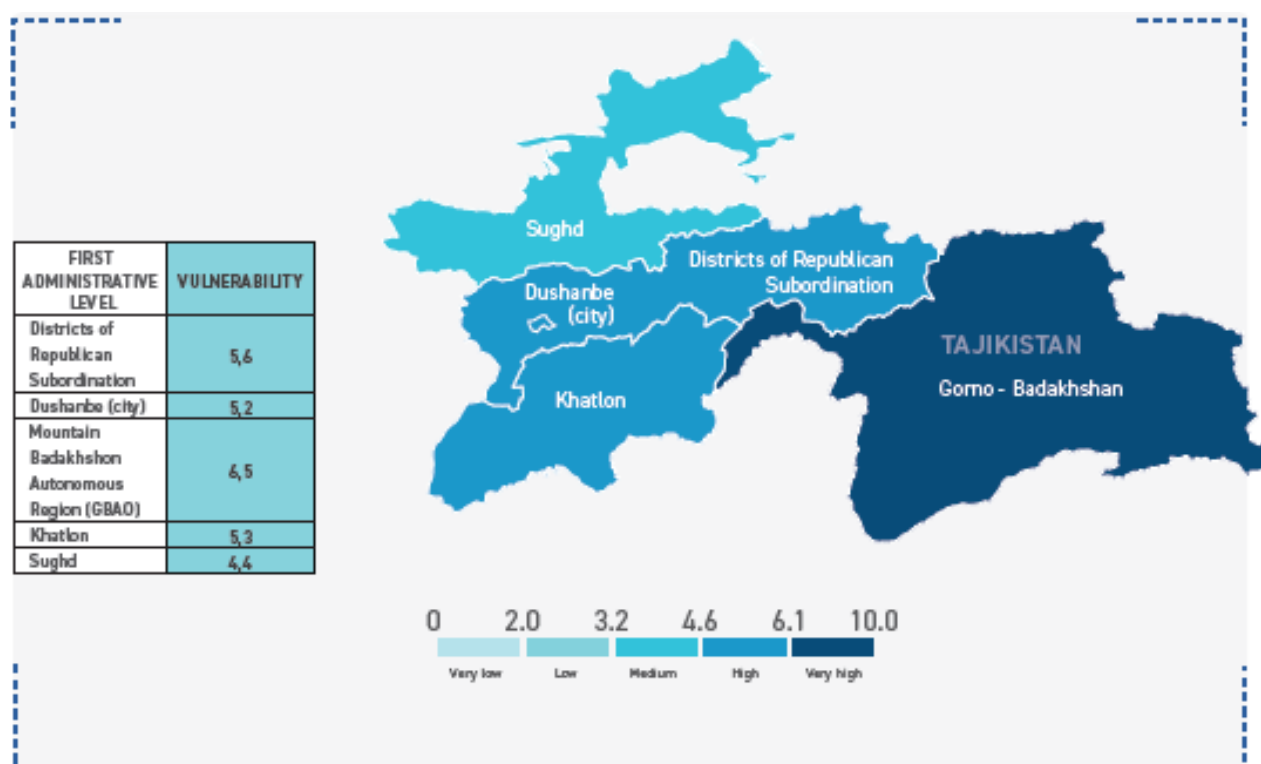


Figure 71. Vulnerability, Tajikistan³⁴¹.

³⁴⁰ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

³⁴¹ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

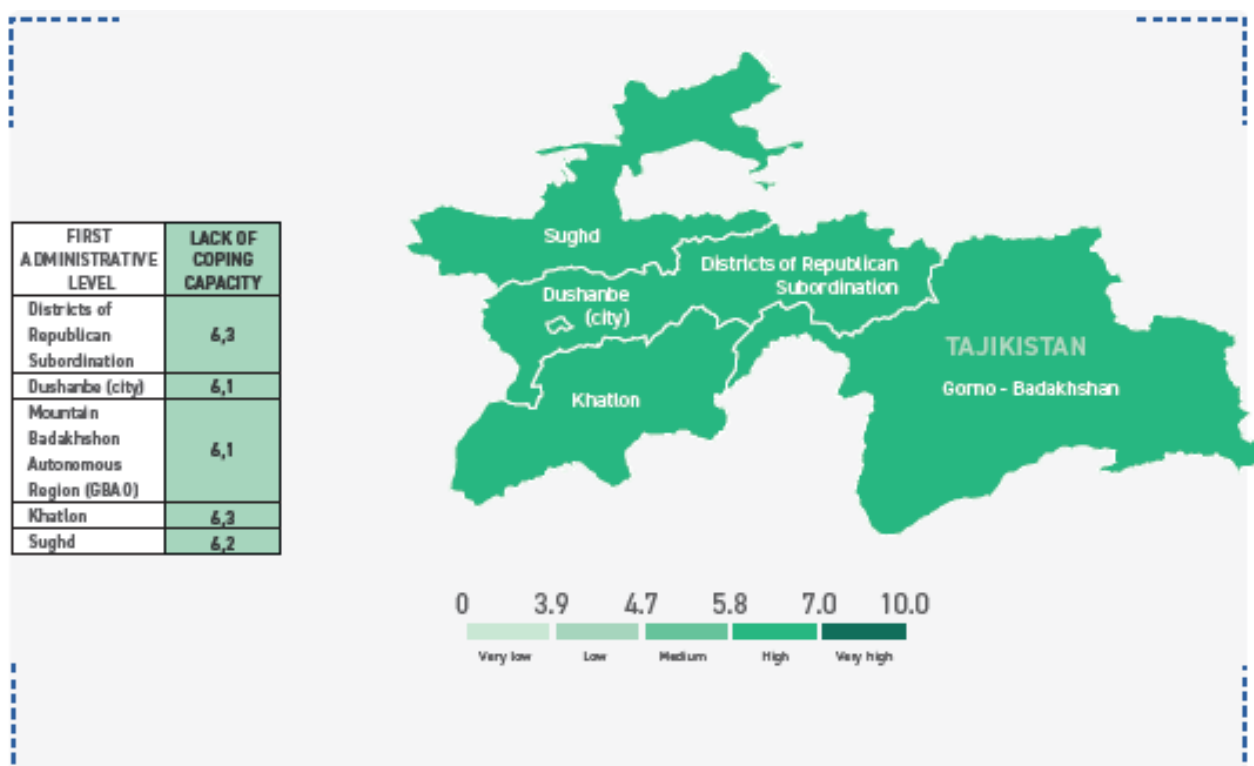


Figure 72. Lack of coping capacity, Tajikistan³⁴².

The ThinkHazard! tool, developed and maintained by the Global Facility for Disaster Reduction and Recovery (GFDRR), provides an overview of hazard likelihoods for specific locations, categorised as very low, low, medium, or high. Based on published hazard data from various public, private, and academic sources, the tool identifies a high likelihood of river floods, urban floods, earthquakes, landslides, and wildfires in Tajikistan (Figure 73). A medium likelihood of water scarcity and extreme heat is reported, while cyclone risk is classified as very low. These findings underline Tajikistan's exposure to multiple hazards, with floods, seismic activity, and landslides presenting the most significant risks

³⁴² UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

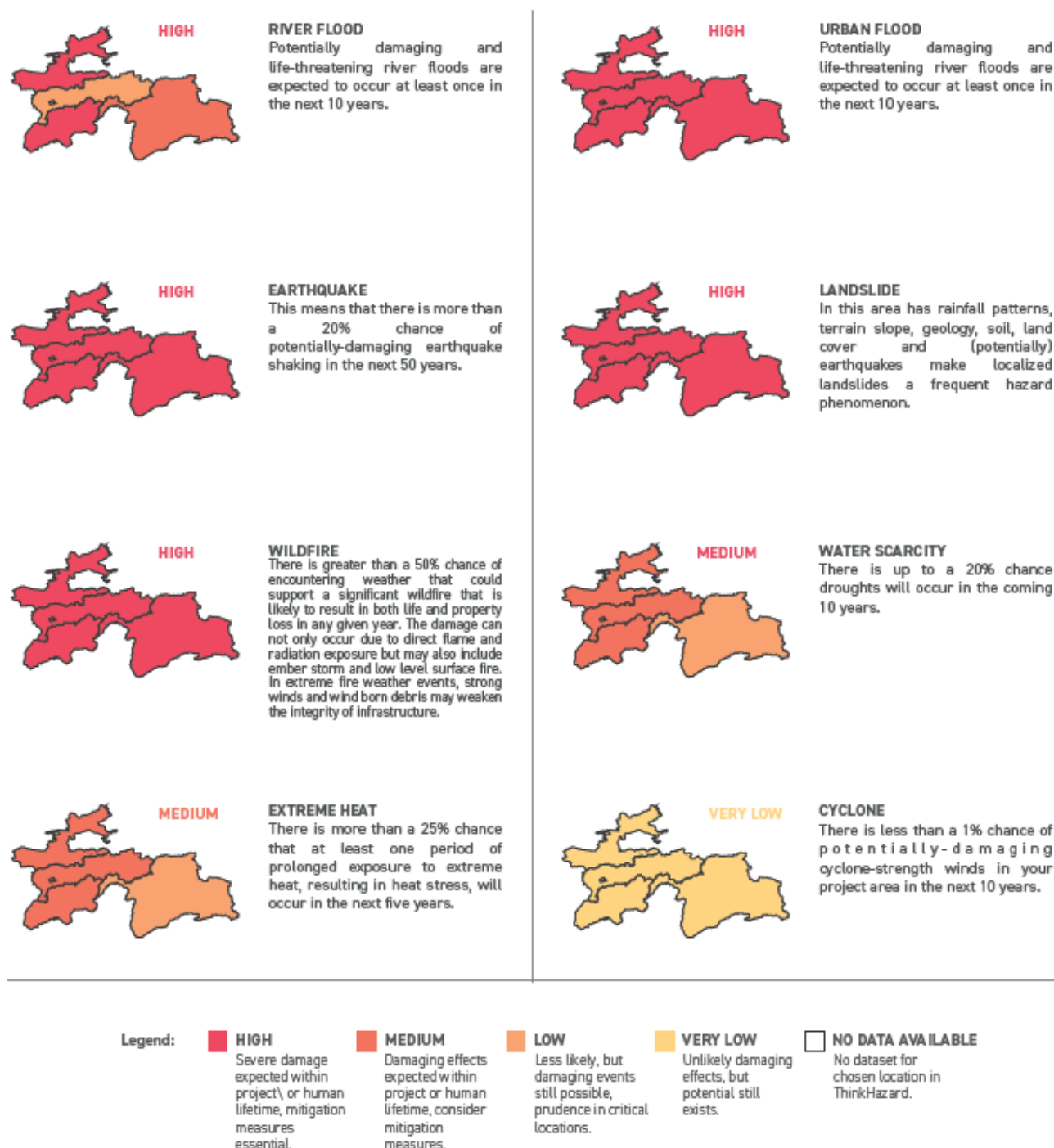


Figure 73. Hazard likelihood, Tajikistan³⁴³.

Poverty and inequality significantly amplify the impacts of climate change in Tajikistan. Despite recent progress in reducing poverty, a large share of the population remains highly food insecure, with 70%–80% of household income spent on food and heavy reliance on imports. This makes poor households particularly vulnerable to climate-related shocks, such as droughts, earthquakes, landslides, and heatwaves, threatening all economic sectors, including agricultural productivity and raising food prices. The poorest communities, especially those relying on rain-fed farming or manual labour, face the most significant risks yet have the fewest resources for adaptation. In both urban lowlands and remote highland areas, inadequate infrastructure, limited

³⁴³ UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

access to health and emergency services, and poor disaster preparedness systems further compound these vulnerabilities³⁴⁴.

Tajikistan's economic dependence on climate-sensitive sectors—notably agriculture, hydropower, and water resources—is a key driver of its vulnerability. The country is recognised as the main glacial centre of Central Asia, with glaciers covering around 6% of its land area. These glaciers, permafrost, and snowpack are vital for water storage and river flow regulation, replenishing major rivers in the Aral Sea basin. Yet, more than 20 billion cubic meters of glacier ice have already been lost due to warming, which threatens long-term water availability and energy production. Tajikistan's continental and semi-arid climate, highly variable by elevation, also brings irregular rainfall. Winter and spring precipitation lead to summer droughts, which severely affect agriculture. Conversely, the harshest cold winters drive up energy demand and, combined with rising food and fuel prices, result in the Central Asia energy crisis³⁴⁵.

3.3.1 The agriculture sector's vulnerability to climate change

Hazards

Tajikistan's agriculture sector faces a broad range of climate-related hazards, including increased frequency and severity of droughts, floods, landslides, mudflows, hailstorms, extreme temperatures, and GLOFs. The country's mountainous terrain makes it especially prone to erosion and runoff during intense rainfall events, while warmer temperatures accelerate glacial melt, contributing to long-term changes in river flows and seasonal water availability³⁴⁶. These hazards disrupt agricultural cycles and damage critical infrastructure like irrigation canals and rural roads.

Vulnerability

The agriculture sector is highly exposed to a wide range of climate-induced hazards that are projected to intensify due to climate change. These include recurring droughts, floods, landslides, mudflows, extreme temperatures, hailstorms, and GLOFs. The country's mountainous terrain and poorly protected arable land make it especially vulnerable to erosion and runoff during heavy rainfall. More than 70% of Tajikistan's population depends on agriculture, much of which is practised in hazard-prone valleys and steep slopes. Furthermore, the sector relies heavily on snow and glacial melt for irrigation, rendering it highly susceptible to shifts in water availability from climate variability³⁴⁷. Hazards like drought reduce soil moisture and crop yields, floods and mudflows destroy infrastructure and livestock assets, and hail and heatwaves damage key fruit and grain crops, affecting food security and rural incomes³⁴⁸.

Due to structural and socio-economic constraints, Tajikistan's agriculture sector is equally sensitive to these climate risks. The industry suffers from aging irrigation infrastructure, widespread land degradation, and limited access to modern, climate-resilient technologies. Most farmers operate on small, resource-constrained plots with minimal technical knowledge of adaptation practices, limiting their ability to recover from or adjust to climate shocks. Weak institutional support, inadequate agricultural extension services, and limited integration of climate risk into national planning further intensify sensitivity. As a result, rising temperatures, shrinking glaciers, and increased frequency of extreme weather events are already reducing crop yields, water access, and pasture productivity, especially in the southern Sughd, Khatlon, and Districts of Republican Subordination (DRS)³⁴⁹.

³⁴⁴ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³⁴⁵ United Nations Development Programme. 2025. Climate change adaptation, Tajikistan. Available [here](#).

³⁴⁶ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³⁴⁷ <https://openknowledge.fao.org/server/api/core/bitstreams/58e8af31-8455-4cca-8b14-f69c1ccb024/content>

³⁴⁸ https://www.adaptation-undp.org/explore/europe-and-central-asia/tajikistan?utm_source=chatgpt.com

³⁴⁹ Khakimov, P. *et al.* 2020. Climate Change Effects on Agriculture and Food Security in Tajikistan. *Silk Road A Journal of Eurasian Development* 2(1).89-112

Tajikistan's agricultural sector is highly vulnerable to climate change due to its exposure to droughts, extreme weather, glacial retreat, and water stress. Outdated irrigation systems, low mechanisation, and institutional and financial constraints limit adaptive capacity. Nevertheless, the country has implemented several strategies and policies to address these challenges. The National Climate Change Adaptation Strategy (NCCAS) 2019–2030³⁵⁰ and the Updated Nationally Determined Contribution 2021³⁵¹ identify agriculture as a priority sector and propose targeted actions, including irrigation efficiency improvements, promotion of climate-resilient crops, agroforestry expansion, and sustainable land management.

Observed vulnerabilities include reductions in crop yields and productivity in areas with increased temperatures and reduced precipitation. For example, cotton cultivation in southern Tajikistan (Khatlon region) has increasingly relied on additional irrigation in sandy-soil zones to offset low rainfall and deep groundwater levels by increasing water-saving technologies and growing crops suited for drier conditions³⁵². Implemented adaptation strategies include irrigation rehabilitation projects, installation of drip and sprinkler systems, and construction of water storage infrastructure under government and donor-supported projects like the TAJ Irrigation Rehabilitation Project (2005) sponsored by the Asia Development Bank (ADB) and the World Bank's PAMP II³⁵³. The government has promoted anti-erosion and bank protection works, forest protection belts, and anti-hail measures in hazard-prone areas. Strengthening farm infrastructure, access to credit, and mechanisation are also underway. Ongoing projects include training farmers in climate-smart agriculture, improving local seed systems, and enhancing early warning systems. For instance, the World Bank-supported RESILAND CA+ and Climate Adaptation and Mitigation Program (CAMP4ASB)³⁵⁴ focus on climate-resilient farming and land degradation control. Efforts are also being made to enhance food security by reducing import dependency. Policies aim to develop a minimum food basket, improve nutrition thresholds, and reintroduce state procurement schemes for key crops. Meanwhile, research on pest- and climate-resilient potato and grain varieties, and promotion of best agro-technological practices, is being carried out in collaboration with national agricultural research institutions³⁵⁵.

Observed Impacts

Tajikistan is considered the main glacial centre of Central Asia, with glaciers covering about 6% of the country's territory. These glaciers play a vital role in water regulation, contributing several cubic kilometers of freshwater annually to the main river basins, as noted in Tajikistan's Second National Communication (2008)³⁵⁶. However, the country has already lost over 20 billion cubic meters of glacial ice volume during the 20th century—about 2.5% of its total—mostly affecting small glaciers. Rainfall patterns have also become increasingly erratic. From 1999 to 2002, most precipitation occurred during winter and spring, causing droughts during the primary growing seasons, severely impacting agriculture. The 2000–2001 drought was the most devastating in the past decade, with rainfall 45% below average and near-total failure of rainfed wheat crops, while irrigated wheat also suffered due to low water availability³⁵⁷. In the lowland Amudarya river basin, water access was reportedly reduced by half, severely disrupting crop production and rural livelihoods. Additionally, in 2007–2008, Tajikistan experienced the coldest winter since 1969, which, coupled with high food and fuel prices, led to the 2008 Central Asia energy crisis³⁵⁸. The damage to crops and vital seed stocks contributed to increased morbidity and mortality among livestock, and food insecurity lasted at least until the next harvest in mid-summer. This harvest

³⁵⁰ <https://faolex.fao.org/docs/pdf/taj190980.pdf>

³⁵¹ Updated Nationally Determined Contribution (NDC, 2021)

³⁵² https://unfccc.int/sites/default/files/resource/tjknc3_eng.pdf

³⁵³ <https://www.gafspfund.org/sites/default/files/inline-files/Tajikistan-Second-Public-Employment-For-Sustainable-Agriculture-and-Water-Resources-Management-Project.pdf>

³⁵⁴ <https://documents1.worldbank.org/curated/en/409081637347740589/pdf/Labor-Management-Procedures-RESILAND-CA-Tajikistan-Resilient-Landscape-Restoration-Project-P171524.pdf>

³⁵⁵ https://unfccc.int/sites/default/files/resource/tjknc3_eng.pdf

³⁵⁶ <https://unfccc.int/resource/docs/natc/tainc2.pdf>

³⁵⁷ <https://www.fao.org/4/x7844e/x7844e00.htm>

³⁵⁸ <https://reliefweb.int/report/tajikistan/central-asia-regional-risk-assessment-responding-water-energy-and-food-insecurity>

has now been placed at severe risk due to unseasonably hot and dry weather that is hampering spring planting³⁵⁹.

Floods and mudflows also pose significant hazards. Riverine floods tend to occur in spring after heavy rains or in summer during snowmelt, while flash floods frequently strike steep and narrow valleys during intense rainfall events. Glacier Lake Outburst Floods (GLOFs), which occur when moraine-dammed lakes in high-altitude regions burst, add to the threat by releasing massive volumes of water that can trigger or coincide with landslides and mudflows³⁶⁰. **Floods and landslides, such as those in 2008 and 2009, according to the Ministry of Agriculture, have damaged 14,000 ha of land, which in monetary terms measured approximately US\$1 million.** From this, 5,000 ha were cotton fields, 696 ha vegetable fields, 124 ha potato fields, about 4 thousand hectares are grain fields, 718 ha are cultivated with melons, and 349 ha of fodder fields. Also, about 2,000 ha of smallholder vegetable gardens and 1,000 ha of vineyards were damaged. Locust infestation has infected some 56,000 ha, of which 44,000 have already been treated. For further treatment of the affected areas, farmers require tractors and hand-sprays, which have caused the death of several livestock³⁶¹. Soil erosion and land degradation have also severely impacted agriculture, with around 70% of irrigated land suffering degradation due to overgrazing, poor land use, and increased climatic stress³⁶². Most of Tajikistan now falls into arid or semi-arid zones, particularly the Eastern Pamir, southern Tajikistan, and lowland Sogd Oblast, where annual precipitation can be as low as 100–150 mm, intensifying agricultural vulnerability³⁶³.

In 2023, observed climate-related impacts on Tajikistan's agrarian value chains revealed productivity gains and critical vulnerabilities. Favourable rainfall and improved access to inputs boosted upstream production, with cereal output reaching 1.39 million tonnes (19% above the five-year average), including record wheat yields of 1.05 million tonnes and strong performances in barley and potatoes. However, climate variability disrupted several value chain stages. Severe winter frost devastated orchards of pomegranates, almonds, citrus, figs, and grapes, damaging processing potential and future supply for domestic and export markets. At the same time, resilient crops like apricot, apple, and pear showed above-average performance. Cotton production dropped by 4.5% compared to 2022 due to reduced cultivation and pest damage, while falling market prices are expected to minimize incomes along the processing and trade chain, especially for dehkan³⁶⁴ farmers. The livestock value chain, which contributes nearly 7% of GDP and underpins rural livelihoods, also faces stress. Despite a large ruminant population of around 9 million, feed shortages, especially during winter and the lambing period, disrupt productivity and supply of animal products such as meat, milk, and eggs. Downstream, this affects local food availability and market stability. Degradation of pasturelands due to reduced rainfall, land conversion, and erosion (up to 4,000 tonnes/hectare) compromises the grazing base and feed input supply, thereby impacting breeding, fattening, and milk production chains. Additionally, floods and mudflows in foothill and mountainous areas disrupt livestock infrastructure and mobility, increasing losses and costs along the value chain. These impacts highlight how climate extremes increasingly strain both crop and livestock value chains from production through processing to market access³⁶⁵.

Projected Impacts

Shifts in the optimal and viable spatial ranges of specific crops in Tajikistan are inevitable, though the extent and speed of those shifts remain dependent on the emissions pathway. Notably, Tajikistan relies heavily on wheat imports—650,000 tons in 2017, equivalent to over 50 kg per capita—making it vulnerable to disruptions in global supply chains under changing climatic conditions. Domestically, climate projections suggest declines in crop yields of 5%–10% by 2050 for key staples such as wheat, barley, maize, vegetables, and fruits. Conversely, some crops like

³⁵⁹ <https://www.ifrc.org/docs/appeals/08/mdrtj004ea01.pdf>

³⁶⁰ <https://openknowledge.fao.org/server/api/core/bitstreams/58e8af31-8455-4cca-8b14-f69c1ccba024/content>

³⁶¹ <https://reliefweb.int/report/tajikistan/tajikistan-floods-and-mudslides-ocha-situation-report-no-1-0>

³⁶² <https://www.adb.org/sites/default/files/institutional-document/32199/taj-july-2004.pdf>

³⁶³ <https://unfccc.int/resource/docs/natc/tainc2.pdf>

³⁶⁴ Small holders or household-based farmers

³⁶⁵ <https://openknowledge.fao.org/server/api/core/bitstreams/58e8af31-8455-4cca-8b14-f69c1ccba024/content>

rice, potatoes, and cotton may see modest improvements in yield due to expanded irrigation or geographic shifts in optimal growing areas³⁶⁶.

Under dry and hot climate scenarios, Tajikistan is expected to experience significant declines in rainfed crop yields (Figure 74) and livestock productivity (Figure 75). By mid-century, agricultural labour productivity may fall by 1%, while heat-related mortality and illness are projected to increase. Rainfed crops are particularly vulnerable, with irrigated crops less affected but still at risk. Climate change will also likely alter pest and disease patterns, further threatening agriculture. Livestock sectors face substantial exposure, with beef and lamb production projected to decline by around 20% under dry/hot conditions by 2050. These impacts will disproportionately affect rural populations in mountainous areas lacking irrigation access, as well as women, women-headed households and persons with disabilities. Even irrigated agriculture is not immune. Rising temperatures and altered streamflow will increase irrigation requirements by 5–8% compared to historical levels. Without adaptation, annual crop production could decline by up to 8% under future climate conditions. Climate change also poses broader risks to social stability. By 2050, Tajikistan’s border areas are projected to become climate vulnerability hotspots. These regions face land degradation and ecosystem service loss, increasing the likelihood of ecological migration. Between 2008 and 2022, over 50,000 people were internally displaced due to environmental pressures. Internal and cross-border migration are expected to rise, exacerbating inequality and heightening fragility, particularly in areas such as the Ferghana Valley, where tensions over water access and land rights are already pronounced³⁶⁷.

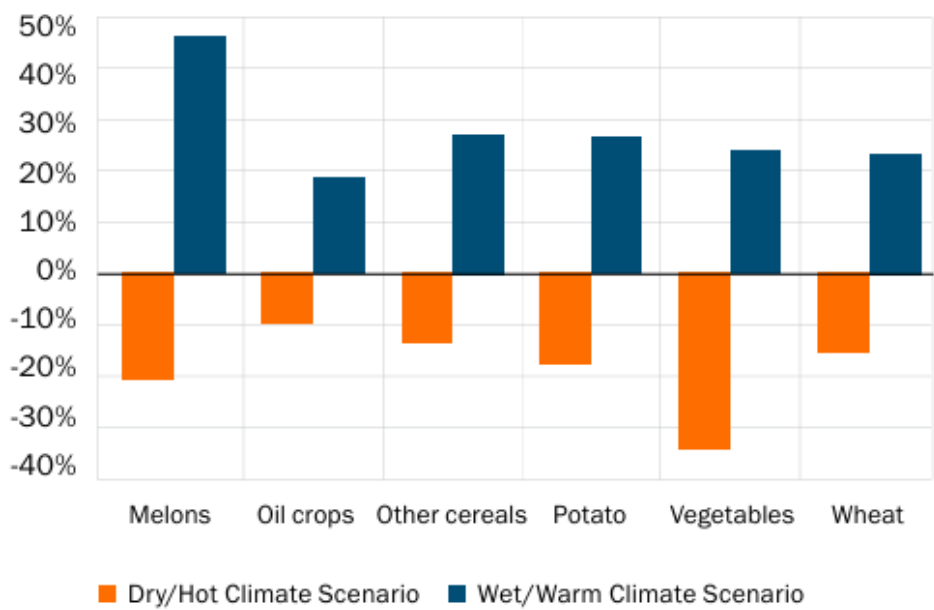


Figure 74. Impact of climate change on rainfed crop production, Tajikistan.

³⁶⁶ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf
³⁶⁷ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

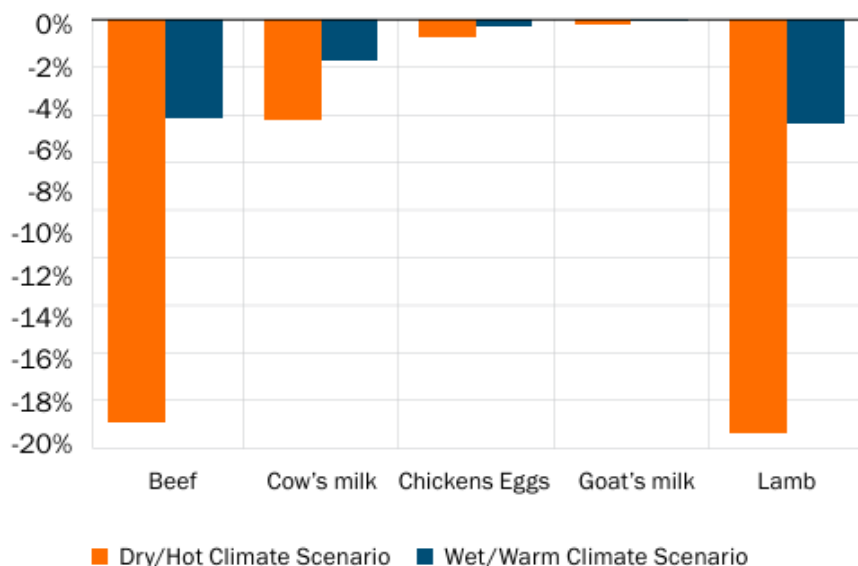


Figure 75. Impact of climate change on livestock production, Tajikistan.

Food security in Tajikistan is projected to be increasingly threatened due to both direct and indirect impacts of climate change. Direct impacts include more frequent and intense rainfall extremes, hot nights, extremely high daytime temperatures (exceeding 37°C), drought, heat stress, flooding, and chilling damage. When temperatures rise above 40°C, as may happen more frequently in southern provinces like Khatlon, many crops may become infertile or cease growing altogether. Additionally, early-season heat waves can reduce flowering in cereals and grains, directly cutting yields. Indirect effects, such as increased outbreaks of pests and diseases, are also expected to worsen, putting further pressure on crop productivity and sustainability. While overall precipitation may increase across most of the country, the expected seasonal shifts and increased heavy precipitation events will largely offset any potential benefits. Intense rainfall will exacerbate soil erosion, waterlogging, and reduced groundwater infiltration, thereby decreasing effective soil moisture availability. These hydrological extremes could lead to greater crop damage and failure risks, particularly in rainfed systems. Droughts, already a recurrent threat, are expected to intensify, further stressing crop and livestock systems. Prolonged dry spells will increase the water demand for both rainfed and irrigated land, reduce fodder availability, and increase the risk of wildfires, land degradation, and wind erosion³⁶⁸. Crops and labour are particularly vulnerable to temperatures exceeding 35°C, and under RCP8.5, such heat events are projected to more than double in frequency by the late 21st century. These impacts, coupled with higher water stress from glacial retreat and changing rainfall, are likely to significantly disrupt both local agricultural production and national food consumption patterns in Tajikistan³⁶⁹.

3.3.2 The water sector's vulnerability to climate change

Hazards

Rising temperatures and degradation of the aquatic system are accelerating glacier retreat—over 1,000 of the country's glaciers have disappeared over the past 3 decades—posing a long-term threat to river flows and water availability³⁷⁰. Precipitation patterns are becoming more erratic, with an observed increase in intense rainfall events and a reduction in snowfall, leading to a decline in snowpack that normally regulates seasonal water flow. These shifts have contributed to a growing frequency of hydrometeorological disasters such as floods, droughts, mudflows, and landslides. For instance, severe flooding and mudflows have become more common during spring and summer, endangering both lives and infrastructure. Moreover, higher temperatures

³⁶⁸ <https://crva.centralasiacclimateportal.org/tajikistan-impacts-sectors-agriculture>

³⁶⁹ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³⁷⁰ <https://ca-climate.org/eng/news/pulsating-glaciers-of-tajikistan/#:~:text=He%20noted:%20%E2%80%9COver%20the%20past,have%20melted%20and%20completely%20disappeared.>

are increasing evaporation rates from reservoirs and rivers, compounding water stress in already arid and semi-arid zones^{371,372}.

Vulnerability

The water sector in Tajikistan is highly exposed and sensitive to climate variability due to its heavy reliance on glacial and snow-fed rivers for irrigation, hydropower, and drinking water. Approximately 60% of Central Asia's water originates from Tajikistan, making it a crucial upstream water source. Tajikistan's water resources supply over 95% of the country's electricity³⁷³. The country's agricultural sector, which employs around 43% of the population and consumes over 90% of freshwater withdrawals, is particularly vulnerable to changes in water availability^{374,375}. Sensitivity is further heightened by the dependence of livelihoods, food security, and national energy production on stable water flows. Much of the irrigation infrastructure is outdated or poorly maintained, compounding inefficiencies and water stress vulnerability. Interstate disputes over water use and distribution persist, highlighting the need for improved transboundary water management, allocation, and cooperation. Furthermore, many rural communities lack reliable access to safe drinking water—4.9 million people lack access to basic sanitation at home, and 1,500 schools do not have adequate WASH facilities, leaving them more exposed and sensitive to water quality degradation caused by floods or drought³⁷⁶. The country's mountainous terrain also exacerbates exposure to landslides and flash floods triggered by intense rainfall or rapid snowmelt³⁷⁷.

Due to institutional, economic, and technical constraints, Tajikistan's adaptive capacity in the water sector remains limited. While the government has taken steps to integrate climate resilience into national water policies, such as the Water Sector Reform Strategy (2016–2025), implementation has been slow, largely due to limited funding and coordination challenges³⁷⁸. Technical capacity for climate monitoring, early warning systems, and water management is insufficient, especially in rural and remote areas. Additionally, much of the infrastructure for irrigation and drinking water is outdated, and resources to modernise or maintain these systems are scarce³⁷⁹. Additionally, the National Development Strategy (2016–2030)³⁸⁰ emphasises water as a critical pillar for sustainable development, linking it to agricultural productivity, energy generation, and public health. The National Water Code (Law No. 34 of 2000)³⁸¹ provides legal foundations for water governance, including rights, permitting, and dispute resolution mechanisms. Furthermore, international development partners have supported capacity-building and infrastructure improvement initiatives. These include the EU's WECOOP (Water and Environment Cooperation Platform), which facilitates regional water and energy efficiency cooperation, helping Tajikistan align with international water governance practices³⁸². The World Bank's CAMP4ASB (Climate Adaptation and Mitigation Program for the Aral Sea Basin) enhances resilience through climate-smart agriculture and efficient irrigation³⁸³. USAID's WAVE (Water and Vulnerable Environment Activity) programme also promotes regional cooperation and climate-adaptive water use practices³⁸⁴.

³⁷¹ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³⁷² <https://www.acted.org/en/water-in-tajikistan-abundant-yet-challenging/>

³⁷³ <https://www.acted.org/en/water-in-tajikistan-abundant-yet-challenging/>

³⁷⁴ <https://www.acted.org/en/water-in-tajikistan-abundant-yet-challenging/>

³⁷⁵ <https://www.osce.org/files/f/documents/c/7/546653.pdf>

³⁷⁶ <https://www.unicef.org/media/86586/file/2021-HAC-Tajikistan.pdf>

³⁷⁷ <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

³⁷⁸ UN. 2024. Progress report for

Ensure a full transition to the integrated water resources management through the National Water Resources Strategy, Tajikistan. Available [here](#).

³⁷⁹ UN. 2024. Progress report for

Ensure a full transition to the integrated water resources management through the National Water Resources Strategy, Tajikistan. Available [here](#).

³⁸⁰ http://nafaka.tj/images/zakoni/new/strategiya_2030_en.pdf

³⁸¹ <https://faolex.fao.org/docs/pdf/taj34375E.pdf>

³⁸² <https://wecoop.eu/>

³⁸³ <https://projects.worldbank.org/en/projects-operations/project-detail/P151363>

³⁸⁴ <https://www.sei.org/projects/usaid-regional-water-wave/>

Observed Impacts

Tajikistan's water sector is increasingly vulnerable to climate change, with glacial retreat and changing hydrological patterns already evident. In the mid-20th century, glaciers covered about 6% of the country's land area; by the early 21st century, this had declined to 5%, reflecting a 30% loss in total glacier volume³⁸⁵. Major glaciers such as Fedchenko, Grumm-Grzhimailo, and Garmo have retreated significantly, with Fedchenko shrinking by more than 1 kilometre in length and showing notable thinning. Additionally, glaciers play a vital regulatory role, functioning like natural reservoirs—storing precipitation as snow and ice in winter, and releasing meltwater in summer, especially during dry and hot years. They store excess snowfall in wetter, colder years, reducing runoff extremes. This buffering capacity stabilises river discharge. Hence, a drastic immediate decline in river flows due to glacial retreat alone is not expected, as river discharge is also strongly influenced by the amount and type of precipitation, especially mountain snowfall. Rivers like the Amu Darya depend on glaciers for up to 50% of their flow, and increased glacial melting has led to short-term runoff increases of less than 10%. Changing temperature and precipitation patterns are already disrupting seasonal flow reliability. Over 80% of natural disasters in Tajikistan—including floods, landslides, and glacial lake outburst floods caused over US\$600 million in damages in the past decade^{386,387}.

Rising temperatures and increased erosion have negatively affected water quality. Sedimentation from landslides and increased runoff contribute to the degradation of aquatic ecosystems and reduce the effectiveness of water infrastructure like reservoirs and canals³⁸⁸. Over 68% of permanent cropland depends on irrigation; however, changes in hydro-meteorological regime because of climate change have affected water availability, leading to inconsistent irrigation supply, reducing productivity, and heightening food security concerns³⁸⁹.

Projected Impacts

Projections indicate that glacier mass loss across Central Asia could reach between 50% and 70% by the end of the 21st century, depending on global greenhouse gas emission scenarios (Figure 76). This could significantly alter hydrological systems in Tajikistan, with long-term reductions in runoff expected once glacier-fed contributions begin to decline³⁹⁰. Significant temperature increases exceeding 5°C in southern districts of the country, as well as in the mountains of central Tajikistan and western Pamir, will reach 2 km per year of glacier losses in the 21st century on average³⁹¹. Studies suggest that the increased runoff caused by accelerated melting may peak in certain basins, such as the Naryn, by around 2040³⁹². Beyond this point, smaller glaciers may disappear entirely, leading to severe reductions in river flows, particularly from smaller tributaries. Due to faster snow and ice melt, the seasonal runoff regime will likely shift, with greater variability and more pronounced peaks during April–June. Uncertainty remains around future precipitation patterns, but these changes could undermine water security, affect power generation from hydropower plants, and increase vulnerability to droughts and floods³⁹³. This trend will reduce river flows and seasonal water storage from snow cover. Diminished snow permanence also lowers surface reflectivity (albedo), increasing land surface temperatures and evaporation. Changes in the timing and seasonality of runoff will affect water availability during summer, when irrigation demand peaks, and will impact reservoir operations needed to balance water across agriculture, hydropower, and municipal uses. These shifts will complicate the fulfilment of transboundary water delivery commitments and require enhanced storage capacity. Although precipitation projections remain uncertain, increased variability is expected, with more frequent and intense rainfall events. This variability heightens the risk of floods and droughts

³⁸⁵ <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

³⁸⁶ Tajikistan Third National communication to the UNFCCC. 2014. Available [here](#).

³⁸⁷ https://www.preventionweb.net/files/73805_73805gizclimatechangeprofiletajikis.pdf

³⁸⁸ International Bank for Reconstruction and Development / The World Bank. 2023. Valuing Green Infrastructure: A Case Study of the Vakhsh River Basin, Tajikistan. Available [here](#).

³⁸⁹ https://www.preventionweb.net/files/73805_73805gizclimatechangeprofiletajikis.pdf

³⁹⁰ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

³⁹¹ <https://www.undp.org/sites/g/files/zskgke326/files/migration/eurasia/UNDP-RBEC-Tajikistan-Climate-Change-and-Disaster-Risk-Reduction-Snapshot.pdf>

³⁹² <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

³⁹³ <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

across downstream regions, further increasing the need for resilient water storage and management systems³⁹⁴.

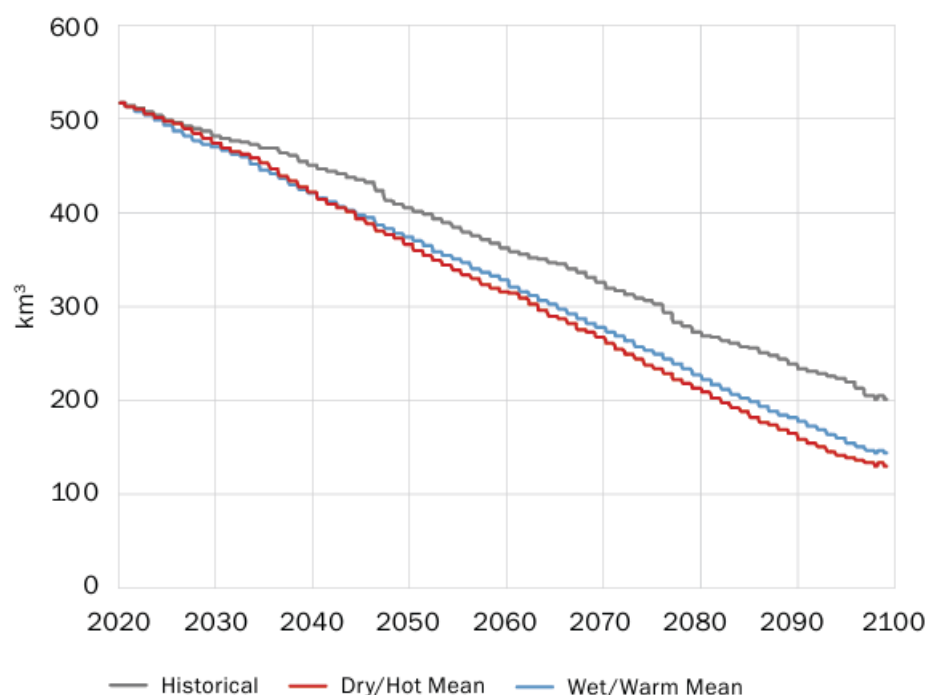


Figure 76. Change in the volume of glaciers in Tajikistan from 2020 to 2100 under different climate conditions.

4. Institutional, legal and policy framework

4.1. National institutions relevant to the project

4.1.1. Institutions relevant to climate change adaptation and mitigation

There are several institutions which are critical to promoting climate change mitigation and adaptation in Tajikistan. The following institutions ensure climate change resilience of vulnerable communities, ecosystems and economic sectors through monitoring, management of resources and reporting on sustainable development progress.

Committee on Environmental Protection (CEP)

The Committee on Environmental Protection coordinates improving Nationally Determined Contributions to the UNFCCC. This entity is also the authorised policymaking and coordination body for climate change-related activities. It promotes the sustainable use of natural resources, including land, minerals, forests, water, and other resources. The agency also provides climate and weather information and forecasting through the Climate Change Center and is the National Designated Authority (NDA) for the Green Climate Fund (GCF)³⁹⁵.

Climate Change Centre (CCC)

The CCC is responsible for managing climate-related research and adaptation and mitigation reporting³⁹⁶.

The Ministry of Education and Science

This ministry develops policies and manages the regulatory framework in education and science. It also promotes teaching and upbringing, scientific and technical activities, guardianship and

³⁹⁴ World Bank Group 2024. Country Climate and Development Report: Tajikistan. [Available online.](#)

³⁹⁵ [Committee for Environmental Protection under the Government of the Republic of Tajikistan | IUCN](#)

³⁹⁶ [Committee for Environmental Protection under the Government of the Republic of Tajikistan | IUCN](#)

trusteeship. In addition to social protection of students and pupils of educational and scientific institutions, it also strengthens individual capacity in educational institutions by implementing environmental educational programmes and conservation awareness³⁹⁷.

The Statistics Agency

This agency collects and disseminates statistics through objective and comprehensive social, economic, and environmental research. It is also the primary provider of energy statistics and activity data for assessing GHG emissions in Tajikistan's reporting under the UNFCCC. Furthermore, it is responsible for household surveys, demographic and economic statistics, including surveys of enterprises and institutions, prices, and foreign trade³⁹⁸.

Agency of Hydrometeorology

This agency monitors and reports on weather events and is the national reporter on climate events and weather. This agency is also responsible for preparing national communications to the UNFCCC and preparing GHG inventories under the leadership of the CEP³⁹⁹.

4.1.2. Institutions relevant to agriculture and water

Several institutions are critical to promoting climate change mitigation and adaptation across the water, agriculture, and energy sectors in Tajikistan. The following institutions ensure the climate change resilience of vulnerable communities, ecosystems, and economic sectors through monitoring, resource management, and reporting on sustainable development progress within these sectors.

Ministry of Energy and Water Resources

This Ministry formulates and implements public policy and fulfils regulatory functions pertaining to fuel, energy, and water resources. It is also responsible for implementing the national energy policy, including licensing and regulating renewable energy sources. It also performs the functions of the NDA for the sustainable development mechanism under the Kyoto Protocol⁴⁰⁰.

The Ministry of Industry and New Technologies

This ministry develops and implements policies in the industry sector. It organises the development of intersectoral research, technical programmes, and innovative projects on climate change and environmental issues. Additionally, it selects and controls investment projects that use modern energy-saving technologies and environmentally friendly production. It reviews industrial companies to check their compliance with environmental standards and government requirements. This ministry also regulates Tajikistan's coal industry and is responsible for setting coal sector development policy and overseeing its implementation⁴⁰¹.

Ministry of Agriculture

The ministry is tasked with developing and implementing state policy on agriculture, including crop production, livestock and other sectors of agriculture. It also promotes the development of programmes and production forecasts that ensure the efficient use of the country's agricultural resources. In addition to data collection and market research, this ministry also drafts legislative and other regulatory legal acts, standards, regulations, instructions, norms, and necessary standards on agriculture. Monitoring compliance with established standards, regulations, instructions, norms, and analysis of the statistical indicators of agricultural production also form part of the ministry's objectives. The ministry also promotes agricultural sector investment by supporting agricultural producers and developing recommendations to improve the production efficiency of various products and agricultural output. It regulates the import, export, production,

³⁹⁷ [DevelopmentAid](#)

³⁹⁸ <https://www.stat.tj/en/>

³⁹⁹ [Agency for hydrometeorology The Committee of Environmental Protection under the Government of the Republic of Tajikistan](#)

⁴⁰⁰ [Tajikistan 2022 Energy Sector Review | OECD](#)

⁴⁰¹ [Tajikistan 2022 Energy Sector Review | OECD](#)

and use of agricultural products, seeds, and pesticides. Comprehensive assessment and forecasting of the state of agriculture are also part of the ministry's objectives⁴⁰².

Forest Research Institute

This institute formulates and implements policies, legal regulations, and state management of forests, forestry activities, forest resources, hunting, and related facilities, flora, and fauna. It is also involved in implementing several climate change programs and projects.

Agency for Reclamation and Irrigation

This agency develops and implements policies, regulations, and state land management. It is also tasked with development involving land reclamation, land irrigation, and water hazard risk awareness and reduction⁴⁰³.

4.1.3. Institutions relevant to CIS, EWS, DRR, and DRM

CoESCD

The CoESCD is the operational hub of DRM in Tajikistan (Table 8). It ensures national preparedness, leads emergency response, and coordinates recovery. While Hydromet provides the risk knowledge and forecasts, CoESCD turns this knowledge into action, issuing alerts, mobilising resources, and coordinating all stakeholders through the National Platform for DRR and REACT.

Table 8. Role of CoESCD in CIS, EWS, DRR, and DRM in Tajikistan

Function	Detail
National Lead on Disaster Risk Management and Response ^{404,405}	<ul style="list-style-type: none"> CoESCD under the Government of Tajikistan is the primary state authority for DRM and emergency response; It is mandated to coordinate disaster preparedness, emergency response, civil protection, and recovery measures; CoESCD oversees search and rescue operations, disaster logistics, and mobilisation of resources during emergencies.
Chairing the National Platform for DRR ^{406,407}	<ul style="list-style-type: none"> CoESCD serves as the Secretariat of the National Platform for DRR, ensuring coordination between ministries, agencies, academia, CSOs, and development partners. Under the Deputy Prime Minister's chairmanship, CoESCD provides technical and operational leadership in implementing the National DRR Strategy (2019–2030) and related Action Plans (2023–2028). It ensures alignment with the Sendai Framework for DRR.
Early Warning Dissemination and Civil Protection ⁴⁰⁸	<ul style="list-style-type: none"> While Hydromet generates forecasts and hazard data, CoESCD is responsible for translating warnings into public alerts and coordinating emergency actions.

⁴⁰² [Ministry of Agriculture of the Republic of Tajikistan — Government Body from Tajikistan — Agriculture, Food Security sectors — DevelopmentAid](#)

⁴⁰³ [Ministry of Agriculture of the Republic of Tajikistan — Government Body from Tajikistan — Agriculture, Food Security sectors — DevelopmentAid](#)

⁴⁰⁴ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

⁴⁰⁵ <https://www.osce.org/files/f/documents/9/d/475244.pdf>

⁴⁰⁶ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

⁴⁰⁷ <https://www.osce.org/files/f/documents/9/d/475244.pdf>

⁴⁰⁸ <https://un-dco.org/stories/tajikistan-unified-approach-tackling-climate-risks>

Function	Detail
	<ul style="list-style-type: none"> It manages dissemination channels to reach at-risk communities, including SMS alerts, sirens, media, and local emergency networks. CoESCD also trains communities in preparedness and evacuation protocols.
Policy and Strategic Role ^{409,410}	<ul style="list-style-type: none"> CoESCD plays a key role in implementing the Mid-term State Programme for Protection of Population and Territories from Emergencies (2023–2028). It integrates DRR into national development planning, including risk-informed land use, infrastructure safety, and financial protection against disasters. CoESCD is also tasked with updating contingency plans, hazard maps, and simulation exercises at the national and local levels.
Coordination of Humanitarian Response (REACT)	<ul style="list-style-type: none"> CoESCD co-chairs the Rapid Emergency Assessment and Coordination Team (REACT) with the UN Resident Coordinator. REACT brings together sectoral working groups, NGOs, and humanitarian partners for coordinated emergency preparedness and response. Through REACT, CoESCD facilitates simulation drills, joint response protocols, and international humanitarian assistance.
Capacity Development and International Engagement	<ul style="list-style-type: none"> CoESCD works with partners such as UNDRR, WMO, UNDP, IFRC, and the World Bank to strengthen institutional and community resilience. It leads on training civil defence units, modernising emergency communications systems, and building search and rescue capacity. Internationally, it represents Tajikistan in regional DRR platforms, CIS agreements, and cross-border emergency response mechanisms.

CEP

The CEP acts as Tajikistan’s environmental and climate policy authority, anchoring international climate commitments and promoting ecosystem-based approaches to DRR (Table 9). Together with Hydromet (risk knowledge) and CoESCD (emergency response), the CEP ensures that climate adaptation, environmental sustainability, and DRR policies are integrated into national development and EWS frameworks.

Table 9. Role of CEP in CIS, EWS, DRR, and DRM in Tajikistan..

Function	Detail
Mandate on Environmental Governance and Climate Change	<ul style="list-style-type: none"> The Committee for Environmental Protection (CEP) under the Government of Tajikistan is the central authority for environmental policy, natural resource management, and climate change coordination. It is responsible for developing and implementing the National Environmental Action Plan, overseeing biodiversity

⁴⁰⁹ <https://www.osce.org/programme-office-in-dushanbe/551305>

⁴¹⁰ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

Function	Detail
	protection, pollution control, and ecosystem-based approaches to DRR.
National Focal Point for International Environmental Conventions	<ul style="list-style-type: none"> • CEP serves as the UNFCCC focal point, leading Tajikistan's engagement in international climate negotiations. • It coordinates reporting under the Paris Agreement (NDCs, BURs, NCs), the CBD, and other environmental conventions. • This places CEP at the centre of climate change adaptation and mitigation planning, ensuring linkages with DRR strategies.
Risk Knowledge and Environmental Monitoring	<ul style="list-style-type: none"> • CEP contributes to hazard and vulnerability assessments through environmental monitoring systems, including water and soil quality, forest cover, land degradation, and ecosystem health. • It plays a crucial role in integrating environmental data into national risk assessments, supporting evidence-based DRR and climate adaptation planning.
Ecosystem-based Disaster Risk Reduction (Eco-DRR)⁴¹¹	<ul style="list-style-type: none"> • CEP promotes ecosystem-based approaches to DRR and climate resilience, such as watershed management, forest restoration, and sustainable land use. • These interventions reduce risks of flooding, mudflows, and landslides, while enhancing water security and livelihoods. • CEP leads the implementation of projects that link biodiversity conservation with disaster risk reduction.
Institutional Role in the National DRR Platform	<ul style="list-style-type: none"> • CEP is an active member of the National Platform for DRR, providing technical expertise on environmental risk management and climate adaptation. • It works with the CoESCD and Hydromet to align DRR strategies with environmental and climate policies. • CEP ensures that environmental safeguards and sustainable resource management are integrated into national DRM frameworks.
Support to Early Warning Systems (EWS)	<ul style="list-style-type: none"> • While not the lead, CEP contributes environmental risk data and land-use planning expertise to strengthen EWS. • It supports community-level awareness and ecosystem-based solutions that complement technical forecasting systems provided by Hydromet and operational alerts by CoESCD.

⁴¹¹ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

Agency of Hydrometeorology

Hydromet is the technical engine of risk knowledge in Tajikistan's DRM/DRR system (Table 10). It does not lead disaster response, as that is the mandate of the CoESCD. It provides the data, forecasts, and scientific basis for all early warnings, climate risk assessments, and disaster prevention strategies. Its modernisation is critical in Tajikistan's shift toward impact-based multi-hazard early warning systems.

Table 10. Role of the Agency of Hydrometeorology.

Function	Details
Lead on Climate Information Systems (CIS) and Hazard Monitoring ^{412,413}	<ul style="list-style-type: none"> The Agency for Hydrometeorology of Tajikistan (Hydromet), under the Committee for Environmental Protection, is the national authority responsible for hydrological and meteorological observations. It operates observation networks, weather stations, and forecasting systems to monitor hydro-meteorological hazards such as floods, mudflows, avalanches, droughts, and heatwaves. This makes Hydromet the primary provider of <i>risk knowledge</i> for DRR and early warning systems (EWS).
Early Warning Systems (EWS) and EW4All ^{414,415}	<ul style="list-style-type: none"> Hydromet provides the technical backbone for early warning. Forecasts and hazard monitoring data feed into the Committee of Emergency Situations and Civil Defense (CoESCD), which issues public alerts and coordinates response. Within the Early Warnings for All (EW4All) roadmap (endorsed 2024), Hydromet is tasked with strengthening multi-hazard forecasting capacity, integrating AI-based exposure mapping, and ensuring warnings are impact-based and community-specific.
Policy and Strategy Alignment ^{416,417,418,419}	<ul style="list-style-type: none"> Hydromet contributes directly to the National DRR Strategy (2019–2030), particularly under priorities related to strengthening risk knowledge, monitoring, and early warning systems. It also supports the Mid-term State Programme for Protection of Population and Territories from Emergencies (2023–2028), especially in developing hazard maps, risk assessments, and disaster monitoring indicators.

⁴¹² <https://www.meteo.tj/en/agency/about-us>

⁴¹³ <https://www.fao.org/mountain-partnership/members/detail/tajikistan/en>

⁴¹⁴ <https://meteo.tj/en/news/2024/06/10/-137>

⁴¹⁵ meteo.tj/en/agency/about-us

⁴¹⁶ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

⁴¹⁷ meteo.tj/en/agency/about-us

⁴¹⁸ <https://www.eda.admin.ch/countries/tajikistan/de/home/internationale-zusammenarbeit/projekte.html/content/dezaprojects/SDC/en/2023/7F11113/phase1>

⁴¹⁹ <https://www.undrr.org/resource/case-study/tajikistan-anchoring-early-warning-systems-part-national-blue-strategy>

Function	Details
Capacity Development and International Cooperation ^{420,421}	<ul style="list-style-type: none"> Hydromet receives significant technical and financial support from the WMO, UNDP, UNDRR, the Government of Switzerland, and the World Bank to modernise its monitoring networks and forecasting tools. Projects like the Climate Adaptation and Mitigation Program for Aral Sea Basin (CAMP4ASB) and UNDP's Enhancing Climate Services initiatives target Hydromet modernisation and data-sharing improvements.
Coordination with Other Institutions ^{422,423}	<ul style="list-style-type: none"> Hydromet works within the National Platform for DRR to provide data and analysis across sectors (agriculture, water, energy, transport). It ensures hazard and climate data are accessible to line ministries, local authorities, and development partners for planning, infrastructure resilience, and adaptation projects.

4.2. International and regional policies, strategies, conventions and treaties

4.2.1. International

Several international treaties, conventions, and frameworks related to climate change and conservation encourage signatories to commit to climate change actions and enhance climate change adaptation. These also promote achieving sustainable development goals, ecosystem conservation, and reducing GHG emissions.

The Rio Conventions

The three Rio Conventions, namely, Biodiversity, Climate Change, and Desertification, derive directly from the 1992 Earth Summit. Each instrument contributes to the Sustainable Development Goals (SDGs) of Agenda 21. The three conventions are intrinsically linked, operating in the same ecosystems and addressing interdependent issues. Tajikistan is a signatory to these, which are crucial in promoting climate change adaptation and mitigation across the country⁴²⁴.

Convention on Biological Diversity (CBD)

Conservation of biological diversity promotes the sustainable use of natural resources and the fair and equitable sharing of benefits arising from the use of genetic resources. Tajikistan has committed to promoting the conservation of vulnerable ecosystems such as rivers, lakes, wetlands, and forests and enhancing their climate change resilience⁴²⁵.

United Nations' (UN) 2030 Agenda for Sustainable Development

⁴²⁰ <https://www.eda.admin.ch/countries/tajikistan/de/home/internationale-zusammenarbeit/projekte.html/content/dezaprojects/SDC/en/2023/7F11113/phase1>

⁴²¹ <https://www.undrr.org/news/experts-tajikistan-trained-desinventar-sendai-software-support-undrr-and-eu>

⁴²² <https://www.undrr.org/news/strengthening-tajikistans-efforts-disaster-risk-reduction-through-international-cooperation>

⁴²³ <https://www.eda.admin.ch/countries/tajikistan/de/home/internationale-zusammenarbeit/projekte.html/content/dezaprojects/SDC/en/2023/7F11113/phase1>

⁴²⁴ [The Rio Conventions | UNFCCC](#)

⁴²⁵ [PowerPoint Presentation: Convention on Biological Diversity](#)

The Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 to address global poverty, conserve natural resources, and promote peace and prosperity on Earth. The 17 SDGs are integrated and recognise that development necessitates a balance of social, economic and environmental sustainability. Countries such as Tajikistan have committed to prioritising progress for those SDGs that end poverty, hunger, and gender discrimination⁴²⁶.

United Nations Convention Framework on Climate Change (UNFCCC)

The UNFCCC informs Tajikistan's National Climate Change Policy. This convention was enforced in 1994 and ensures that countries take responsibility for mitigating global climate change. In line with the Montreal Protocol of 1987, the UNFCCC ensures that member states act in the interest of human safety when climate change is considered. Developing countries such as Tajikistan are classified as Non-Annex I parties and report less regularly and more generally to the UNFCCC on mitigation and adaptation actions in addressing climate change. Reporting is contingent on funding support in the case of least-developed countries⁴²⁷.

Paris Agreement

Since Tajikistan signed the Paris Agreement in 2015, the country has taken several steps towards combating climate change and enhancing climate resilience. This includes enhancing vulnerable communities' climate change preparedness and promoting sustainable use of natural resources. The Paris agreement empowers all countries to act to prevent average global temperatures from rising above 2 degrees Celsius and to reap the many opportunities that arise from a necessary global transformation to clean and sustainable development⁴²⁸.

Aichi Biodiversity Targets

In line with the Aichi Biodiversity Targets, Tajikistan is working towards updating and aligning the National Strategy and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP) with global conservation priorities. The Aichi Targets, adopted under the Convention on Biological Diversity, provide a comprehensive framework for biodiversity conservation and sustainable development. By incorporating the Aichi Targets into the NBSAP, Tajikistan can ensure its conservation efforts harmonise with international standards and best practices⁴²⁹.

The Ramsar Convention

Since 2001, Tajikistan has been a signatory to the Convention on the Conservation of Wetlands, which promotes the protection of wetlands and other aquatic ecosystems globally. The following ecosystems have been designated as Ramsar sites: Karakul Lake (36,400 hectares) in the eastern part of the country; Kayrakum Reservoir (52,000 hectares), Shorkul and Rangkul lakes (2,400 hectares) and Zorkul Lake⁴³⁰.

Sendai Framework

The Sendai Framework on Disaster Risk Reduction (2015-2030) is an ambitious agreement that sets out the overall objective to reduce disaster risk and losses in lives substantially, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. In addition to limiting future losses due to climate change hazards, it also aims to reduce "existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience"⁴³¹.

⁴²⁶ [Tajikistan_CCA_2022_Public_Version_Final.pdf](#)

⁴²⁷ United Nations Climate Change. What is the United Nations Framework Convention on Climate Change? [Available online.](#)

⁴²⁸ [Tajikistan Submits its Climate Action Plan Ahead of 2015 Paris Agreement | UNFCCC](#)

⁴²⁹ [cbd.int/pa/doc/dossiers/tajikistan-abt11-country-dossier2021.pdf](#)

⁴³⁰ [Tajikistan | The Convention on Wetlands, The Convention on Wetlands](#)

⁴³¹ [Sendai Framework | UNECE](#)

4.2.2. Regional

Regional Climate Change Adaptation Strategy for Central Asia

This strategy was developed by the region's countries, and approved by the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan. At the Fourth Consultative Meeting of the Heads of State of Central Asia, the position of the leaders of Central Asia on expanding cooperation in the field of ecology and combating climate change was demonstrated. In a Joint Statement, the Heads of State of Central Asia noted the importance of further strengthening regional cooperation on climate change mitigation and adaptation, desertification control, rational use of water and energy resources, safe drinking water supply, environmental protection, ecology, conservation of biodiversity and glaciers, promoting projects and programmes in these spheres. To implement the 2030 Agenda for Sustainable Development, the UN Framework Convention on Climate Change and the Paris Agreement, the Meeting adopted the Green Agenda Regional Programme for Central Asia, which expressed political intentions to expand mutually beneficial bilateral and regional cooperation for ensuring green economic growth and sustainable development in the region through the implementation of joint projects, technology transfer and knowledge sharing⁴³².

Central Asia Regional Economic Cooperation 2030 Strategy for Sustainable Regional Development (CAREC)

This strategic framework aims to promote green economic development across Central Asia by:

- Aligning with national strategies and supporting the new international development agenda, embodied in the sustainable development goals (SDGs) and the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21);
- Adopting a dual-track approach by deepening cooperation in the traditional areas of transport, energy, trade, and economic corridor development, while selectively expanding into new areas of cooperation in line with member countries' priorities;
- Deepening policy dialogue based on CAREC's standing and ability to deliver quality knowledge services;
- Integrating the role of the private sector and civil society by promoting people-to-people and business-to-business contacts across member countries; and
- Building an open and inclusive platform to help strengthen cooperation and build synergies with other international and regional cooperation mechanisms active in the region, and maximise development partners' resources and expertise to support regional cooperation⁴³³.

4.3. *National legal and policy framework*

4.3.1. Climate change-related policies, strategies and plans

National Communication (NC) to the UNFCCC

The country has submitted four National Communications to the UNFCCC, the last of which was submitted in 2022. The Government of the Republic of Tajikistan developed and submitted its first national communication in 2002, the second national communication in 2008 and the third national communication in 2014. The updated NC emphasises that the country has achieved a significant GHG reduction, which contributes to the achievement of common goals to reduce global greenhouse gas emissions, and with the support of the international community, the Republic of Tajikistan can achieve low-carbon development. Priority sectors include energy, agriculture, waste and water⁴³⁴.

Nationally Determined Contribution (NDC)

The main objective of the NDC is to support sustainable and efficient development, considering climate change and environmental and socio-economic challenges. The Republic of Tajikistan

⁴³² [strategy-eng.pdf](#)

⁴³³ [CAREC 2030 Strategic Framework | CAREC Program](#)

⁴³⁴ www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/53027416_Tajikistan-NC4-1-4NC_TJK_eng.pdf

formally communicated its INDC under the Paris Agreement in 2015, which became its NDC upon ratification of the Paris Agreement in 2017. In the interim, the country had undertaken steps to increase its ambition by developing the national regulatory framework and implementing different projects and interventions. This includes improving the understanding of climate change impact and enhancing institutional and community capacity in climate risk management. Unlike the country's original NDC, the Updated NDC contains the changes in an unconditional greenhouse gas (GHG) emissions reduction goal for 2030 and a conditional GHG emissions reduction goal. The updated NDC is significantly improved by involving a broader scope of participants. Taking into account its national circumstances, the Republic of Tajikistan offers ambitious targets and measures to achieve the transition to a low-carbon and climate-resilient development in a sustainable manner. The country aims to progress towards implementing the Sustainable Development Goals (SDGs) at the national level by mainstreaming the focus of Agenda 2030 into the Updated NDC. NDCs' revision process involves five key sectors identified as priorities: agriculture, energy, forestry, biodiversity, industry, transport and infrastructure⁴³⁵.

National Climate Change Adaptation Strategy (NCCAS)

This programme aims to enhance the resilience of vulnerable communities, sectors and ecosystems to climate change impacts. Furthermore, this strategy aims to assist in meeting Sustainable Development Goals (SDG). These include: sustainable human development, eradication of poverty, and promoting steady consumption patterns and production. The sectors prioritised by the NCCAS include energy, water, agriculture, and transport. Adaptation options in these sectors involve enhancing the uptake of renewable energy sources, sustainable water and land use, increasing the use of climate-resilient agriculture practices and enhancing sustainable livelihoods through skills and knowledge sharing⁴³⁶.

In the *Medium-term Development Program of the Republic of Tajikistan for 2016-2020*, the main measures to reduce the impact of climate change include expanding access to natural resources and their rational use, creating legal protection mechanisms, providing financial support and meeting the needs for new technologies that develop a green economy and prevent the risks of climate change; the development of renewable energy sources, modernisation of all types of transport, construction of six hydroelectric power plants with a capacity of 700 kWh, reconstruction of 700 km of highways. In the *Medium-term Development Program of the Republic of Tajikistan for 2021-2025*, adopted by the Government of the Republic of Tajikistan in 2021 under No. 168, a special section is devoted to environmental protection, climate change and natural disasters. In conjunction with the NSACC, the development of capacity-building processes for adaptation to climate change for employees of authorised bodies and civil servants is promoted. In addition, developing gender-sensitive climate change indicators was noted as an adaptation measure. Within the framework of this program, sectoral measures for adaptation to climate change are formulated⁴³⁷.

4.3.2. CIS, EWS, DRR and DRM related policies, strategies, plans and acts

Tajikistan employs a robust, multi-level institutional and policy framework anchored in national strategy, technical coordination via the National Platform, operational leadership by the CoESCD, and reinforcement with EW4All/CIS systems and international cooperation, all of which aim to enhance disaster resilience.

*National Disaster Risk Reduction Strategy 2019–2030*⁴³⁸

This strategy, aligned with the Sendai Framework, forms the central policy foundation to reduce existing risks and prevent new ones by strengthening national DRM capacities. It emphasises four objectives:

⁴³⁵ [Microsoft Word - NDC UPDATE -TAJIKISTAN final version 27_09](#)

⁴³⁶ [National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030 \(NSACC 2030\) - Climate Change Laws of the World](#)

⁴³⁷ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁴³⁸ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available online.](#)

- Reducing fatalities and material losses from disasters;
- Ensuring stakeholder access to risk information;
- Embedding DRM into development processes;
- Enhancing preparedness and response frameworks.

It establishes the Unified State System for emergency prevention and response, led by multi-level Commissions chaired by senior officials, including the Government Chairman at the national level.

National Platform for Disaster Risk Reduction^{439,440,441}

Established in 2012 under the Committee of Emergency Situations and Civil Defense (CoESCD), the Platform is the core coordination mechanism for DRR. The Platform meets quarterly under a structured work plan. Chaired by the Deputy Prime Minister, with the CoESCD as secretariat, its mandate includes:

- Developing cross-sectoral DRR policy;
- Coordination and monitoring of DRR activities;
- Supporting thematic working groups;
- Engaging civil society, the private sector and international partners.

Operational DRM Authority CoESCD^{442,443}

The Committee of Emergency Situations and Civil Defense (CoESCD) is the designated lead agency for DRM operations. It manages emergency planning and crisis response and institutionalises DRR governance across national and local levels. The CoESCD's Crisis Management Centre anchors coordination and response. With support from the Agency on Statistics, CoESCD keeps historical records on emergencies caused by natural, technogenic, and biological events.

Early Warning Systems: EW4All and MHEWS Roadmap^{444,445,446}

Tajikistan launched the Early Warnings for All (EW4All) initiative in August 2023, under joint leadership of the Deputy PM and UN Resident Coordinator. The initiative involves UN agencies (UNDRR, WMO, ITU, IFRC) and key national institutions to build a Multi-Hazard Early Warning System (MHEWS). In July 2024, the country endorsed a costed national MHEWS roadmap, developed via the National Platform, aligning with Sendai Framework Target G and integrating CIS and EWS capabilities.

*Monitoring and Information System (MIS) for DRR*⁴⁴⁷

In March 2025, the National Platform launched a Working Group to develop a Monitoring and Information System that tracks implementation of the National DRR Strategy and the Mid-term State Program (2023–2028). This initiative promotes transparency, stakeholder engagement, including communities, and enhanced accountability via indicator-based tracking.

International Cooperation and Strategic Alignment^{448,449,450}

⁴³⁹ UNDRR. Tajikistan National Platform. [Available online.](#)

⁴⁴⁰ UNDP 2019. National Platform for Disaster Risk Reduction in Tajikistan Meets to Introduce Priorities for the Upcoming Decade. [Available online.](#)

⁴⁴¹ UN in Tajikistan 2025. Strengthening Tajikistan's Disaster Risk Reduction Through International Cooperation. [Available online.](#)

⁴⁴² UNDRR 2023. Strengthening Disaster Resilience and Accelerating Implementation of the Sendai Framework for Disaster Risk Reduction in Central Asia. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

⁴⁴³ <https://www.devex.com/organizations/committee-of-emergency-situations-civil-defense-tajikistan-127247>

⁴⁴⁴ UNDRR 2023. UN Secretary-General's Early Warnings for All Initiative launched in Tajikistan. [Available online.](#)

⁴⁴⁵ UNDCO 2025. Tajikistan: A Unified Approach to Tackling Climate Risks. [Available online.](#)

⁴⁴⁶ UNDRR 2025. Tajikistan: Anchoring early warning systems as part of the national DRR strategy. [Available online.](#)

⁴⁴⁷ UNDRR 2025. Advancing disaster risk monitoring and information system in Tajikistan. [Available online.](#)

⁴⁴⁸ UNDP 2020. UNDP project on improved disaster risk reduction policy comes to end. [Available online.](#)

⁴⁴⁹ UNDRR 2021. Tajikistan strengthens stakeholder engagement in disaster risk reduction. [Available online.](#)

⁴⁵⁰ ECO 2024. The 9th ECO Ministerial Meeting on Disaster Risk Reduction. [Available online.](#)

Tajikistan's DRR governance is regularly strengthened through collaboration with UN partners, notably UNDRR and UNDP, as well as bilateral partners like Switzerland. Notable contributions include:

- UNDP-led Disaster Risk Governance projects boosting DRM coordination and policy;
- Strengthening regional DRR dialogue, including hosting the 9th ECO Ministerial DRR meeting, reinforcing the regional framework and the Dushanbe Declaration.

4.3.3. Other relevant policies, strategies, plans and acts

National Strategy and Action Plan on the Conservation and Sustainable Use of Biodiversity

Tajikistan's National Strategy and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP) was adopted in 2003. It focuses on evaluating and conserving biological resources, biological safety, and the sustainable use of resources. The NBSAP plays a crucial role in safeguarding the country's rich natural heritage and promoting the sustainable management of its biological diversity. The action plan identifies 15 key priorities for biological conservation, addressing a wide range of challenges and opportunities, including a national ecological network, which aims to connect and protect diverse ecosystems across the country. By establishing this network, Tajikistan can enhance habitat connectivity, preserve genetic diversity, and ensure the long-term survival of its unique flora and fauna. The NBSAP also emphasises the conservation of each ecosystem, recognising the importance of maintaining the integrity and functionality of specific habitats. Through targeted conservation efforts, Tajikistan can protect vulnerable ecosystems such as forests, wetlands, and grasslands, which provide essential services such as carbon sequestration, water regulation, and habitat provision for vulnerable species⁴⁵¹.

Development Strategy for the Forest Sector of the Republic of Tajikistan

This draft would be applicable from 2020 until 2030 and aims to ensure high and sustainable economic growth rates. The national forest strategy promotes sustainable forest management in the country and for the successful integrated development of the entire forest sector. It defines current and future decisions in the field of forest management, is the basis for developing programs and plans for forests and ensures their coherence and focus on achieving common goals^{452, 453}.

Agrarian Reform Programme of the Republic of Tajikistan for the period 2012-2020 provides for the development and introduction of new agricultural technology (for example, the cultivation of drought-resistant crops), research work, the creation of a support system for the development of animal husbandry and meeting the needs of farms in adapted animal breeds, improving the structure of acreage for fodder crops, the use of improved pastures as measures of adaptation to climate change. A comprehensive program for the development of animal husbandry in the Republic of Tajikistan for the period 2018-2022, as mitigation and adaptation measures to climate change, provides for selection and breeding work, improvement of livestock raising technology and fodder norms, and an increase in pasture productivity⁴⁵⁴.

The Pasture Development Programme of the Republic of Tajikistan for the period 2016-2020 as mitigation and adaptation measures to climate change, provides for an increase in pasture feed stocks, assistance in increasing the number of highly productive livestock, preparation of land for sowing seeds, improvement of pasture lands, repair and construction of roads and bridges, improvement of the condition of 1,500 hectares of pastures, import and production of meadow grass seeds, improvement of grazing routes⁴⁵⁵.

⁴⁵¹ [Tajikistan Biodiversity: Animal and Plant Species and What Is Under Threat](#)

⁴⁵² [Tajikistan DP83_1922475_E_WEB.pdf](#)

⁴⁵³ [Overview of the State of Forests and Forest Management in Tajikistan | UNECE](#)

⁴⁵⁴ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁴⁵⁵ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

The Water Sector Reform Programme of the Republic of Tajikistan for the period 2016-2025 provides and implements the development of a long-term plan for the use and protection of water resources in five river basins, the development of seasonal and annual plans for the distribution and management of water resources in river basins, the restoration of irrigation infrastructure and improvement of its maintenance and operation conditions, the introduction of new water-saving technologies⁴⁵⁶.

National Disaster Risk Reduction Strategy 2019–2030

The Government of Tajikistan adopted the National Disaster Risk Reduction Strategy (2019–2030), approved by Resolution No.602 of December 2018, to strengthen resilience to natural and climate-induced hazards. The Strategy is anchored in the National Development Strategy 2030, and aligns with the Sendai Framework for Disaster Risk Reduction (2015–2030) and the 2030 Agenda for Sustainable Development. It represents a decisive shift from reactive disaster response towards proactive risk reduction and resilience-building. The Strategy's goal is to reduce existing and prevent new disaster risks by strengthening national capacity. It sets four objectives:

1. Reduce lives, livelihoods, and infrastructure losses compared to 2005–2015.
2. Ensure access to disaster risk information through national and local databases and ICT solutions.
3. Mainstream disaster risk management into development, including climate adaptation, gender equality, and ecosystem-based approaches.
4. Strengthen preparedness and response mechanisms, emphasising integrated early warning systems and improved search and rescue capacity.⁴⁵⁷

Strategies relating to gender equality⁴⁵⁸:

After ratifying the *Convention on the Elimination of All Forms of Discrimination Against Women in 1993*, the Government of Tajikistan approved several regulatory documents that impact women and girls' resilience to climate change risks. This includes the *Family Code of the Republic of Tajikistan*, and the *National Strategy for Enhancing the Role of Women in the Republic of Tajikistan for 2011-2020*. These identify goals for realising the potential of women in the economy, including opportunities to train women in new skills and specialities. The plans propose several measures that can reduce the impact of climate change on women and increase their adaptive capacity. Gender perspectives of climate change are included in the *NDS-2030* (2016). The strategy is based on the commitment of the Government of Tajikistan to achieve the SDGs, including SDG 5, which promotes gender equality. The Strategy emphasises the need to address gender equality and climate change, especially sustainable development in rural areas. **NSACC-2030** describes the opportunities for investing in improving resilience to climate change, considering the multifaceted challenges associated with gender, youth and other vulnerable groups. The Strategy recognises the vulnerability of women employed in agriculture.

The *Medium-Term Development Program of the Republic of Tajikistan for 2021-2025* provides specific goals and indicators related to the gender perspective of climate change. Thus, one of the gender indicators is to increase women's awareness of the risks of climate change from 15% to 35% in 2025. To improve regulatory documents per international standards, the task is to develop gender-sensitive climate change and disaster risk management indicators by 2022. Gender indicators should also be included in sectors of the economy such as agriculture, water supply and energy, social protection, education and health. Programmes and strategies also aim to raise awareness of the relationship between gender and climate change in the context of development by promoting the principle of the relationship between gender and climate change in planning, budgeting and implementation of development. Furthermore, capacity-building and

⁴⁵⁶ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁴⁵⁷ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁴⁵⁸ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

enabling women's active participation in sustainable socio-economic development should be prioritised to promote climate change resilience⁴⁵⁹.

5. Relevant past and ongoing work

5.1. Climate change initiatives in the agriculture and water sectors

Several past and ongoing projects have been established in Tajikistan, aiding in the green development of its agriculture and water sectors. Projects after 2020 are discussed below and projects completed before 2020 are in Table 11.

GCF FP283 Glaciers to Farms (G2F) Programme⁴⁶⁰

The G2F programme is a multi-country, multi-component initiative led by the Asian Development Bank (ADB). Four components form an integrated “pipeline” of science-based planning, investment implementation, capacity building, and regional cooperation:

1. **Component 1 – Science-based climate-risk planning and investment mechanisms**
This component strengthens national planning by integrating glacier and climate-risk assessments into infrastructure, agriculture and river-basin planning; it also promotes innovative finance mechanisms.
2. **Component 2 – G2F investment solutions**
This component finances scalable, locally adapted solutions such as climate-smart agriculture, climate-resilient irrigation infrastructure, multi-hazard early-warning systems (EWS), adaptive social-protection and health systems, and nature-based disaster-risk-reduction measures. Within this component, Component 2.1 (Early Warning System implementation) and Component 2.4 (Adaptive health/social protection) include specific demonstration projects for Tajikistan.
 - **Tajikistan – Hydrometeorological Services and Disaster-Risk-Reduction Early Warning for All (Phase 2):** This demonstration project will strengthen real-time hydrometeorological systems, integrate climate risks into water-resource planning, and improve forecasting and community-level EWS. It aims to reduce flood, landslide and drought risk by enhancing data and forecasting capacity and integrating climate risk into planning.
 - **Tajikistan – Integrated Regional Health Security and Primary Health-Care Services Project:** Under Component 2.4, this project seeks to strengthen community preparedness and adaptation by modernising primary health-care institutions, improving digital surveillance, and transforming health centres into community hubs for risk communication on climate-change impacts.
3. **Component 3 – Capacity building for climate-finance access**
This component provides technical assistance and training to agri-MSMEs and financial institutions, aiming to catalyse blended-finance models and improve access to climate finance.
4. **Component 4 – Regional knowledge platform for adaptive learning and climate action**
G2F establishes a regional knowledge platform to harmonise data, share lessons and foster cross-border cooperation.

Potential overlaps with the proposed project

⁴⁵⁹ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁴⁶⁰ <https://www.greenclimate.fund/project/fp283>

Early-warning and climate-information systems

- **CN Component 1 (Output 1.2)** seeks to improve the Agency for Hydrometeorology's forecasting capacity and expand SMS- and AI-based dissemination of climate information to local governments and smallholder farmers. It also proposes training extension workers and ~1 400 farmers to interpret climate advisories and act on DRR/anticipatory protocols.
- **G2F Component 2.1** includes the Tajikistan "Hydrometeorological Services and Disaster-Risk-Reduction Early Warning for All (Phase 2)" project, which aims to enhance real-time hydrometeorological systems, integrate climate risk into water planning and strengthen community-level early-warning systems.

Overlap: Both initiatives target hydrometeorological services and early-warning systems. However, the CN emphasises local-level climate-information dissemination and capacity building (training extension workers and farmers), whereas the G2F project focuses on national-level hydromet system upgrades and integration into water-resource planning. There is a risk of duplicating support for hydromet forecasting if activities are not coordinated.

Complementarity/Synergy: Data and forecasting improvements under G2F can feed into the CN's local dissemination channels. The CN's training of extension workers and farmers ensures that early-warning information generated under G2F is used effectively at the community level. Coordinated implementation would ensure that the CN focuses on downscaling and operationalising early-warning products while G2F handles system-wide modernisation. Joint planning with the Agency for Hydrometeorology will avoid duplicative investments.

Knowledge management and awareness raising

- The CN's Component 3 focuses on building awareness of climate-change impacts on food security and nutrition through community campaigns and training, particularly targeting women, youth and people with disabilities. It also commits to systematically documenting lessons, uploading knowledge to existing platforms and producing manuals for practitioners.
- G2F Component 4 establishes a regional knowledge platform (G2F Monitoring Information System) to harmonise data, share lessons and foster regional cooperation. Additionally, G2F Component 2.4's health-security project will transform health centres into community hubs for risk communication about climate-change impacts.

Overlap: Both programmes generate and disseminate knowledge and awareness materials. The risk of duplication is low because the CN is oriented toward district-level campaigns and smallholder farmers, whereas G2F's knowledge platform has a regional focus and the health-project's communication channels target health and epidemic preparedness.

Complementarity/Synergy: Lessons and data generated by the CN (e.g., DAPs, community campaigns, adaptation innovations) can feed into the G2F regional platform, enhancing cross-country learning and providing Tajikistan's perspective. Conversely, the CN can leverage G2F's regional platform to access cutting-edge glacier and climate science and to align local awareness campaigns with regional messages. Coordination between WFP, CEP and ADB in knowledge-management planning will maximise synergy.

Capacity building and financing mechanisms

- CN Component 1 emphasises building the capacity of district governments to prepare DAPs and integrate adaptation and DRR into local development. Training local authorities and community members is a core activity.
- G2F Component 3 focuses on building the capacity of agri-MSMEs and financial institutions to access climate finance.

Complementarity: The CN's local-government capacity building can complement G2F's financial-capacity interventions. For example, district authorities trained through the CN could

support the identification of bankable projects for the Mountain & Glacier Finance Facility, while G2F's financial tools can enhance the sustainability of adaptation investments identified in DAPs.

Health, nutrition and social protection

- CN Component 3's awareness campaigns highlight the links between climate change, food security and nutrition and aim to influence dietary practices and policy.
- G2F Component 2.4's health-security project seeks to strengthen community preparedness, digital surveillance and health-risk communication.

Complementarity: While their sectors differ, both initiatives use community outreach to build awareness and behavioural change. Synergies could be achieved by integrating climate-nutrition messages from the CN into the health-risk communication channels developed under G2F. This would promote holistic approaches to health and nutrition adaptation.

Opportunities for coordination and risk of duplication

1. **Coordinate hydromet and early-warning investments.** The CN's Output 1.2 and G2F's Tajikistan EWS project both support the Agency for Hydrometeorology. A joint implementation plan should delineate responsibilities—e.g., G2F finances national-scale infrastructure and modelling upgrades; the CN focuses on last-mile dissemination and user training. Shared data protocols and co-developed triggers for DAPs will prevent duplication and enhance effectiveness.
2. **Synchronise adaptation planning with G2F's investment pipeline.** DAPs developed under the CN should inform the prioritisation of bankable projects that could later access financing through G2F's Mountain & Glacier Finance Facility or other ADB finance streams. Aligning planning timelines will ensure that CN outputs feed into G2F Component 3.
3. **Leverage the regional knowledge platform.** The CN's knowledge-management outputs should be uploaded to the G2F Monitoring Information System. This will provide Tajikistan-specific lessons to other countries and allow local stakeholders to access regional climate-risk datasets and adaptation innovations.
4. **Integrate communication and awareness campaigns.** Community campaigns on climate-nutrition links (CN Component 3) and health-risk communication platforms (G2F Component 2.4) could be aligned to avoid message fatigue and ensure consistent, gender-sensitive messaging across sectors.
5. **Maintain clear thematic delineation.** The CN should avoid proposing large-scale hydromet equipment purchases or national-level data systems, since those investments fall under G2F. Instead, it should focus on district-level planning, last-mile dissemination, participatory training and the integration of DRR/anticipatory action protocols into local adaptation plans. Similarly, CN Component 3 should coordinate with national ministries to ensure that knowledge-management activities complement, rather than duplicate, those envisaged under G2F.

Conclusion

The WFP Tajikistan CN and the GCF FP283 Glaciers-to-Farms programme share overarching goals of improving climate resilience, but their scopes are different. Overlap is most pronounced in early-warning systems and climate-information services, where both projects plan to strengthen hydrometeorological services. Through coordination—ensuring that G2F focuses on national infrastructure and the CN on last-mile dissemination—duplication can be avoided. Knowledge-management, awareness-raising, and capacity-building activities in the CN complement G2F's regional knowledge platform and health-security interventions. By aligning planning timelines, integrating lessons learned, and leveraging each other's platforms, the two initiatives can create synergies that enhance resilience for vulnerable communities in Tajikistan.

Project implementation period: Jan 2025–Jan 2031

Geographic coverage: 21 of the most climate-vulnerable districts across Tajikistan. In Khatlon these are Jomi, Baljuvon, Bokhtar / Kushoniyon, Dangara, Farkhor, Hamadoni, Jaloliddin Balkhi, Khovaling, Khuroson, Kulob, Panj, Shamsiddin Shohin, Temurmalik, Vakhsh, Vose, and Yovon. In the RRS these are Gissor, Rudaki and Shakhrinav, and in Sughd these are Mastchoh and Zafarobod.

Accredited Entity: The International Fund for Agricultural Development (IFAD)

Executing entities: i. Republic of Tajikistan, acting through (a) the Ministry of Finance, and (b) the Ministry of Agriculture via the State Enterprise Project Management Unit for Livestock and Pasture Development (PMU), ii. Committee on Environmental Protection, through the Centre for Implementation of Investment Projects, iii. Food and Agriculture Organisation of the United Nations (FAO)

Funding breakdown: Total US\$79.7 million of which GCF Grant US\$30 million, GCF loan US\$9 million and co-financing US\$40.7 million

Beneficiaries: 650,000 direct individual beneficiaries (about 100,000 rural households) and 2,268,426 indirect individual beneficiaries across the country (51.5% women)

Theme and results areas: Cross-cutting; ecosystems and ecosystem services; forest and land use; health, food and water security; infrastructure and built environment; livelihoods of people and communities.

Project overview: The programme will strengthen national and local climate resilience by improving public sector coordination, technical capacity, and climate-resilient natural resource management. It will build community capacity for adaptation, promote market-based livelihood approaches, and advance locally-led adaptation through enhanced local agency for climate risk assessment and solution implementation. National capacity for emissions accounting, legal frameworks for green growth, and access to green investment will be improved. The programme will also promote innovative technologies, research, and cross-learning.

Components and outputs

Component 1: Strengthening public sector capacity for transformative climate-resilient management of natural resources.

- Output 1.1: By year 7, capacities and enhanced coordination among relevant national institutions for climate-resilient natural resource management strengthened
- Output 1.2: By year 7, enabling environment for climate adaptive, inclusive and integrated management of pasture, forestry and livestock resources is enhanced

Component 2: Investments in community capacity for adaption and resilience to climate change.

- Output 2.1: By year 3, 400 Climate-sensitive Community Action Plans (CsCAP) based on 21 district-level climate diagnostics are developed.
- Output 2.2: By year 7, 400 Climate-sensitive Community Action Plans (CsCAP) implemented in 21 districts with benefits for 100,000 rural households.

Component 3: Strengthening livelihoods for enhanced resilience through market-based approaches.

⁴⁶¹ <https://www.greenclimate.fund/document/community-based-agriculture-support-programme-plus-casp>

- Output 3.1: By year 7, 105,600 smallholder livestock farmers receive Artificial Insemination (AI) services, animal health or training services to increase productivity of their livestock.
- Output 3.2: By year 4, 9 productive alliances between livestock producers' groups and private aggregators established and operational.

Output 3.3: By year 7, 12,400 smallholders have strengthened climate resilient production practices and private sector market linkages.

Relevance to the proposed project

Given the geographic overlap, similar institutional actors (especially CEP/CIIP), and shared climate-resilience objectives, a clear articulation of complementarity and non-duplication with CASP+ is essential.

Relationship Between CASP+ Community Plans (CsCAPs) and WFP District Adaptation Plans (DAPs)

CASP+ prepares village-level CsCAPs, each reflecting community-specific priorities for pasture rehabilitation, forestry restoration, ecosystem management, and small-scale climate-resilient infrastructure.

The proposed WFP project prepares District Adaptation Plans (DAPs), which operate at one administrative level higher and focus on district-wide climate risk assessment, anticipatory action triggers, integrated water planning, and cross-village prioritisation.

The relationship is therefore complementary, not overlapping. CsCAPs represent community-level adaptation priorities. DAPs represent district-level frameworks for planning, investment, early warning, and anticipatory action. In overlapping districts, all existing and planned CsCAPs will be systematically reviewed and incorporated into the DAP preparation process. This ensures that CASP+ community-level priorities underpin district-level planning and that DAPs reflect aggregated and validated community perspectives.

Avoidance of Duplication and Conflicting Priorities

CASP+ FP233 explicitly includes mechanisms to avoid duplication of investments, including selection criteria that exclude villages receiving similar support from other donors. The proposed project will strengthen this by:

- Mapping all CASP+ CsCAPs and planned investments in Temurmalik and Khuroson. Excluding CsCAP villages from WFP-funded investments where CASP+ is financing community-level activities.
- Focusing WFP Component 2 investments (climate-resilient water assets, production systems, livelihood diversification) in villages not receiving CASP+ support.
- Ensuring coordinated district-level planning through CIIP district units, which serve as the shared executing entity for both projects.
- Leveraging CASP+ Participatory Governance Mechanisms

CASP+ includes a rich ecosystem of participatory mechanisms:

- PUUs / PUGs for pasture governance
- Forest User Groups in collaboration with Leskhoz
- Village organisations and assemblies
- Community planning committees for developing CsCAPs
- CEP district offices / CIIP district units for cross-village coordination

The WFP project will leverage these mechanisms by:

1. Using PUUs/PUGs and Community Action Planning Committees as primary entry points for informing DAPs.

2. Engaging Leskhoz groups and community forestry structures to align district-level ecosystem resilience priorities.
3. Integrating CASP+ governance practices into the District Adaptation Committees (DACs).
4. Learning from CASP+ on inclusive participation, especially on women's engagement and social inclusion.

Strengthening LLCA Through CASP+ Lessons

CASP+ provides critical LLCA-aligned experience relevant to WFP's project:

- Highly participatory and devolved community planning processes
- Clear mechanisms for community-driven prioritisation
- Transparent village selection and investment choices
- Strong gender inclusion practices
- Use of climate diagnostics in planning
- Institutionalisation of feedback loops (PUUs, leskhoz, CsCAP committees)

The project will adopt and adapt CASP+ methodologies—particularly community-led prioritisation, inclusion of PUUs/PUGs, and structured feedback mechanisms—to enhance LLCA dimensions of the WFP project.

Summary of Complementarity Logic

- The roles of both projects are complementary: CASP+ operates primarily at the village level through CsCAPs.
- WFP operates at the district level through DAPs.
- Governance structures reinforce each other.
- Investments are distinct but aligned.

FP067 Building climate resilience of vulnerable and food insecure communities through capacity strengthening and livelihood diversification in mountainous regions of Tajikistan⁴⁶²

Project implementation period: Sep 2020–Mar 2025

Geographic coverage: Most vulnerable and food-insecure communities in the Rasht valley, Khatlon and Gorno-Badakhshan Autonomous Region (GBAO) regions. Villages were chosen in 11 targeted districts of Khovaling, Muminobod, Faizobod, Nurobod, Rasht, Tojikobod, Jirgatal, Rushon, Shugnon, Roshtqala and Ishkoshim.

Accredited Entity: World Food Programme (WFP)

Executing entities: The Committee for Environment Protection (CEP) under the Government of the Republic of Tajikistan with WFP co-executing entity on specific activities.

Funding breakdown: Total US\$10m of which GCF grant is US\$9.3m and co-financing US\$700,000

Beneficiaries: Direct 50,000 and indirect 70,000, with 52% of the total being women.

Theme and results areas: Ecosystem and ecosystem services; health, food and water security; livelihoods of people and communities.

⁴⁶² <https://www.greenclimate.fund/project/fp067>

Project overview: This project will implement targeted adaptation measures to address the impacts of climate change that are driving reduced agricultural yields, rising food prices, and declining agricultural incomes. Focusing on the most vulnerable and food-insecure populations, the initiative will apply an integrated approach combining climate information services, capacity development, sustainable water resource management, and climate-resilient agriculture and forestry practices.

Components and outputs

Component 1: Capacity strengthening and awareness raising of food-insecure, climate vulnerable communities and national actors for enhanced rural resilience and food security

- Output 1.1: Climate and weather products improved and tailored to the needs of vulnerable food-insecure communities through increased capacity of hydromet.
- Output 1.2: Locally relevant delivery mechanisms for the provision of tailored climate and weather information through relevant ICTs identified and piloted.
- Output 1.3: Decision making in vulnerable households enhanced through improved capacities to interpret and act on tailored climate advisories.
- Output 1.4: Improved community capacities and awareness on climate change impacts on health and nutrition.
- Output 1.5: Publications of lessons learnt and best practices compiled and disseminated.
- Output 1.6: Adaptation plans integrated at District Development Committees (DDC) with full participation of community members and local authorities.

Component 2: Resilience building at household and community level through diversification of livelihoods and market access.

- Output 2.1: Climate change adaptation supported through diversification of livelihoods.
- Output 2.2: Improved water management for drinking water and small-scale irrigation.
- Output 2.3: Provision of and training to utilise greenhouses, renewables and climate-proof post-harvest storage facilities established to withstand long-term climate change.
- Output 2.4: Household resilience and adaptive capacity of climate-vulnerable poor in target areas improved.

WB-P179852 Tajikistan Strengthening Resilience of the Agriculture Sector Project⁴⁶³

Project implementation period: Jun 2021–Jun 2027

Geographic coverage: Nationwide in Tajikistan

Accredited Entity: World Bank

Executing entities: Ministry of Agriculture

Funding breakdown: US\$58.00 million

Beneficiaries: Smallholders (dehkans) and large-scale commercial farmers, agri-businesses, exporters, and other value chain actors, as well as staff of public agricultural institutions, from agricultural researchers and extension field officers to staff working in various departments of the Ministry of Agriculture (MOA) and public agencies in the local government as well as public and private seed farms and nurseries.

Theme and results areas: Environment and natural resource management; finance; human development and gender; private sector development; urban and rural development.

⁴⁶³ <https://projects.worldbank.org/en/projects-operations/project-detail/P175952>

Project overview:

The proposed project will strengthen the resilience of Tajikistan's agriculture by supporting public institutions in delivering improved and expanded services to farmers and agribusinesses. It will enhance domestic food self-reliance, build the foundation for increased production and export competitiveness in the growing horticulture sector, and improve the early warning, preparedness, and response capacity of the Ministry of Agriculture (MoA) and other relevant public institutions. The project will also foster strategic engagement between public institutions and the private sector, supporting the development of a viable rural micro, small, and medium enterprise (MSME) sector and generating employment opportunities in regions with limited legal livelihood alternatives.

Components and outputs

Component 1: Strengthen seed, seedling and planting material systems.

- Sub-component 1.1: Enabling environment.
- Sub-component 1.2: Research and development.
- Sub-component 1.3: Multiplication of seeds, seedlings, and planting materials.
- Sub-component 1.4: Quality assurance.

Component 2: Support investments in agri-logistics to enhance horticulture value chains.

- Sub-component 2.1: Support the establishment and operation of Agri-Logistical Centres (ALCs).
- Sub-component 2.2: Capacity building for operation and management of ALCs and awareness raising.

Component 3: Build public capacity for crises prevention and management.

- Sub-component 3.1: Real-time monitoring of agricultural production, land use, and agrometeorology.
- Sub-component 3.2: Soil fertility management.
- Sub-component 3.3: Crop protection and locust control.

Component 4: Project management and coordination.

- Includes: i. management, coordination and implementation; ii. monitoring and evaluation (MandE); iii. fiduciary and safeguard compliance, iv. technical assistance (TA); and v. a grievance redress mechanism (GRM).

WB-P179851 Tajikistan Strengthening Resilience of the Agriculture Sector Project Additional Financing⁴⁶⁴

Project implementation period: Dec 2022–Jun 2027

Geographic coverage: Nationwide in Tajikistan, with Component 2 focus in Khatlon, Sughd, and Dushanbe regions.

Accredited Entity: World Bank

Executing entities: Ministry of Agriculture

Funding breakdown: US\$50.00 million

Beneficiaries: Beneficiary groups expanded on the parent project include rural households receiving agriculture inputs such as seeds, fertiliser, and small-scale farm machinery, identified through the Farmers' Registry and a household survey targeting vulnerable dehkan farmers, including women. Nutrition activities will focus on pregnant and lactating women and children

⁴⁶⁴ <https://projects.worldbank.org/en/projects-operations/project-detail/P179851>

aged 6–59 months, identified through national health surveys and local healthcare screening, with children suffering from severe acute malnutrition receiving therapeutic food. Food fortification beneficiaries include all operating wheat flour and edible salt producers, who will access fortified premixes via a Premix Revolving Fund (PRF). This sustainable financing mechanism ensures a continuous supply of essential nutrients to improve population nutrition.

Theme and results areas: Environment and natural resource management; finance; human development and gender; private sector development; urban and rural development.

Project overview:

The additional financing (AF) will support the Government's response to the food and nutrition security emergency, focusing on immediate needs while also funding medium-term investments to strengthen resilience. Grant resources will co-finance existing activities under the parent project WB-P179852's sub-components and introduce a new sub-component under Component 3 for planned nutrition interventions. While the parent project's overall design, components, and objectives remain largely unchanged, the Project Development Objective (PDO) will be revised to: *strengthen the foundations for a more resilient agricultural sector and support emergency interventions to address food and nutrition security in Tajikistan*. Additional PDO- and intermediate-level indicators will be introduced to reflect the expanded scope, with scaled-up targets for existing indicators and new ones for the added activities. The AF will maintain the same geographic focus and selection criteria as the parent project, while expanding the beneficiary base to include recipients of emergency seed and fertiliser distribution and nutrition-enhancing activities.

Components and outputs

Component 1: Strengthen seed, seedling and planting material systems.

- Sub-component 1.1: Enabling environment.
- Sub-component 1.2: Research and development.
- Sub-component 1.3: Multiplication of seeds, seedlings, and planting materials.
- Sub-component 1.4: Quality assurance.

Component 2: Support investments in agri-logistics to enhance horticulture value chains.

- Sub-component 2.1: Support the establishment and operation of Agri-Logistical Centres (ALCs).
- Sub-component 2.2: Capacity building for operation and management of ALCs and awareness raising.

Component 3: Build public capacity for crises prevention and management.

- Sub-component 3.1: Real-time monitoring of agricultural production, land use, and agrometeorology (expanded scope to enhance the early warning systems infrastructure).
- Sub-component 3.2: Soil fertility management.
- Sub-component 3.3: Crop protection and locust control.
- Sub-component 3.4: Nutrition improvement

Component 4: Project management and coordination.

- Includes: (i) management, coordination and implementation; (ii) monitoring and evaluation (MandE); (iii) fiduciary and safeguard compliance, (iv) technical assistance (TA); and (v) a grievance redress mechanism (GRM).

AF An integrated landscape approach to enhancing the climate resilience of small-scale farmers and pastoralists in Tajikistan^{465,466}

⁴⁶⁵ https://fifspubprd.azureedge.net/afdocuments/project/12039/12039_Clean%20for%20posting%20.pdf

⁴⁶⁶ [An integrated landscape approach to enhancing the climate resilience of small-scale farmers and pastoralists in Tajikistan - Adaptation Fund](#)

Project implementation period: Aug 2021–Aug 2027

Geographic coverage: Focus on the Kofirnighan River Basin (KRB), Tajikistan.

Accredited Entity: UN Development Programme

Executing entities: Committee for Environmental Protection (CEP)

Funding breakdown: AF Grant US\$9,996,441.

Beneficiaries: Direct 46,000 (54% female) and indirect 828,000 (50% female).

Theme and results areas: integrated catchment management, ecosystem-based adaptation (EbA), climate-smart agriculture and sustainable land management, and capacity building and knowledge sharing.

Project overview: The project aims to enhance the livelihoods and climate resilience of small-scale farmers and pastoralists in the Kofirnighan River Basin (KRB), facing increasing risks from extreme climate events such as floods, droughts, and landslides. It will implement an integrated catchment management strategy at raion and jamoat levels, operationalise climate-resilient agro-ecological landscape approaches at the village level, and strengthen knowledge platforms for EbA. The project supports participatory planning and sustainable land and water management, aligned with national water sector reforms and the National Adaptation Plan (NAP). By scaling EbA interventions across sectors and basins, the project will build adaptive capacity, inform policy, and contribute to long-term climate-resilient development in Tajikistan.

Components and outputs

Component 1: Integrated catchment management to build climate resilience

- Output 1.1. Multi-hazard climate risk model developed for vulnerable watersheds in the Kofirnighan River Basin.
- Output 1.2. Support provided for upgrading automated weather stations in Kofirnighan River Basin watersheds.
- Output 1.3. Integrated catchment management strategy developed for the Kofirnighan River Basin.
- Output 1.4. Strengthened coordination and training mechanisms for integrated climate-resilient catchment management.
- Output 1.5. Payment for Ecosystem Services models to support the long-term financing of integrated catchment management strategy implementation.

Component 2: Ecosystem-based Adaptation, including Climate smart Agriculture and Sustainable Land Management, in agroecological landscapes

- Output 2.1: Agro-ecological extension services supported at the jamoat level to provide technical support for EbA implementation.
- Output 2.2. Watershed Action Plans developed that promote climate resilience and enhance economic productivity for target communities.
- Output 2.3. EbA interventions implemented in target watersheds by local communities.

Component 3: Knowledge management on building climate resilience through integrated catchment management and EbA

- Output 3.1: Existing knowledge management platforms supported for collating information on the planning, implementation and financing of EbA interventions.
- Output 3.2. An impact evaluation framework established to enable effective adaptive management of EbA activities.

Project implementation period: 2022–2027

Geographic coverage: The project sites are located within the following river basins: (a) Zarafshon basin, encompassing three districts, Ayni, Panjekent, and Kuhistoni Mastchoh (Sughd oblast), bordering Uzbekistan and Kyrgyzstan; (b) Greater Panj basin, covering four districts, Vanj, Rushon, Shughnon, and Murghab (Gorno-Badakhshan Autonomous Oblast), bordering Kyrgyzstan and Afghanistan; and (c) Lower Kofarnihon basin, including three districts, Shahrituz, Nosir Khosrov, and Qubodiyon (Khatlon oblast), bordering Uzbekistan and Afghanistan.

Implementing entities: The Committee for Environmental Protection (CEP) under the Government of the Republic of Tajikistan

Funding breakdown: International Development Association (IDA) Grant US\$45.00 million

Beneficiaries: Rural communities, including households, farms, villages, farmer groups, and resource user groups reliant on pastures, forests, and water resources, with particular attention to women and youth engaged in sustainable land management.

Themes: Sustainable landscape management, climate resilience enhancement, transboundary cooperation, and livelihood improvement.

Key results areas:

The following are the indicators to measure the achievement of the PDO and the project's key results

- a) Land area under sustainable landscape management practices (CRI, Ha).
- b) People benefitting from landscape management practices (Number, sex disaggregated).
- c) Transboundary sustainable landscape management policies harmonized (Number).

Project overview: The Project Development Objective is to increase the area under sustainable landscape management in selected Tajikistan locations and promote Tajikistan's collaboration with Central Asia countries on transboundary landscape restoration.

Components and outputs

Component 1: Strengthen Institutions and Policies, and Regional Collaboration

- Sub-component 1.1: Strengthen Institutions and Policies. a) Strengthening policy, legal and implementation frameworks.
- Sub-component 1.2: Strengthen Regional Collaboration

Component 2: Enhance Resilient Landscapes and Livelihoods

- Sub-component 2.1: Forest Restoration and Sustainable Forest Management.
- Sub-component 2.2: Integrated Pasture Management and Restoration.
- Sub-component 2.3: Protected Area Management and Biodiversity Conservation
- Sub-component 2.4: Landscape Restoration and Livelihoods.

Component 3: Project Management and Coordination: This component will finance the operating costs of an Implementation Group (IG) within CEP to carry out project management functions for Components 1 and 2.

Climate Adaptation and Mitigation Program for the Aral Sea Basin (CAMP4ASB)^{469,470}

⁴⁶⁷ Development Projects: RESILAND CA+ Program: Tajikistan Resilient Landscape Restoration Project - P171524

⁴⁶⁸ <https://documents1.worldbank.org/curated/en/429701637217166153/pdf/Project-Information-Documents-RESILAND-CA-Tajikistan-Resilient-Landscape-Restoration-Project-P171524.pdf>

⁴⁶⁹ <https://www.greenclimate.fund/project/fp014>

⁴⁷⁰ <https://www.greenclimate.fund/sites/default/files/document/funding-proposal-fp014-world-bank-tajikistan-and-uzbekistan.pdf>

Project implementation period: June 2020–June 2025

Geographic coverage: Tajikistan and Uzbekistan

Accredited Entity: World Bank

Executing entities: International Fund for Saving the Aral Sea (EC-IFAS), the Regional Environmental Centre for Central Asia (CAREC), National Coordination Units (NCUs), including the Uzbekistan Ministry of Agriculture and Water Resources, and the Tajikistan Committee on Environmental Protection.

Funding breakdown: Total project cost US\$68.8 million: GCF grant US\$19 million, Co-financing (Grant: US\$26.8 million and US\$23 million as a loan).

Beneficiaries: Rural communities with 205,000 direct beneficiaries (at least 40% female), including farmers and farmer groups, and villages and village groups.

Results areas:

1. Increased resilience of the most vulnerable people and communities
2. Ecosystem and ecosystem services

Project overview: The scaling up of the Climate Adaptation and Mitigation Program for the Aral Sea Basin (CAMP4ASB) project supports adaptation activities in Tajikistan and Uzbekistan, providing grants to the most vulnerable communities for climate-resilient measures in priority areas, including the poorest populations residing in risk-prone areas and marginalised groups such as women.

Components and sub-components

Component 1: Scaling up CAMP4ASB's Climate Investment Assessment Mechanism

- Sub-component 1.1. Climate Investment Assessment Mechanism
- Sub-component 1.2. Outreach and Coalition Building, including holding an annual Climate Knowledge Forum.

Component 2: Regional Climate Investment Facility

- Sub-component 2.1: Investment Financing
- Sub-component 2.2. Capacity Building and Community Support

Component 3: Regional and National Coordination

- Sub-component 3.1: The Regional Coordination to finance the operating costs of the Regional Coordination Unit (RCU) established under the regional host institution (EC-IFAS)
- Sub-component 3.2: National Coordination to support the National Coordination Units (NCUs) operating costs, responsible for national investment oversight, in each participating country.

WB-Tajikistan Strengthening Water and Irrigation Management Project (SWIM)⁴⁷¹

Project implementation period: 2022-2027

Geographic coverage: Lower sub-basin of the Vakhsh river, upper Vakhsh, and Zarafshon basins

Accredited Entity: World Bank

⁴⁷¹ <https://projects.worldbank.org/en/projects-operations/project-detail/P175356>

Executing entities: Ministry of Energy and Water Resources (MEWR), Agency for Land Reclamation and Irrigation (ALRI), FVWRMP PMU under the ALRI

Funding breakdown: The total project cost was US\$47.34 million (European Commission Development Fund: Grant US\$17.34 million, and IDA Loan: US\$30 million).

Beneficiaries: Irrigation schemes in the Vakhsh and Zarafshon river basins.

Themes: Environment and Natural Resource Management, and Urban and Rural Development

Project overview: The project aims to strengthen water and irrigation management in Tajikistan by building on past successful initiatives, expanding institutional capacity, and modernising infrastructure—mainly in the lower Vakhsh river sub-basin, with smaller investments in the upper Vakhsh and Zarafshon basins, and institutional support in the upper Kofarnihon basin.

Components and sub-components

Component 1: To channel support to ALRI for the development of an Irrigation Management Information System at the national level for improved water accounting, tariff collection, and asset management in the selected irrigation schemes

- Sub-component 1.1: Strengthening National and Basin-level Water Resources Policy and Planning.
- Subcomponent 1.2 - Improving Irrigation Planning and Management.

Component 2: Irrigation Scheme Improvements

- Sub-component 2.1: Improving Large-scale Irrigation Schemes
- Subcomponent 2.2: Improving Small- and Medium-scale Irrigation Schemes

Component 3: Support incremental operating costs and other eligible expenditures associated with the project execution, including project administration and management, monitoring of compliance with social and environmental requirements, financial management (FM), procurement, contract administration, project reporting, and monitoring and evaluation (MandE). This component will also include a zero-allocation' contingent emergency response (CERC)

Component 4: Support government emergency responses in the event of an eligible emergency.

GEF 8-Tajikistan Ecosystem Restoration and Resilient Agriculture (TERRA) Project (in the pipeline)⁴⁷²

Project implementation period: Anticipated to start in 2025—2030

Geographic coverage: Lower Panjriver sub-basin in Khatlon province

Accredited Entity: International Fund for Agricultural Development (IFAD)

Executing entities: IFAD

Funding breakdown: Total project cost US\$20.97 million (GEF grant US\$9 million and co-financing US\$11.97 million)

Beneficiaries: Local communities

Project overview: The project objective is to generate multiple environmental and socio-economic benefits by applying integrated landscape management approaches for the restoration

⁴⁷² <https://www.thegef.org/projects-operations/projects/11398>

of degraded grassland ecosystems in the Lower Panjriver sub-basin in Khatlon province – a global priority area for ecosystem restoration, and a critical production area where trends in land degradation and overall ecosystem health are deteriorating. The effort will result in multiple land degradation neutrality (LDN), biodiversity, and climate change adaptation and mitigation benefits through integrated landscape management (ILM) approaches in areas of high priority for biodiversity conservation.

Components and outputs

Component 1: Enhancing the enabling environment for ecosystem restoration

Outcome 1.1: Enhanced governance of ecosystems tackling drivers of LD and biodiversity loss

- Output 1.1.1: Policy framework for land degradation, biodiversity, protected areas, and integrated ecosystem management reviewed and enhanced
- Output 1.1.2: National platform for inter-sectoral coordination mechanisms for land degradation, biodiversity, protected areas, and ecosystem management strengthened at all levels
- Output 1.1.3 In-depth stocktaking of existing data and metrics carried out for LDN Baseline Assessment, PA management effectiveness, and ecosystem management plans - targets set and action plans developed

Outcome 1.2: Improved capacity of executing partners

- Output 1.2.1 Capacity building to restore degraded ecosystems and report to global frameworks (e.g. development of protected area management plans; review of legislation) is conducted
- Output 1.2.2: Study and Action Plan on participation in international carbon trading system developed and key stakeholders informed
- Output 1.2.3: Study on the economic viability of reforestation, agroforestry, and alternative cropping practices is conducted for different agro-climatic conditions

Component 2: Reversing land degradation and promoting ecosystem restoration

Outcome 2.1: Strengthened ecosystem, integrated land management, and agrobiodiversity conservation in targeted regions

- Output 2.1.1: Registry of genetic resources (database) developed and digitized
- Output 2.1.2: Genetic banks (seeds and seedlings funds) are established
- Output 2.1.3: Economic valuation of ecosystem services conducted
- Output 2.1.4: Protected areas management plans developed and implemented, SMART patrol system piloted

Outcome 2.2: Improved landscape-level ecological integrity, soil organic carbon, and land productivity in major ecosystem functional types using integrated ecosystem management plans

- Output 2.2.1: Gender responsive Forest management plans developed (JFM)
- Output 2.2.2: Transhumance routes are mapped using GIS tools and verified on the ground
- Output 2.2.3: Integrated, inclusive, and gender responsive community-based ILM and ecosystem management plans developed

Outcome 2.3: Enhanced resilience of sustainably managed ecosystems

- Output 2.3.1: Investments to support ILM and ecosystem restoration undertaken in collaboration with all community participants (including women)
- Output 2.3.2: Capacities of local communities improved, including women, men, and youth in ILM and ecosystem management.

Component 3: Project learning and knowledge management

Outcome 3.1: Successful knowledge management

- Output 3.1.1: Project knowledge outputs documented and learning initiatives undertaken involving women, men, and youth from local communities
- Output 3.1.2: Learning activities conducted with key government executing departments reflecting gender and youth considerations

Component 4: Monitoring and Evaluation

Outcome 4.1: MandE framework established (including Gender Action Plan)

- Output 4.1.1: Mid-term review and Final evaluation are conducted

UNDP-Enabling an effective National Adaptation Plan process for Tajikistan⁴⁷³

Project implementation period: August 2020 to May 2025

Geographic coverage: Tajikistan

Accredited Entity: UNDP

Executing entities: Committee of Environmental Protection under the Government of the Republic of Tajikistan (CEP), Agency for Hydrometeorology, Ministry of Economic Development and Trade, Committee on Emergency Situations and Civil Defense, Ministry of Agriculture, Agency for Land Reclamation and Irrigation, and the Committee on Land Use, Geodesy and Cartography.

Funding breakdown: GCF US\$2,979,428

Beneficiaries: NA

Theme and results areas: Water resources, natural resource management, agriculture/food security

Project overview: The project aims to build the institutional arrangements, capacities, and financing conditions needed for Tajikistan to develop and implement its National Adaptation Plan in line with the National Climate Change Adaptation Strategy. It will strengthen key agencies in the priority sectors of energy, water, transport, and agriculture, mainstream climate adaptation into their work, address financing and subnational implementation gaps, coordinate with ongoing initiatives, and ensure broad stakeholder engagement, especially of vulnerable groups such as women.

Components and outputs

- Outcome 1: Governance, coordination and institutional arrangements for climate change adaptation planning and implementation strengthened
- Outcome 2: Priority sector adaptation plans developed, capacities strengthened, and a long-term capacity development program established
- Outcome 3: Implementation capacities for climate change adaptation is strengthened.

Expected results

- Committee on Environmental Protection is strengthened as the lead agency and coordinating body for climate change adaptation.
- Statistics Agency develops and implements national indicators and reporting methodology for climate change adaptation planning and implementation.
- Climate Change Centre knowledge management capabilities are strengthened.

⁴⁷³ [Enabling an effective National Adaptation Plan process for Tajikistan | UNDP Climate Change Adaptation](#)

- Mainstreaming of climate change adaptation in priority sector planning and regulatory frameworks is advanced.
- Priority sector vulnerabilities and adaptation options are identified.
- A long-term climate change adaptation capacity development program is established and implemented.
- Establish and institutionalise a financing mechanism for the NAP/NCCAS/NDC implementation.
- Sub-national capacities for climate change adaptation mainstreaming, planning, and project implementation are enhanced.
- Private sector is engaged in climate change adaptation activities at national and sectoral levels

UNDP: Climate change and Resilience in Central Asia^{474,475}

Project implementation period: 2021–2025

Geographic coverage: Districts of Sughd Region (Fergana valley)
In Kyrgyz Republic, Tajikistan, and Uzbekistan

Accredited Entity: Not provided

Executing entities: UNDP Istanbul Regional Hub for Europe and the CIS, Committee of Environmental Protection, MEWR, AoH, MFA, and ALRI

Funding breakdown: Total project cost US\$3,217,062 million (European Union: US\$ 2,925,500 and UNDP:US\$291,562)

Beneficiaries: The primary beneficiaries are high-level government officials and decision-makers at national, regional, and local levels, while sectoral experts and CSO representatives, including academia, will benefit from knowledge products, a toolkit, and capacity-building activities.

Theme and results areas: Climate risk assessment and capacity building, policy integration and technical assistance, regional cooperation and awareness, and early warning systems and prevention measures.

Project overview: The overall objective of the project is to support stability and climate-resilient development in the Ferghana Valley, a trans-border area of the Kyrgyz Republic, Tajikistan, and Uzbekistan. The project will i) improve knowledge of climate fragility risks amongst stakeholders at local, national, and regional levels; ii) facilitate risk-informed policymaking and transboundary resource management; and iii) support practical risk reduction interventions. Early warning and prevention measures will be enhanced. Knowledge base will be increased through targeted public awareness campaigns to ensure growing consciousness on climate-induced vulnerability implications, spill-over effects, and climate change resilience. The project takes a people-centred, gender sensitive, and climate risk-informed holistic approach.

Components and outputs

- Output 1: Enhanced knowledge base and capacities to identify and assess climate-driven resilience risks in the Kyrgyz Republic, Tajikistan, and Uzbekistan trans-border areas.
- Output 2: Technical assistance provided on introducing climate fragility risks into national policies, climate change adaptation, and development strategies and plans in the Kyrgyz Republic, Tajikistan, and Uzbekistan.

⁴⁷⁴ [Climate Change and Resilience in Central Asia | United Nations Development Programme](#)

⁴⁷⁵ <https://www.undp.org/eurasia/projects/climate-change-and-resilience-central-asia>

- Output 3: Opportunities to promote regional cooperation and awareness on climate and fragility risks created.
- Output 4: Enhanced early warning and prevention measures demonstrated at pilot site/s in the Ferghana Valley.

Table 11. Relevant past and ongoing projects in Tajikistan completed by 2020, relating to agriculture and water.

Project title	Geographic coverage	Funding	Project executing agency	Project description
<p>USAID Family Farming Programme^{476,477}</p> <p>2010 to 2015</p>	Tajikistan	US\$29 million	Development Alternatives Inc. (DAI)	<ul style="list-style-type: none"> • Implement irrigation system rehabilitation activities; • strengthen Water User Associations (WUA) federations; • conduct WUA legal and regulatory analysis and recommend updates; • train WUAs on advanced policy guides; • 56 new WUAs established and 4 strengthened in Khatlon province; • 60 WUAs trained in leadership, grants and financial management, irrigation maintenance, and conflict resolution; • WUA membership fee collection increased by 60%, enhancing irrigation water management funding; • 968 water control gates repaired/installed, 84,920 metres of drainage dredged, 50,220 metres of irrigation canals cleaned; • 122,992 ha under improved water management, 67,642 ha under improved or rehabilitated irrigation; • 14 crop and animal production guides and 3 household nutrition and budgeting guides developed and disseminated; • Stakeholder-led legal analysis of WUA law conducted; revised law drafted incorporating suggested reforms.
WB Tajikistan second public employment for sustainable agriculture and water resources management project ^{478,479}	Southern Khatlon's twelve districts with a notable emphasis on the lower	Total funding: US\$45.90 million, consisting of Global Agriculture and Food Security	Project Management Unit (PMU) managed under the World Bank-financed Ferghana	<ul style="list-style-type: none"> • The project aims to: (i) provide employment to food-insecure people through rehabilitating irrigation and drainage infrastructure, (ii) boost crop production through improved irrigation and infrastructure, and (iii) strengthen policies and

⁴⁷⁶ [Tajikistan—USAID Family Farming Program \(FFP\) · DAI: International Development](#)

⁴⁷⁷ <https://oig.usaid.gov/sites/default/files/2018-06/5-176-14-002-p.pdf>

⁴⁷⁸ <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/142331468173952803>

⁴⁷⁹ <https://documents1.worldbank.org/curated/en/142331468173952803/pdf/722930PAD0P1330Official0Use0Only090.pdf>

Project title	Geographic coverage	Funding	Project executing agency	Project description
2012-2020	Kofarnihon River basin.	Program US\$27.90 million IDA reallocated as a grant US\$18.00 million	Valley water resource management project	<p>institutions for water resource management to enhance food availability and access for low-income rural populations in the project areas;</p> <ul style="list-style-type: none"> • benefiting low-income rural households in 12 districts of Khatlon and DRS, water user associations in these areas, the Ministry of Amelioration and Water Resources Management (or its reform successor), and selected Mirobs and newly established river basin organisations; • public works programme providing temporary employment for around 22,000 low-income people, prioritising the most food-insecure households, with at least 20% being women; • rehabilitation of irrigation and drainage systems, improving irrigation access for 190,000 ha, benefiting about 750,000 rural residents and 20,000 dehkan farms
WB Environmental Land Management and Rural Livelihoods Project ⁴⁸⁰ 2013–2018	Tajikistan	World Bank using GEF/CIF funds, actual disbursed amount US\$17,628,155	Committee on Environmental Protection (CEP)	<ul style="list-style-type: none"> • Strengthened productive assets of rural households; • addressed environmental degradation and unsustainable natural resource use; • integrated improved assets with sustainable resource management to enhance climate resilience; • targeted rural communities in climate-vulnerable areas; • objectives included increasing productive assets, improving natural resource management, and building resilience to climate change; • direct beneficiaries of 243,000 people, with 40% women.
GIZ: Strengthening Livelihoods through	Batken Province Kyrgyzstan and Sugd Province in Tajikistan.	GIZ	Not provided	<ul style="list-style-type: none"> • Strengthen livelihoods of vulnerable rural communities in Kyrgyzstan and Tajikistan through climate change adaptation measures, including:

⁴⁸⁰ <https://documents1.worldbank.org/curated/en/183461545337753103/pdf/icr00004451-12172018-636808536685094337.pdf>

Project title	Geographic coverage	Funding	Project executing agency	Project description
climate change adaptation in Tajikistan ⁴⁸¹ 2014 to 2018				<ul style="list-style-type: none"> • introduction of water-saving irrigation methods and water-efficient crops, the use of quality seed, and the rehabilitation of water reservoirs. • the construction of dams and riverbank reinforcement, and, in particular, erosion control for disaster risk reduction.
EU Improving water management in Tajikistan ⁴⁸² Announced 2016	Tajikistan: Zarafshan sub-basin, which includes interventions at a central level	Over US\$5.2 million	Ministry of Energy and Water Resources	<ul style="list-style-type: none"> • A 42-month-long project; • develop a water sector policy; • establish a river basin organisational structure; • develop water management planning tools; • improve irrigation infrastructure; • strengthen water management community organisations; • manage watersheds to reduce flash flooding and erosion; • monitor and evaluate sustainable water use.
WB Tajikistan - Ferghana Valley Water Resources Management Project P084035 ⁴⁸³ 2005–2014	Ferghana Valley, Tajikistan	Phase I; US\$24.21 million	Ministry of Water Resources supported by a dedicated Project Management Unit (PMU)	<ul style="list-style-type: none"> • Project aimed (i) to increase the capacity of productivity of irrigated agriculture in the Ferghana Valley by improving land and water management; and (ii) to improve Kayrakkum dam and reservoir safety and regulation, thereby contributing to enhanced water management security and efficiency at the basin level; • revised in 2010 with additional funding to assist in: (i) increasing the coverage of drained and irrigated areas in Bobojon Gafurov and Kannibodom raions, respectively; and (ii) strengthening the early warning system of the Kayrakkum dam, as well as

⁴⁸¹ [Strengthening of livelihoods through climate change adaptation in Kyrgyzstan and Tajikistan - giz.de](http://giz.de)

⁴⁸² [Landell Mills | Improving water management in Tajikistan – project...](#)

⁴⁸³ <https://documents1.worldbank.org/curated/en/656041467998481597/pdf/ICRR14702-P084035-Box393183B-PUBLIC.pdf>

Project title	Geographic coverage	Funding	Project executing agency	Project description
				carrying out a geotechnical study for assessing the risks associated with said dam

5.2. Other relevant past and ongoing initiatives

Several past and ongoing initiatives have prioritised enhancing climate resilience in agriculture, energy, and water management by integrating early warning systems, social protection, and climate-resilient livelihoods. Key objectives include reducing community vulnerability to climate risks and increasing income through diversified, climate-resilient livelihoods. Additionally, the initiatives focus on strengthening institutional capacity for climate adaptation and climate-resilient infrastructure, integrating climate measures into district planning, and mobilising finance for adaptation projects through risk mitigation and investment facilitation. Projects after 2020 are discussed below and projects completed before 2020 are in Table 12.

Strengthening Critical Infrastructure Against Natural Hazards^{484,485,486}

Project implementation period: 2018–2024

Geographic coverage: Tajikistan

Accredited Entity: Not provided

Executing entities: UNDP, Ministry of Transport (Project Implementation Group under the Ministry of Transport), Agency for Land Reclamation and Irrigation (Project Management Unit at ALRI), Ministry of Finance (Project Implementation Unit under the Ministry of Finance)

Funding breakdown: Total project cost US\$50 million (IDA Grant US\$25 million and US\$25 million credit)

Beneficiaries: 660,515 people (target was 556,900) benefited from reduced disaster risks through more resilient flood protection and riverbank erosion prevention infrastructure.

Theme and results areas:

Themes: Environment, natural resource management, finance, and urban and rural development.

Project overview: The project's objectives are to strengthen critical infrastructure against natural hazards and the recipient's disaster risk management capacities, enhance the resilience of its critical infrastructure against natural hazards, and improve its capacity to respond to disasters.

Components and outputs:

Component 1: Strengthening Disaster Risk Management Capacity.

Subcomponent 1.1: Modernising the Crisis Management Centres and Systems for Improved Disaster Preparedness

Subcomponent 1.2: Seismic Hazard Assessment for Improved Disaster Risk Identification:

Subcomponent 1.3: Preparation of a Financial Protection Strategy for mitigating fiscal shocks caused by natural disasters

Component 2: Making Critical Infrastructure Resilient against Natural Hazards

Subcomponent 2.1. Strengthening of Bridges

Subcomponent 2.2. Strengthening of Flood Protection and Riverbank Erosion–Protection Infrastructure

⁴⁸⁴ <https://projects.worldbank.org/en/projects-operations/project-detail/P158298?lang=en>

⁴⁸⁵ <https://www.worldbank.org/en/news/press-release/2017/07/10/tajikistan-aims-to-better-protect-people-and-property-from-natural-disasters-and-climate-change>

⁴⁸⁶ <https://documents1.worldbank.org/curated/en/099011725111518932/pdf/P158298-1834f74b-5b0b-490e-b16d-4d041db4b340.pdf>

Component 3: Contingent emergency response

Component 4: Project management component

GEF7-Strengthening the capacity of the Republic of Tajikistan to comply with the Enhanced Transparency Framework under the Paris Agreement^{487,488}

Project implementation period: 2023–2026

Geographic coverage: Tajikistan

Accredited Entity: FAO

Executing entities: Executed by the Agency for Hydrometeorology of the Committee for Environmental Protection

Funding breakdown: Total project Cost: US\$1,919,863 million (GEF funded US\$1,319,863, and co-financing US\$500,000)

Beneficiaries: Not provided

Theme and results areas: Not provided

Project overview: Strengthening Tajikistan's national capacities to meet the enhanced transparency framework (ETF) for climate change mitigation and adaptation actions, and support received for the sectors covered by nationally determined contributions (NDCs).

Components and outputs:

Component 1: Strengthening institutional capacity for coordinated monitoring and reporting under ETF.

Outcome 1.1: Enhanced institutional coordination for monitoring and reporting under ETF.

- Output 1.1.1 Established ETF roadmap, action plan and institutional arrangement focusing on climate change mitigation and adaptation and support received in Tajikistan.

Outcome 1.2: Enhanced stakeholders' capacity and knowledge of the ETF's modalities, procedures, guidelines (MPGs), and reporting formats.

Component 2: Enhancing stakeholders' technical capacities for ETF reporting focusing on climate change adaptation, mitigation, and climate finance.

Outcome 2.1: Strengthened technical capacities for monitoring and reporting NDC adaptation

- Output 2.1.1 National stakeholders with enhanced technical capacity for monitoring and reporting NDC climate change adaptation actions.

Outcome 2.2: Strengthened technical capacities for monitoring and reporting NDC mitigation actions

Outcome 2.3: Enhancement of the existing technical capacities for monitoring and reporting climate finance and support received for NDC actions.

⁴⁸⁷ <https://www.thegef.org/projects-operations/projects/10967>

⁴⁸⁸ <https://www.fao.org/countryprofiles/news-archive/detail-news/en/c/1639656/>

Component 3: Developing a data and information management system for ETF on NDC mitigation, adaptation actions, and support received

Outcome 3.1: Developed a transparency portal with updated data and information on NDC mitigation, adaptation actions, and support received

- Output 3.1.1 Established guidelines, protocols and indicators on data collection, update archiving, and tracking of GHG inventory, adaptation, climate finance, and support received in Tajikistan

Component 4: Monitoring and Evaluation (MandE)

GIZ Technology-based Adaptation to Climate Change in Rural Areas of Tajikistan and Kyrgyzstan⁴⁸⁹

Project implementation period: 2019–2023

Geographic coverage: Tajikistan, Kyrgyzstan

Accredited Entity: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Executing entities: Committee for Emergency Situations and Civil Defence, Tajikistan and State Committee for Information Development of the Government of Kyrgyzstan

Funding breakdown: Not provided

Beneficiaries: Government, private, and civil society in need of geographic data analysis on natural resource management, climate change, and disaster risk management.

Theme and results areas: Not provided

Project overview: The project aimed to strengthen climate adaptation in rural Tajikistan and Kyrgyzstan by developing national spatial data infrastructures, improving geodata management, and closing information gaps through remote sensing. It aimed to establish an earth observation lab in Tajikistan, train authorities, and use improved data for risk analyses and adaptation planning. Selected measures include erosion control, pasture management, and waste management.

Components and outputs: Not provided

Advancing Risk Knowledge to Improve Tajikistan's Disaster Early Warning System⁴⁹⁰

Project implementation period: 2023–2027

Geographic coverage: Tajikistan

Accredited Entity: United Nations Tajikistan

Executing entities: United Nations Office for Disaster Risk Reduction (UNDRR), World Meteorological Organization (WMO), International Telecommunication Union (ITU), and International Federation of Red Cross and Red Crescent Societies (IFRC)

Funding breakdown: Not provided

⁴⁸⁹ [Technology-based Adaptation to Climate Change in Rural Tajikistan and Kyrgyzstan - giz.de](https://www.giz.de/en/technology-based-adaptation-to-climate-change-in-rural-tajikistan-and-kyrgyzstan)

⁴⁹⁰ [Enhancing risk knowledge for stronger early warning systems in Tajikistan | United Nations in Tajikistan](#)

Beneficiaries: Not provided

Theme and results areas: Not provided

Project overview: The project, a partnership between the UN Office for Disaster Risk Reduction and the Government of Switzerland, aims to enhance Tajikistan's resilience to disasters and climate change. It will review and improve existing approaches, provide training on new tools, promote the use of AI-powered exposure mapping, and strengthen early warning systems to save lives. By advancing the country's capacity to monitor climate risks, the project seeks to ensure that all communities are protected from the impacts of natural hazards.

Components and outputs: Not provided

Table 12. Other relevant past and ongoing projects up to 2020 in Tajikistan relating to climate change adaptation.

Project title	Geographic coverage	Funding	Project executing agency	Project description
Pilot Programme for Climate Resilience (PPCR) ⁴⁹¹	Tajikistan	Total project cost: US\$50 million (Government of Tajikistan: US\$47.75 million; Multilateral development banks: US\$ 2.25 million)	Committee for Environmental Protection (CEP)	<ul style="list-style-type: none"> • Integrate climate risks in development planning; • strengthen Tajikistan's capacity and analytical evidence base, and help refine the needed investment committee; • build capacity for climate resilience aimed at building stronger institutional capacity and awareness of climate change; • improve Weather, Climate and Hydrological Service Delivery; aimed at enhancing the national hydro-meteorological monitoring system to provide timely warnings on dangerous events; • support water management, and build the evidentiary basis for climate variability and change; • promote a Climate Science and Modelling Programme aimed at enhancing Tajikistan's capacity to conduct climate science and glaciology research; • enhance the Climate Resilience of the Energy Sector; aimed at piloting the integration of climate change analysis and climate resilience measures into investments in hydropower facilities using the rehabilitation of Kairakkum hydropower plant (HPP) as a pilot; • promote agriculture and Sustainable Land Management; aimed at replicating and scaling up effective, existing land management practice and agricultural production; • build Climate Resilience in the Pyanj River Basin.
Advancing Risk Knowledge to Improve Tajikistan's Disaster Early Warning System ⁴⁹²	Tajikistan	Not provided	UN Office for Disaster Risk Reduction and the Government of Switzerland.	<ul style="list-style-type: none"> • review current approaches, training, and learning about new tools; • promote use of AI-powered exposure mapping; evaluate, and deliver life-saving warnings;

⁴⁹¹ [Proposal for the Formulation of the Tajikistan Strategic Programme for Climate Resilience](#)

⁴⁹² [Enhancing risk knowledge for stronger early warning systems in Tajikistan | United Nations in Tajikistan](#)

Project title	Geographic coverage	Funding	Project executing agency	Project description
				<ul style="list-style-type: none"> • create a more resilient future for the country, ensuring that no community is left unprotected from the threats of natural disasters; • strengthen the country's ability to monitor climate change risks.

6. Best practices and lessons learned

6.1. *Community-based disaster risk management (CBDRM) in Tajikistan*

CBDRM engages at-risk communities in identifying, analysing, treating, monitoring, and evaluating disaster risks to reduce vulnerabilities and strengthen resilience. Tajikistan's most vulnerable areas include glacier-dependent river basins supporting hydropower and irrigation, fragile mountain ecosystems, and isolated forests in mountainous and riverine terrains prone to landslides and land degradation. Lessons Learned demonstrate that integrating bottom-up and top-down approaches enhances the effectiveness of disaster risk management in Tajikistan. Risk mitigation activities have been shown to protect lives, property, and livelihoods, while continuous monitoring reduces exposure to hazards. Additionally, involving actors at micro, meso, and macro levels enables rapid and coordinated responses when disasters occur. Best Practices highlight the importance of building the capacity of at-risk communities to anticipate, prepare for, and cope with disasters. Engaging communities in developing risk mitigation plans ensures local ownership, while identifying and establishing community safe havens provides secure locations during emergencies. Strengthening risk assessment, monitoring, and early-warning systems improves preparedness, and facilitating coordinated disaster responses by linking micro-, meso-, and macro-level actors enhances efficiency and overall resilience⁴⁹³.

6.2. *Sustainable agricultural practices in Tajikistan, including soil, plant, water and knowledge management.*

Sustainable agricultural practices are increasingly recognised as a cornerstone of climate-resilient rural development in Tajikistan. Under the Integrated Rural Development Project (IRDP)/Towards Rural Inclusive Growth and Economic Resilience 2015–2018 (TRIGGER), implemented by GIZ and co-financed by the German Federal Ministry for Economic Cooperation and Development and the European Union, successful approaches have been documented that integrate climate change adaptation, biodiversity conservation, and resilience into farming systems. The project complements value chain development with a holistic farming systems perspective, strengthening expertise on sustainable agriculture and introducing climate risk management into agribusiness and water resource management at the basin level. By conserving scarce natural resources and promoting green and resilient agrotechnological practices, these interventions enhance soil fertility, water retention, and ecosystem services, while supporting sustainable income generation and food security. The synthesis presented here highlights proven best practices in soil, plant, and water management, implemented by diverse national and international partners, that are suitable for replication and scaling to increase the resilience of farming communities across Tajikistan. In Tajikistan, best practices for sustainable farming have been identified, particularly in the Rasht and Zarafshon valleys, to strengthen biodiversity conservation and climate resilience. These practices require site-specific pre-assessment and are grouped into four categories: (a) soil management, (b) plant management, (c) water management, and (d) knowledge management. Together, they help farmers adapt to changing environmental and economic conditions while supporting ecosystem health⁴⁹⁴.

6.2.1. Soil management

Soils are crucial for both climate change mitigation and adaptation. They store carbon, helping reduce greenhouse gas emissions, and effective soil management enhances resilience by improving nutrient content, water retention, and biodiversity. Given their central role in global

⁴⁹³ <https://www.osce.org/files/f/documents/7/d/110626.pdf>

⁴⁹⁴ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

carbon and nitrogen cycles, adopting good soil management practices is essential to decreasing emissions, enhancing carbon sequestration, and strengthening climate resilience⁴⁹⁵.

i. Intercropping⁴⁹⁶

Intercropping is the cultivation of multiple crops together to optimise space, nutrients, and biodiversity. There are four main types (Figure 77):

1. Row cropping/alley cropping involves crops planted in alternating rows (e.g., carrots and onions).
2. Mixed cropping is the cultivation of different compatible plants together without a specific arrangement (e.g., maize with beans).
3. Strip intercropping is when crops are grown in separate rows within the same field, balancing independence with microclimate interaction.
4. Relay (temporal) intercropping is when a slow-growing crop is planted alongside a faster-growing one, which is harvested first, allowing the slow crop to occupy the space fully (e.g., potatoes and pumpkins).

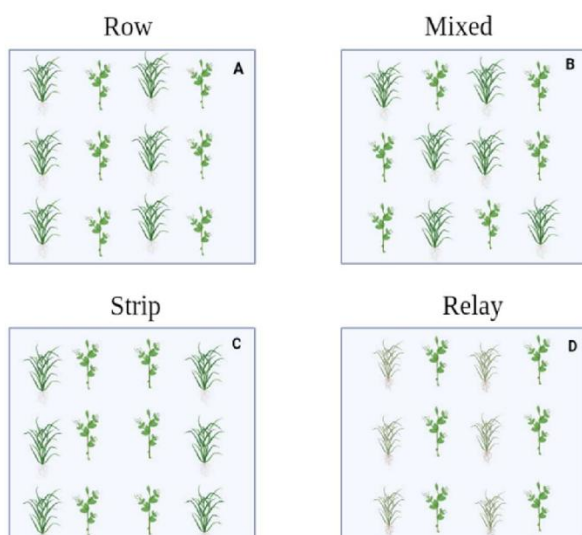


Figure 77. Main types of intercropping⁴⁹⁷.

Intercropping increases biodiversity, attracts pollinators, supports beekeeping, protects against pests, and improves yields. Crops should come from different plant families to minimise shared pests and optimise nutrient use across soil layers. Row width should balance independent management with mutual microclimate benefits.

Intercropping: practical examples and benefits⁴⁹⁸

- Examples:
 - In tomato fields, corn planted every 1.5 m provides shade for tomatoes, improves microclimate, and generates additional income.
 - Corn and beans can be grown together; corn supports climbing beans, while beans fix nitrogen, benefiting the corn.
 - Potato fields can include horse beans as mixed crops, improving overall yield.

⁴⁹⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁴⁹⁶ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁴⁹⁷ Guerchi, Amal & Mnafigui, Wiem & Mengoni, Alessio & Badri, Mounawer. (2023). Alfalfa (*Medicago sativa* L.)/Crops intercropping provides a feasible way to improve productivity under environmental constraints. [Available online.](#)

⁴⁹⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Location and implementation: Rasht Valley, Jafr Village; implemented by Public Organisation (PO) Rushnoi; seasonal activity; low-cost but requires knowledge of compatible crops.
- Climate and economic benefits:
 - Diversified plots help farmers cope with climate variability, extreme events, and exploit potential climate advantages (e.g., earlier planting or new varieties).
 - Increases harvest diversity and reduces total crop loss from pests and diseases.
 - Maintains soil fertility by preventing nutrient depletion.
 - Enhances biodiversity, attracting beneficial and predatory insects.
 - Prolonged flowering season supports beekeeping.
- Knowledge management and inclusiveness:
 - Farmers and village advisors received targeted training.
 - All farmers in the area were included in training and implementation.

ii. Crop rotation⁴⁹⁹

Crop rotation is the planned alternation of crops (and fallow) in the same field over time. It preserves soil structure, conserves biodiversity, prevents pests, and maintains soil fertility by ensuring crops with different nutrient requirements follow each other. Pulses (e.g., chickpeas, green peas, lentils) add nitrogen to the soil, supporting fertility and pollinators. Choosing suitable predecessor crops reduces soil-borne pathogens and pest risks.

- Examples of crop rotation schemes:
 - Pure fallow → Winter rye → Potato
 - Spring wheat + clover (with clover overseeding)
 - Good predecessors: tilled crops, annual legumes, winter crops; satisfactory: spring cereals
- Location and implementation:
 - Sughd region: Konibodom, Kuhistoni Mastchoh, J. Rasulov, B. Gafurov, Spitamen, Zafarobod.
 - Khatlon region: Jayhun, Vakhsh, Kushoniyon, A. Jomi
 - Implementing agency: Cooperative “Sarob”
 - Timeframe: seasonal activity
 - Budget: low-cost but requires knowledge of compatible crops
- Climate and economic benefits:
 - Increases overall resilience to climate change
 - Reduces harvest loss from pests (increasing with higher temperatures)
 - Mitigates wind and water erosion
 - Improves soil fertility, crop productivity, and quality
 - Reduces the need for additional fertilisers
 - Decreases crop contamination and susceptibility to diseases and pests
- Knowledge management and inclusiveness:
 - Cascade training: master trainers → field agronomists → farmers
 - Women trained as field agronomists to advise female farmers

⁴⁹⁹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Supporting materials: brochures and booklets

iii. Mulching⁵⁰⁰

Mulching involves applying a layer of organic material (grasses, hay, leaves, wood shavings, wool, manure, or hand-picked weeds) around trees or between crops. It helps retain soil moisture, provides nutrients, reduces weeds, prevents erosion, and mitigates heat stress. Cover crops planted after cash crop harvests also improve soil fertility and structure. Mulching is typically applied around tree holes in Tajikistan due to limited availability (Figure 78).



Figure 78. Mulching⁵⁰¹.

- Examples:
 - Circle radius for mulch: ~45 cm for shrubs, ~75 cm for medium-sized trees
 - Mulch under trees, shrubs, and perennial vegetables is replenished annually, improving soil structure after 2–3 years
 - Common cover crops: legumes (red clover, peas, beans), cereals (rye, wheat, oats), grasses (barley, ryegrass, millet), broadleaf species (buckwheat, mustard)
- Location and implementation:
 - Sughd region and Rasht valley

⁵⁰⁰ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁰¹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Implementing agencies: PITTU (named by Academician Osimi) and PO “Rushnoi”
- Timeframe: seasonal activity
- Budget: low-cost; availability of mulch may be a constraint
- Climate and economic benefits:
 - Adaptation: improved soil water storage, resilience to heavy rain, heat, and strong winds
 - Mitigation: increased soil carbon storage and reduced soil erosion
 - Reduced economic losses from soil degradation
 - Improved soil quality and fertility, leading to better future harvests
 - Harvested cover crops can enhance family nutrition or serve as fodder
 - Restoration of degraded land boosts yields and income
 - Water cost savings
- Knowledge management and inclusiveness:
 - Handouts, booklets, farmer field schools, field days, exchange visits, training events
 - Inclusive of all farmers, including women and other vulnerable groups
 - Documentation: GIZ guide on biodiversity-enhancing farming methods (RO Rushnoi); no public documentation from PITTU

iv. Vermicompost⁵⁰²

Vermicompost (biohumus) is a high-quality organic fertiliser produced through vermiculture, where specific worms (e.g., Californian worms) consume organic waste and excrete humate-rich pellets. Within 4–6 weeks, this material becomes nutrient-rich compost that enhances soil fertility, water retention, infiltration, carbon content, and overall soil health. Vermicomposting is faster and less demanding than traditional composting and can be produced at home or at scale.

- Location and implementation:
 - J. Rasulov, B. Gafurov, and Tursunzoda districts
 - Implementing agency: Cooperative Sarob
 - Timeframe: seasonal activity
 - Budget: low-cost
- Climate and economic benefits:
 - Improves soil fertility and health, supporting crop growth
 - Reduces the need for chemical fertilisers and pesticides
 - Effects last 4–5 years
 - Supports resilience to climate change through healthier soils
- Knowledge management and inclusiveness:
 - Farmer field schools, exchange visits, and training events
 - All farmers in the target villages were included
- Documentation:
 - booklets and brochures

⁵⁰² Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

v. Restoration of degraded areas⁵⁰³

Land degradation is a significant environmental challenge in Tajikistan, caused by soil erosion, salinisation, waterlogging, pollution, and loss of productivity. Restoration involves organic fertilisers (manure, compost), water-saving technologies, improved cultivation methods (crop rotation, intercropping), and introducing drought-resistant species. Drought-tolerant crops include beans, peas (cowpeas, black-eyed peas, field peas), quinoa, okra, summer squashes, sunflowers, and various herbs. Imported drought-resistant varieties like tomatoes have also been tested, though sustainability depends on local reproducibility. Combining drought-tolerant species with sound soil management enhances yields.

- Location and implementation:
 - Sughd region: Konibodom, Kuhistoni Mastchoh, J. Rasulov, B. Gafurov, Spitamen, Zafarobod
 - Khatlon region: Jayhun, Vakhsh, Kushoniyon, A. Jomi
 - Rasht and Zarafshon valleys
 - Implementing agencies: Cooperative Sarob, MSDSP, UNDP
 - Timeframe: long-term
 - Budget: high
- Climate and economic benefits:
 - Reduces land degradation and soil vulnerability
 - Improves agricultural resilience and adaptive capacity
 - Increases yields and reduces fertiliser needs
 - Generates additional income from newly cultivated areas
 - Reduces technical and mechanised labour requirements
- Knowledge management and inclusiveness:
 - Farmer field schools, exchange visits, and training events
 - All farmers in target villages were included
 - Documentation: booklets and brochures

vi. Planting in saline soil⁵⁰⁴

Soil salinisation is a significant challenge in Tajikistan, affecting over 12% of agricultural land. Even low salinity levels can reduce yields by up to 25%, mainly due to improper irrigation and declining groundwater levels. Salt-tolerant crops, including potatoes, pulses, maize, alfalfa (varieties Vakhsh 300, Kizilkesek, Evrika), and sorghum (ICSV-172, ICSV-745, Sugar Graze, Speed Feed), have been successfully cultivated in saline soils. These crops can be integrated into crop rotation systems to maintain productivity on affected lands.

- Location and implementation:
 - Asht district, Sughd region
 - Muminobod district, Khatlon region
 - Lakhsh district, Rasht valley
 - Implementing agencies: Soil Melioration Station of Sughd region, Caritas
 - Timeframe: seasonal activity
 - Budget: relatively high, depending on salinisation levels
- Climate and economic benefits:
 - Improves soil resilience and adaptive capacity to climate change
 - Enables productive use of previously unproductive salinized land

⁵⁰³ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁰⁴ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Supports fodder production and livestock rearing, providing additional income
- Reduces vulnerability of agricultural systems to salinity-related losses
- Knowledge management and inclusiveness:
 - Farmer field schools, exchange visits, training events
 - Targeted at farmers and landowners affected by salinity
 - Documentation: brochures, booklets, scientific articles, dissertations

vii. Restoration of pastureland⁵⁰⁵

Degraded natural pastures in Tajikistan often suffer from overgrazing and low soil cover. Restoration begins with fencing to protect and regenerate vegetation, followed by re-seeding with fodder crops. Commonly used species include asparagus and alfalfa, while native grasses and herbaceous plants are preferred for promoting biodiversity and resilience to drought, pests, and diseases. Minimal cultivation preserves root systems, allowing regrowth once herbivores are introduced.

- Location and implementation:
 - Rasht valley
 - Implementing agency: PO “Rushnoi”
 - Timeframe: seasonal activity
 - Budget: high, particularly for fencing, often beyond farmers’ own resources
- Climate and economic benefits:
 - Reduces wind-blown sediment and soil degradation
 - Improves soil quality, biomass, and feed quantity/quality
 - Increases farm income through better fodder production
 - Reduces surface runoff and prevents gullies and ravines
- Knowledge management and inclusiveness:
 - Farmer field schools
 - All farmers in the target villages were included
 - Documentation: manuals, booklets, brochures

Since 2014, the Mountain Societies Development Support Programme (MSDSP) and the Aga Khan Foundation (AKF) have supported 326,000 farmers in Tajikistan to adapt to climate change, enhance food security and nutrition, and reduce risks in disaster-prone mountain areas. Within this work, MSDSP and AKF have focused on soil fertility and land quality, improving agricultural productivity in resource-poor mountain regions. Interventions have included the development of new arable land and providing sustainable access to fertiliser and other soil inputs through 137 Agricultural Input Revolving Funds, which have reached 17,684 smallholder farmers, more than half of whom are women. These initiatives strengthen household resilience by ensuring farmers can sustain soil productivity under changing climate conditions⁵⁰⁶.

6.2.2. Plant Management

Good plant management is critical worldwide for ensuring high agricultural yields, preventing pests, and sustaining food and nutrition security. In Tajikistan, however, suboptimal plant management practices are frequently observed, leading to lower crop productivity and disruption of agroecosystem stability. Farmers in the country have successfully tested and

⁵⁰⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁰⁶ <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

adopted sustainable plant management practices, technically and environmentally sound methods that prevent or reduce common agricultural production problems. Key approaches include diversification of species and crop varieties, which enhance resilience to extreme climate events such as frost, heavy rainfall, and strong winds, as well as climate-adaptive cultivation techniques and effective pest management strategies⁵⁰⁷.

In Tajikistan, the country's diverse agroecosystems require careful consideration of ecological conditions when selecting crop species, varieties, and cultivation schemes. Climatic variability and changing weather patterns make it essential for farmers to assess their plots and plan their cultivation season accordingly. Agricultural planning tools, such as farm maps that indicate water availability, wind patterns, and sun exposure, can guide the selection of species best suited to each plot. While market demand is important for ensuring the harvest sale, successful cultivation depends on balancing economic opportunities with the ecological suitability of the chosen crops⁵⁰⁸.

Ecological planting calendars are another valuable tool that can be developed through farmer field schools, tailored to each area's specific climatic conditions and the cultivated crops' requirements. These calendars help farmers choose varieties with suitable growing seasons, including those with extended maturation periods, while accounting for traditional Tajik vegetables that may become more challenging to grow under changing climate conditions. Adjustments to sowing and harvesting times, such as earlier sowing when soil moisture, air humidity, and temperature are optimal, can ensure crops mature effectively despite shifting climate patterns. An example of such a calendar for Savnob and Roshorv, Tajikistan, is available [here](#)⁵⁰⁹.

Seed availability and quality remain major challenges in Tajikistan, representing a key constraint to closing the country's yield gap. Farmers obtain seeds through self-reproduction, market purchases, service providers, or development projects. With few official seed banks and limited capacity for quality testing, farmers often cannot reliably assess the quality of seeds they use.⁵¹⁰

⁵⁰⁷ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁰⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁰⁹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵¹⁰ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)



Figure 79. Personal seedbank in Rasht Valley, Tajikistan⁵¹¹.

Seed choice depends on multiple factors, including purpose (fresh consumption or processing), productivity, physical characteristics, transportability, seasonality, disease resistance, growing conditions, and whether the seed is treated. Seeds are generally classified as open-pollinated (varietal) or hybrid (Table 13):⁵¹²

- Open-pollinated seeds result from natural pollination, producing plants similar to the parent and can be reused for several generations.
- Hybrid seeds are produced by controlled cross-pollination of different varieties to improve quality and yield, but cannot be reliably reproduced by farmers. Misuse of hybrid seeds in subsequent seasons can drastically reduce yields.

Table 13. Key differences between varietal and hybrid seeds.

Feature	Varietal	Hybrid
Parentage	Single	Two or more
Isolation requirement	Lower	Higher
Pollination	Open	Controlled
Reusability	3–5 generations	Must replace every season
Production care	Less	More
Yield	Lower	Higher
Profit	Lower	Higher

While hybrid seeds often yield more, they create dependency on imported seeds and are economically challenging for farmers to sustain. Tajikistan lacks varietal development and testing programmes, and the private sector's involvement in seed multiplication and

⁵¹¹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵¹² Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

distribution is minimal. Seed inspection, certification, and testing capacities are very limited, causing market mixing of local, imported, and hybrid seeds. This leads to variety loss, reduced harvests, and heightened vulnerability to climate change. Until an effective governmental seed system is established, local private seed production remains essential to meet demand and reduce import dependency⁵¹³.

i. Plant diversification⁵¹⁴

Seed banks and nurseries

- **Seedbanks:** In Rasht and Aini, local varieties of grains, vegetables, and fruits were collected from villages to create community-managed seed funds. These rudimentary seedbanks preserve local varieties and farmer independence, enabling minimal genetic exchange. Women run both seedbanks, which can be visited in Jafr and Mazor villages of the Rasht district. No seed analysis or breeding takes place.
- **Nurseries/Orchards:** Traditional or semi-intensive orchards using local varieties are cheaper to establish (requiring ~500–600 plants/ha versus 2600–3125 for intensive orchards) and allow intercropping with vegetables or fodder crops, often offsetting potential economic disadvantages. Local varieties also bear fruit longer (30–50 years versus 10–12 years).
- **Practice details:**
 - Location: Rasht valley
 - Implementing agency: PO “Rushnoi”
 - Timeframe: Seasonal for crops, up to 15 years for orchards
 - Budget: Low cost but requires access to local seedbanks and nurseries
- **Climate change and environmental benefits:**
 - Preserves traditional species and diversified landscapes, increasing resilience
 - Reduces pesticide use and irrigation needs
 - Stabilises production
- **Knowledge management and inclusiveness:**
 - Farmer field schools, field days, exchange visits, and training events were conducted, with a focus on women
- **Documentation:**
 - Available in brochures and local project materials

ii. Crop diversification⁵¹⁵

This practice focuses on increasing plant yield, quality, health, nutritional value, and resistance to diseases, pests, and environmental stresses. Crop diversification involves incorporating new or improved species into agricultural production, considering value-added crops that offer additional market opportunities.

Drivers of crop diversification include:

- Increased incomes for small farms;

⁵¹³ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵¹⁴ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵¹⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- improved resilience to price fluctuations;
- risk mitigation from climate variability;
- balanced food demand and nutrition requirements; and
- improved fodder for livestock

Climate change in Tajikistan has altered agroecological conditions, creating challenges and opportunities. Projects have introduced drought-resistant species (e.g., melons, pumpkins, corn) and non-traditional crops (e.g., red beans, coriander, radish), enabling farmers to generate additional income after main crop harvests.

- Practice details:
 - Location: Devashtich district, jamoats Mujun, Vahdat, and I. Somoni
 - Implementing agency: ICPO JOVID
 - Timeframe: Seasonal activity
 - Budget: Low cost but requires knowledge of compatible crop combinations
- Climate change and environmental benefits:
 - Enhances plant resistance to stresses related to climate change
 - Diversified plots help farmers cope with uncertainties, as another can offset the poor performance of one crop
- Knowledge management and inclusiveness:
 - Farmers trained through training events, Farmer Field Schools (FFS), and demo plots
 - Targeted support for women and youth
- Documentation:
 - Booklets

iii. Plant management techniques under a changing climate⁵¹⁶

Frost protection measures in orchards and vineyards

Late frosts in March and April have become increasingly common in Tajikistan, particularly in the Sughd region. These frosts pose severe risks to blossoming fruit trees such as apricot, almond, peach, cherry, apple, plum, pear, grapevines, and potatoes. Damage to blossoms leads to significant harvest losses. Farmers, therefore, apply a range of measures to mitigate frost damage and protect yields.

- Main methods applied include:
 - Smoke: A traditional and widely used technique, where bonfires are lit on the leeward side of orchards to create a smoke curtain that increases air temperature by several degrees. Effective for frosts not below -4°C.
 - Soil management: Moist soils absorb and release more heat, providing natural protection at night and early morning.
 - Mulching and hilling: Stems are covered with soil, straw or mulch to insulate plants.
 - Root top dressing: Compost or sand is spread over fields to protect roots.
 - Tree covering: Burlap, sheets or tarps are used to trap ground heat.
 - Fertilisation and watering: Micronutrient sprays and pre-frost irrigation slow down tree awakening and reduce frost susceptibility.
 - Prolongation of resting phase: Winter irrigation in January–February or application of Aria oil delays flowering, reducing exposure to late frost.

⁵¹⁶ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Practice details:
 - Location: Sughd region, Asht district
 - Implementing agencies: PO Neksigol Mushovir, PITTU
 - Timeframe: Seasonal activity
- Climate change and environmental benefits:
 - Enhances adaptation to increasingly frequent late spring and early winter frosts
 - Protects crop yields and reduces losses from climate-induced frost events
- Economic considerations:
 - Costs vary depending on method, with some practices relatively expensive for smallholders in Tajikistan
- Knowledge management and inclusiveness:
 - Farmers are supported through SMS early warnings, training, manuals, brochures, online resources (e.g., Hosil.tj) and agricultural recommendations published in Agroinform.tj
 - Practices apply to all orchard and vineyard farmers
- Documentation:
 - Booklets, brochures, expert agricultural recommendations, online resources

Prolongation of the agricultural season⁵¹⁷

Climate change brings additional stressors to agriculture and creates new opportunities. Long-term meteorological data show an increase in days with temperatures above 10°C after the normal harvesting period for winter crops. In Tajikistan, this now averages 100–110 days in Sughd, 120–130 days in the Gissar Valley, and 140–150 days in Bokhtar and Kulob. This extended period allows farmers to cultivate one additional cycle of grain or vegetables. Crop and variety choice must consider the available growing days, local wind conditions, and altitude. Low-growing, wind-resistant varieties are recommended where winds are strong.

- Practice details:
 - Location: Sughd region
 - Implementing agency: Polytechnic Institute of the Tajik Technical University named after academician M. Osimi (PI TUT, Khujand).
 - Timeframe: Seasonal activity
 - Budget: Low cost but requires good knowledge of suitable species
 - Climate change and environmental benefits:
 - Increases economic resilience by enabling an additional harvest
 - Makes productive use of extended warm periods caused by climate change
- Economic considerations:
 - Low direct cost but requires informed seed selection
 - Provides additional income from one more cultivation cycle
- Knowledge management and inclusiveness:
 - Promoted through training events and field exchange visits
 - Practice applicable to both smallholders and commercial farmers
- Documentation:
 - Training materials, handouts, and extension guidance

⁵¹⁷ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

Solar greenhouses⁵¹⁸

In Tajikistan's mountainous regions, winters are extremely cold (often below -30°C) with low precipitation (<300 mm annually), but solar radiation is strong. Solar greenhouses use this natural energy to enable vegetable cultivation almost year-round, improving food security and income generation. They are particularly valuable where resources are scarce and outdoor agriculture is limited. Greenhouses are best built on open land with abundant sunlight, access to water, and stable soils.

Key construction features include:

- East–west orientation for maximum sun exposure (Figure 80)
- Trench foundation (1 m deep, with manure and fertile soil for insulation and fertilisation)
- Double clay walls with insulation (straw, sawdust, or other organic material) to store and release heat
- Internal thermal mass (mud bricks, stones) for night-time warmth

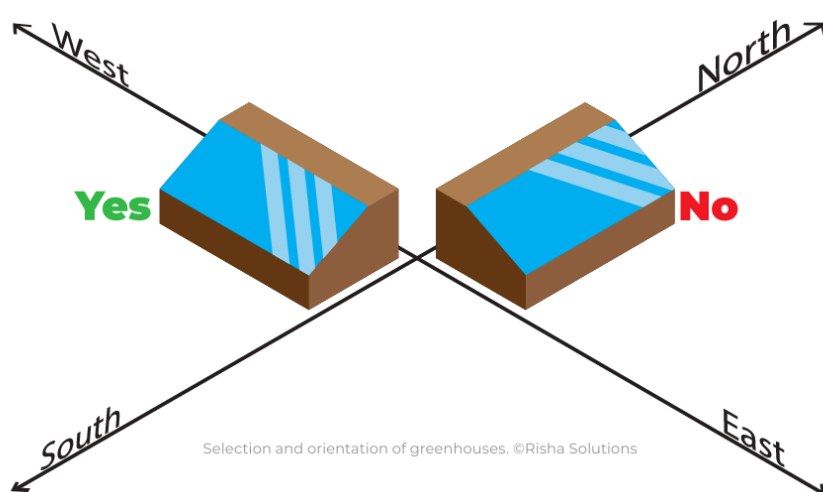


Figure 80. Greenhouse orientation, Tajikistan⁵¹⁹.

- Practice details:
 - Location: Aini, Asht, Kulob, B. Gafurov, J. Rasulov, and Spitamen districts
 - Implementing agency: Geres
 - Timeframe: Continuous use after construction
 - Budget: High initial investment, but long-term benefits
- Climate change and environmental benefits:
 - Provides protected production against climate variability and extremes
 - Enables fresh vegetable production in winter
 - Efficient use of solar energy and organic insulation materials
- Economic considerations:
 - High installation cost but creates reliable income opportunities
 - Provides food security and reduces dependence on imports in remote areas
- Knowledge management and inclusiveness:

⁵¹⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵¹⁹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Implemented through Training of Trainers (ToT), field schools, exchange visits, and farmer demonstrations
- Accessible to mountain farmers, particularly in resource-limited areas
- Documentation:
 - Manuals, brochures, posters, training materials, and publications

Basic plastic greenhouses and tunnels

Greenhouses and low tunnels are increasingly used in Tajikistan to protect crops from frost and extend the growing season. By creating a controlled microclimate, these structures shield plants from temperature extremes, wind, and precipitation, supporting early planting and improved yields.

- Main methods applied include:
 - Plastic-covered greenhouses for vegetables, seedlings, and fruit saplings
 - Low tunnels made of plastic film stretched over wire frames for small-scale crop protection
 - Combined use with heating, mulching, and irrigation to enhance effectiveness
- Practice details:
 - Location: Widely used across Tajikistan, especially in peri-urban areas and regions with high vegetable production
 - Implementing agencies: Farmers, cooperatives, local agribusinesses, NGOs, and extension services
 - Timeframe: Year-round use, with peak importance in winter and early spring
 - Budget: Moderate to high, depending on structure type, size, and materials
- Climate change and environmental benefits:
 - Protects crops from frost, hail, and heavy rainfall
 - Extends the cultivation season and increases food security under changing climate conditions
 - Reduces reliance on imports by enabling local production of off-season vegetables
- Economic considerations:
 - Requires initial investment, but provides higher returns through extended production and reduced crop losses
 - Particularly beneficial for high-value vegetable and fruit crops
- Knowledge management and inclusiveness:
 - Farmers receive training from NGOs, cooperatives, and government extension services
 - Accessible to smallholders and women when supported by microfinance or cooperative initiatives
- Documentation:
 - Promoted through demonstration plots, extension manuals, and agricultural guides

The FAO and the Ministry of Agriculture of Tajikistan launched a pilot project in 2020 in the Khatlon region to develop sustainable, high-yield greenhouse vegetable production. One example was a 100 m², optimised smart greenhouse equipped with insect nets, a ventilation system, a drip irrigation system, and a double-door entrance to prevent pest intrusion. These features ensured better temperature, humidity, nutrition, pest and disease control while reducing water use and reliance on chemical pesticides. This pilot site produced 8 t cucumbers

and 8 t tomatoes/year, improving annual income to TJS120,000 (approximately US\$11,000), stabilising yields against erratic weather⁵²⁰.



Figure 81. Greenhouse pilot project, Khatlon, Tajikistan⁵²¹.

iv. Other plant management techniques

Technical solutions are complemented by ecosystem-based approaches such as mulching, agroforestry, and raised bed cultivation to enhance soil moisture retention and adaptive capacity⁵²². Strengthening the operational capacity of Water User Associations (WUAs) remains a cross-cutting priority to ensure the sustainability of local water management systems⁵²³. In mountain slopes: terracing, planting native grasses, shallow runoff-trenching, wetland restoration to reduce erosion, recharge groundwater, slow runoff and buffer droughts and floods^{524,525}. Further plant management techniques used in Tajikistan are discussed below.

*Terracing*⁵²⁶

Terracing is the practice of creating levelled surfaces on sloped, hilly, or mountainous terrain to make land suitable for cultivation. It reduces soil erosion, improves water infiltration, and increases arable land, making it highly relevant in Tajikistan, where steep slopes are common. Though labour-intensive, it is relatively low-cost and has been applied since 2001 on both small and large plots. Farmers report reduced erosion, improved soil fertility, and increased yields within a few years.

⁵²⁰ <https://www.fao.org/europe/resources/stories/details/innovative-farming-in-tajikistan/en>

⁵²¹ <https://www.fao.org/europe/resources/stories/details/innovative-farming-in-tajikistan/en>

⁵²² <https://news.mongabay.com/2018/11/agroforestry-saves-soil-and-boosts-livelihoods-in-tajikistan/>

⁵²³ World Bank 2023. Modernising Irrigation Infrastructure under the SWIM Project. [Available online.](#)

⁵²⁴ <https://www.worldbank.org/en/news/press-release/2022/02/25/tajikistan-to-protect-its-natural-resources-and-increase-climate-resilience-with-world-bank-support>

⁵²⁵ <https://www.slideshare.net/slideshow/german-kust-sustainable-land-management-oriented-projects-in-tajikistan-experience-and-lessons-learned/18660723>

⁵²⁶ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

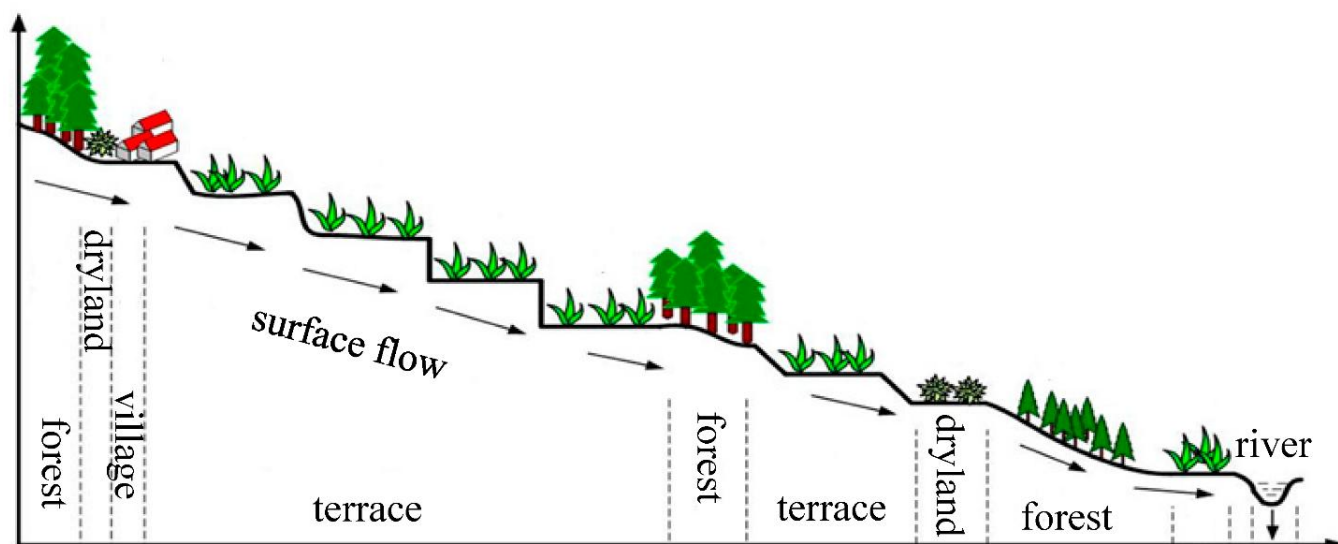


Figure 82. Terracing⁵²⁷

- Main methods applied include:
 - Levelling of slopes into terraces on land with >20% gradient (also used on flatter areas to prevent erosion)
 - Application on both small plots and large fields (>30 ha)
 - Maintenance through seasonal labour inputs
- Practice details:
 - Location: Zindakon village, Aini district
 - Implementing agencies: PO IPD, Welthungerhilfe
 - Timeframe: Seasonal activity
 - Budget: Low-cost but labour-intensive
- Climate change and environmental benefits:
 - Reduces soil erosion and nutrient runoff
 - Saves irrigation water and fertilisers (3–5 times efficiency gain)
 - Prevents landslides and mudflows during heavy rains
 - Improves food, fodder, and wood production
- Economic considerations:
 - Low financial cost, but requires substantial manual labour
 - Yield increases seen within 3–4 years
- Knowledge management and inclusiveness:
 - Farmers trained through FFS, demo plots, and training events
 - Applicable especially for smallholders in mountainous regions
- Documentation:
 - Manuals, booklets, brochures, posters, publications

*Fencing with natural materials*⁵²⁸

Farmers in Tajikistan commonly construct fences for their fields and orchards using natural materials. These fences protect crops from livestock and wildlife, reduce wind speed, and, in

⁵²⁷ <https://ar.inspiredpencil.com/pictures-2023/terracing-diagram>

⁵²⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

some cases, help prevent soil erosion. They are low-cost, use locally available resources, and can be maintained by households.

- Main methods applied include:
 - Fences made from branches, reeds, shrubs, or other vegetation
 - Live fencing through planting trees or shrubs along boundaries
 - Combination with other measures (e.g., hedgerows for windbreaks)
- Practice details:
 - Location: Various regions of Tajikistan
 - Implementing agencies: Local farmers, community groups, NGOs
 - Timeframe: Permanent, with periodic maintenance
 - Budget: Very low-cost, based on local resources
- Climate change and environmental benefits:
 - Protects fields from grazing animals and reduces crop losses
 - Provides wind protection, reducing soil erosion and moisture loss
 - Contributes to biodiversity when live fences are used
- Economic considerations:
 - Low or no financial costs, but requires labour for construction and upkeep
 - Reduces risks of livestock damage, helping secure yields
- Knowledge management and inclusiveness:
 - Knowledge transferred through traditional practice and peer learning
 - Accessible to all farmers due to reliance on local, freely available materials
- Documentation:
 - Local agricultural manuals, demonstration plots, farmer exchange visits

*Early cultivation of seedlings*⁵²⁹

Farmers in Tajikistan increasingly use seedling nurseries to extend the growing season and secure higher yields. Seedlings are cultivated in protected environments before being transplanted into open fields, which reduces vulnerability to early frosts and shortens the time needed for crops to mature in the field.

- Main methods applied include:
 - Seedbeds or trays placed in small greenhouses, cold frames, or covered areas
 - Early sowing of vegetables such as tomatoes, cucumbers, peppers, and cabbage
 - Transplantation into fields once weather conditions become favourable
- Practice details:
 - Location: Widespread across Tajikistan, particularly in valleys and peri-urban areas
 - Implementing agencies: Individual farmers, cooperatives, NGOs, agricultural institutes
 - Timeframe: Seasonal activity (spring and early summer)
 - Budget: Low to medium cost, depending on the infrastructure used
- Climate change and environmental benefits:
 - Reduces risks of crop failure due to late frosts or shortened growing seasons

⁵²⁹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Increases food security and resilience against climate variability
- Allows efficient use of land and water resources
- Economic considerations:
 - Generates earlier harvests, increasing potential market prices
 - Requires initial investment in seedling structures but has long-term benefits
- Knowledge management and inclusiveness:
 - Disseminated through farmer field schools, agricultural extension services, and peer exchanges
 - Accessible to smallholders, women, and youth with low entry barriers
- Documentation:
 - Farmer manuals, demonstration sites, and training workshops

*Mulching*⁵³⁰

Mulching is a widely adopted practice in Tajikistan to protect crops and fruit trees from frost, conserve soil moisture, and improve soil fertility. By covering the soil surface with organic or synthetic materials, mulching reduces temperature fluctuations and protects plant roots and stems during cold spells.

- Main methods applied include:
 - Application of straw, leaves, grass clippings, compost, or other organic matter around plant bases
 - Use of plastic films or agro-fabric in vegetable cultivation
 - Layer thickness adjusted to ensure insulation without smothering roots
- Practice details:
 - Location: Various regions of Tajikistan, common in orchards and vegetable plots
 - Implementing agencies: Farmers, supported by NGOs, cooperatives, and local agricultural extension services
 - Timeframe: Seasonal activity, applied before winter and maintained into spring
 - Budget: Relatively low-cost, materials often sourced locally
- Climate change and environmental benefits:
 - Protects crops against frost damage and temperature fluctuations
 - Conserves soil moisture, reducing irrigation demand
 - Improves soil fertility and structure over time
- Economic considerations:
 - Cost-effective adaptation measure accessible to most farmers
 - Enhances crop yields and reduces risk of losses from extreme temperatures
- Knowledge management and inclusiveness:
 - Promoted through training manuals, farmer field days, and extension services
 - Accessible to smallholders, including women and vulnerable households
- Documentation:
 - Included in agricultural recommendations, demonstration projects, and practical farmer guides

⁵³⁰ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

*Agroforestry and shelterbelts*⁵³¹

Agroforestry practices, including forest belts and shelterbelts, are used in Tajikistan to protect farmland from wind and water erosion, improve soil moisture retention, and provide habitat for beneficial insects and wildlife. These systems combine trees, shrubs, and crops on the same land to enhance resilience and productivity.



Figure 83. Forest shelter belt⁵³².

- Main methods applied include:
 - Planting rows of tall trees (e.g., poplars) along field boundaries
 - Integrating smaller fruit, nut, or thorny shrubs (e.g., rosehip, sea buckthorn) within the belts
 - Using belts as natural windbreaks, erosion barriers, and microclimate regulators
- Practice details:
 - Location: Rasht Valley, Pamir, Asht, Aini, Gorno Matcha, and other mountainous areas
 - Implementing agencies: WHH, PO Rushnoi, GIZ, and local farmers
 - Timeframe: 3–5 years, depending on tree and shrub composition
 - Budget: Medium costs, depending on plant species, size, and spacing
- Climate change and environmental benefits:
 - Reduces soil erosion and landslide risks
 - Improves water retention in soils
 - Provides habitat for pollinators and beneficial insects
 - Protects crops from wind, drought, and climate variability
- Economic considerations:
 - Provides additional income through fruit, nuts, and firewood
 - Increases long-term productivity of farmland
- Knowledge management and inclusiveness:
 - Farmers receive training through field days, demonstrations, and exchange visits
 - Particularly suitable for smallholder farmers in mountainous regions
- Documentation:
 - Manuals, booklets, brochures, posters, field guides

⁵³¹ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵³² Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

*Riverbank protection*⁵³³

Riverbank protection in Tajikistan strengthens the shores of natural and artificial water streams to prevent soil erosion, landslides, and mudflows, especially in steep valleys (Figure 84). Living (trees and shrubs) or non-living materials stabilise banks while also providing additional environmental and economic benefits.



Figure 84. Tajikistan river valley with riverbank protection⁵³⁴.

- Main methods applied include:
 - Planting fruit trees and shrubs along riverbanks
 - Building catchment dams using living or non-living materials
 - Annual reinforcement of vulnerable river stretches
- Practice details:
 - Location: J. Rasulov, Asht, and Lakhsh districts
 - Implementing agencies: PO Jovid, WFP, ACTED, PO IPD, UNDP Rasht, PO “Development of Cross Border Relations in Jirgatal,” and local farmers
 - Timeframe: Seasonal activity, reinforced yearly
 - Budget: Low cost, requires knowledge of species and planting techniques
- Climate change and environmental benefits:
 - Reduces soil loss, surface runoff, and erosion
 - Protects against landslides and mudflows
 - Provides habitat for pollinators and beneficial insects
- Economic considerations:
 - Protects arable land and harvests from erosion
 - Potential additional income from trees and shrubs cultivated along banks

⁵³³ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵³⁴ <https://wallpapers.com/wallpapers/tajikistan-river-valley-da2mj79snkct5wws.html>

- Knowledge management and inclusiveness:
 - Farmers trained through practical seminars and field days
 - Targeted at local smallholder farmers
- Documentation:
 - Handouts, field guides, training materials

*Grafting of fruit and nut trees*⁵³⁵

Grafting is an ancient technique to propagate fruit and nut trees by merging a scion with a rootstock (Figure 85). It enables the cultivation of multiple varieties on the same tree, rejuvenates ageing trees, and improves productivity, immunity, and climate resilience.



Figure 85. Grafting fruit trees⁵³⁶.

- Main methods applied include:
 - Cultivating new plants from root shoots or seedlings
 - Grafting several varieties onto a single tree
 - Forming the desired crown shape
 - Replacing or rejuvenating tree varieties without uprooting
- Practice details:
 - Location: Rasht valley, Tojikobod
 - Implementing agencies: Local farmers trained by FFS and demo plots
 - Timeframe: Seasonal activity
 - Budget: Low cost, primarily knowledge-intensive
- Climate change and environmental benefits:
 - Enhances resilience to harsh climates and diseases
 - Extends the productive lifespan of trees
- Economic considerations:
 - Faster harvest gains through new grafts
 - Reduced risk of harvest loss
 - Allows cultivation in conditions usually unsuitable for certain varieties

⁵³⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵³⁶ <https://bifruit.club/2018/02/20/our-march-grafting-event-is-coming/>

- Knowledge management and inclusiveness:
 - Farmers trained through field events and FFS
 - Accessible to all farmers in the target region
- Documentation:
 - Not specified

*Regional seed exchange*⁵³⁷

A regional seed exchange system enables farmers to store, multiply, and share high-quality local seeds. It ensures seed availability for the next planting season, reduces dependence on external suppliers, and promotes biodiversity and crop diversity.

- Main methods applied include:
 - Establishing local seed banks
 - Facilitating seed exchange among farmers
 - Conducting seed quality analysis
 - Providing training on seed storage
- Practice details:
 - Location: Rasht valley and Sughd region
 - Implementing agencies: PO Rushnoi, PO ASDP Nau
 - Timeframe: Seasonal activity
 - Budget: Low-cost farmer-driven model or higher-cost project-supported model
- Climate change and environmental benefits:
 - Improves biodiversity
 - Supports sustainable land use and reclamation
 - Enables efficient use of irrigation water
- Economic considerations:
 - Diversifies production and income
 - Increases sown area and quality of harvest
 - Provides opportunities to sell products
- Knowledge management and inclusiveness:
 - ToT, exchange visits, and field days
 - Mostly subsistence farmers benefit
- Documentation:
 - Manuals, booklets, brochures

*Integrated pest management (IPM)*⁵³⁸

IPM combines multiple pest control techniques to reduce pest populations while minimising risks to human health, the environment, and farm economics (Figure 86). It includes agrotechnical practices, crop rotation, biological controls, and careful monitoring of pest and disease pressures.

⁵³⁷ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵³⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

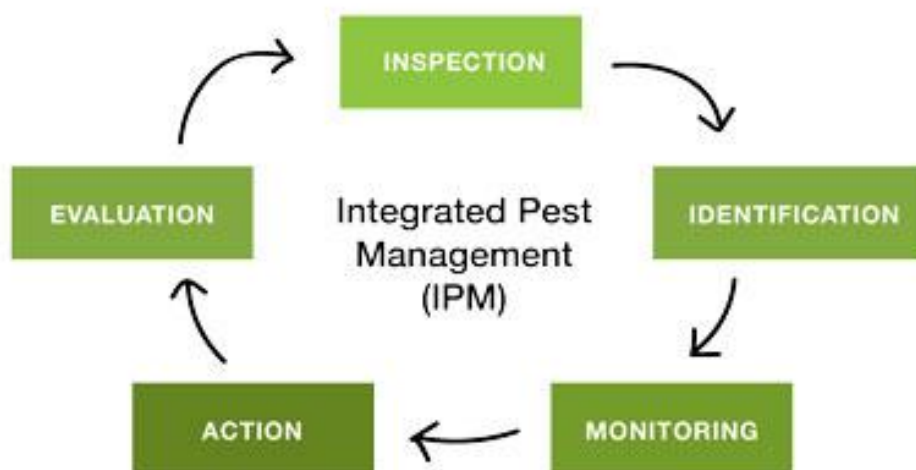


Figure 86. Integrated pest management steps.

- Main methods applied include:
 - Crop rotation, tillage, and proper seed handling
 - Timing and methods of sowing, fertilisation, and harvesting
 - Biological pest control using natural predators (birds, insects, frogs, toads)
 - Diversification of the farming system to increase resilience
- Practice details:
 - Location: All regions of Tajikistan
 - Implementing agencies: Sarob, PO Neksigol, PO IPD, DAI
 - Timeframe: Seasonal activity
 - Budget: Low-cost, requires knowledge of IPM
- Climate change and environmental benefits:
 - Enhances resilience to emerging pests and diseases due to climate change
 - Reduces pesticide use, fuel, equipment, and labour inputs
- Economic considerations:
 - Cost-effective by avoiding unnecessary pesticide application
 - Protects the yield and quality of crops
- Knowledge management and inclusiveness:
 - Field schools (FFS) and training events for all farmers
- Documentation:
 - Booklets, brochures, posters, manuals

MSDSP and AKF programmes promote sustainable crop and plant management practices to strengthen farm resilience and improve nutrition. This includes the introduction of resilient seed varieties adapted to climate change and measures to increase crop diversity, yields and nutritional value. To enhance long-term income security and resilience, MSDSP and AKF support establishing orchards and promoting agroforestry practices, which improve soil conservation and biodiversity while diversifying farmer livelihoods in mountain regions⁵³⁹.

⁵³⁹ <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

6.2.3. Water management practices

In Tajikistan, climate-resilient agriculture is increasingly shaped by decentralised, low-cost water infrastructure tailored to smallholder farming systems, particularly those led by women. Integrated watershed and land management interventions, supported by UNDP in mountainous districts such as Ayni and Panjakent, have included the construction of gabion check dams, contour bunds, and infiltration trenches to reduce flood risks and improve soil moisture retention⁵⁴⁰. Complementary efforts have introduced gravity-fed drip irrigation in orchards and garden plots, improving water-use efficiency, reducing surface runoff, and boosting crop yields⁵⁴¹. FAO has similarly distributed household-scale drip kits, comprising high-capacity tanks, drip lines, vegetable seeds, and saplings, to women-led households in Khatlon Province to support year-round food production under water scarcity conditions⁵⁴². These irrigation systems, designed for gravity-based low-pressure application, deliver water directly to plant roots, enabling precise water control and minimising losses through evaporation or overuse⁵⁴³. They are well-suited for diverse agro-ecological zones, including drought-prone areas and peri-urban gardens. In addition to drip irrigation, sprinkler systems are used on larger fields to improve distribution uniformity, particularly where pressurised systems are feasible⁵⁴⁴. Despite its economic significance, water use efficiency in agriculture remains low. The cost of irrigation per cubic metre is minimal, exacerbating water scarcity and undermining food security in rural areas. Efficient water management is therefore critical to optimise irrigation, reduce water losses, enhance wastewater reuse, conserve ecosystems, and improve agricultural productivity. A key challenge during the growing season is the uneven distribution of irrigation water, with farmers often receiving water on a rotational basis. Rational water use aims to ensure the equitable and efficient allocation of available water resources among irrigation users, supporting sustainable agriculture and climate-resilient livelihoods. Further low-tech and high-tech solutions and infrastructure management in Tajikistan are discussed below⁵⁴⁵.

i. Canal rehabilitation and infrastructure modernisation

The World Bank, USAID, and ADB-funded projects to modernise the Soviet-era Chubek irrigation system (CIS) in southern Tajikistan included canal rehabilitation, pump modernisation, and new drainage for irrigated land to improve efficiency in peak-drought months^{546,547,548}. Ongoing infrastructure upgrades under UNDP-IsDB and World Bank–EU-supported initiatives have reinforced climate resilience through the rehabilitation of irrigation canals and small pump stations, coupled with the modernisation of intake structures, canal lining, and the automation of headworks^{549,550}. Measures include mechanised canal cleaning, pump retrofitting, and erosion protection works to secure infrastructure against floods and mudflows.

District-level investments reported in late 2025 further illustrate the expansion of climate-resilient irrigation infrastructure in northern Tajikistan. In Penjikent, the ongoing restoration of the Gurbik Canal is expected to expand reliable irrigation coverage to approximately 190 ha

⁵⁴⁰ UNDP 2022. Integrated Watershed and Sustainable Land Management in Tajikistan. [Available online.](#)

⁵⁴¹ UNDP 2022. Drip irrigation helps farmers in Tajikistan grow crops and adapt to climate change. [Available online.](#)

⁵⁴² FAO 2023. Drip irrigation boosts water efficiency for Tajik farmers. [Available online.](#)

⁵⁴³ World Bank 2023. Modernising Irrigation Infrastructure under the SWIM Project. [Available online.](#)

⁵⁴⁴ UNDP 2023. Water Resources Management in Khatlon Region. [Available online.](#)

⁵⁴⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁴⁶ <https://dai-global-developments.com/articles/uniting-tajikistans-farmers-to-fix-broken-irrigation-systems/>

⁵⁴⁷ <https://www.worldbank.org/en/news/press-release/2023/04/19/water-and-irrigation-management-project-kicks-off-in-tajikistan>

⁵⁴⁸ <https://www.worldbank.org/en/news/press-release/2022/06/23/tajikistans-water-sector-to-benefit-from-additional-world-bank-support>

⁵⁴⁹ World Bank 2023. Modernising Irrigation Infrastructure under the SWIM Project. [Available online.](#)

⁵⁵⁰ World Bank 2021. Tajikistan Resilient Irrigation Project. [Available online.](#)

of agricultural land. The project involves the rehabilitation of 3,500 m of canal, including the replacement of 1,200 m of pipe infrastructure, and the construction of three water storage reservoirs using geomembrane technology, each with a capacity of 1,500 m³. These upgrades will increase irrigated area from 80 ha to include an additional 110 ha of newly developed land in surrounding mountainous villages, improving water availability in areas previously constrained by topography and seasonal scarcity. The rehabilitated system will support the establishment of climate-appropriate orchards, including almond, pistachio, apple, and apricot, using modern drip irrigation to enhance water-use efficiency and crop productivity. The Gurbik Canal restoration forms part of broader local and partner-supported efforts to modernise agricultural water management, improve irrigation efficiency, and strengthen food security and climate resilience in Penjikent District⁵⁵¹.

In Khatlon Region, a project implemented by the Regional Environmental Centre for Central Asia (CAREC) with financial support from The Coca-Cola Foundation demonstrates the effectiveness of integrated canal rehabilitation and water-use efficiency measures at the community level (Figure 87). Launched in April 2024 under the initiative Increasing Economic Independence and Improving the Status of Women in Central Asia through Access to Irrigation Water and Infrastructure, the project rehabilitated canals, restored abandoned agricultural lands, and installed drip irrigation systems within the pilot Panjrud Water Users Association. Comprehensive rehabilitation covered 400 ha of irrigated land, improved the reclamation of over 90 ha, and restored usability of approximately 25 ha through cleaning 3 km of the Avgonsho-1 irrigation canal and 5 km of the Nusratullo Mahsum drainage system, improving water supply for over 4,000 ha across A. Jomi and Khuroson districts. The installation of a 1-hectare drip irrigation system resulted in a 50–70% annual reduction in water use and a 20–30% increase in crop yields, with expected 2–3-fold increases in productivity. Crops cultivated include cotton, watermelons, corn, tomatoes, cucumbers, wheat, and fruit trees (apricot, apple, almond, cherry). The project reached more than 1,200 dekhan farms and approximately 700 households, benefiting over 5,000 people. Active collaboration with local communities, WUAs, and government authorities ensured the prioritisation of canals and infrastructure in the greatest need, thereby strengthening sustainable irrigation management, climate resilience, and food security at the household and community levels⁵⁵².

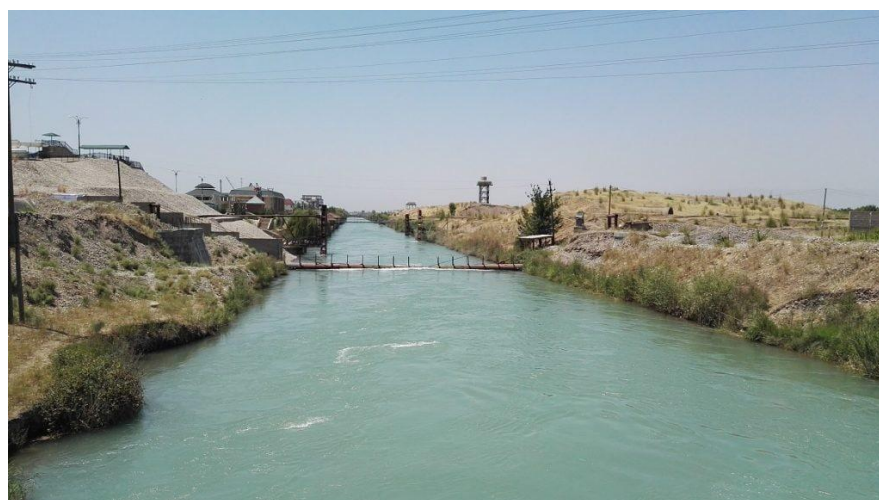


Figure 87. Irrigation canal in Khatlon province⁵⁵³.

⁵⁵¹ <https://en.vesta.tj/2025/12/08/in-penjikent-the-restoration-of-the-gurbik-canal-will-expand-irrigation-to-190-hectares/>

⁵⁵² <https://centralasiacclimateportal.org/double-increase-of-yields-in-tajikistans-agriculture-through-implementation-of-a-new-project-on-water-resources-management-in-central-asia/>

⁵⁵³ <https://asiaplustj.info/en/news/tajikistan/economic/20220624/world-bank-supports-modernization-of-tajikistans-irrigation-system>

The SWIM project in Tajikistan, funded by the World Bank and European Union, provides a best-practice example of integrated irrigation modernisation and capacity-building at national and basin levels. Approved in 2022, the project combines infrastructure rehabilitation with institutional strengthening and climate-smart water management. Investments target critical irrigation systems in the Vakhsh River basin, including the Vakhsh Main Canal (VMC) and Shurobod Main Canal (SMC), with a focus on canal rehabilitation, pump station upgrades, and the modernisation of water distribution and measurement systems (Figure 88). SWIM complements physical upgrades with capacity-building for farmers and WUAs. Activities include training in on-farm irrigation management, adoption of water-saving technologies, and incentives for WUAs to improve maintenance and service delivery. Approximately 45 WUAs benefit from support in climate-resilient irrigation practices and efficient resource use, addressing challenges posed by droughts, high temperatures, and extreme weather events. By combining infrastructure upgrades with institutional reform, training, and participatory approaches, SWIM exemplifies a holistic methodology for enhancing irrigation efficiency, water-use sustainability, and climate resilience at both basin and farm levels. The project also contributes to broader national water sector reform, including the preparation of a national irrigation strategy to guide future development, financial sustainability, and governance of the sector. Key elements of best practice include:

- Integration of infrastructure modernisation with WUA capacity-building and farmer training.
- Basin-level prioritisation and targeted interventions on critical canals.
- Use of incentive mechanisms to improve maintenance and operational sustainability.
- Climate-smart irrigation practices to address drought, heat, and extreme precipitation.
- Support for national water sector reform, linking field-level action to policy and planning.

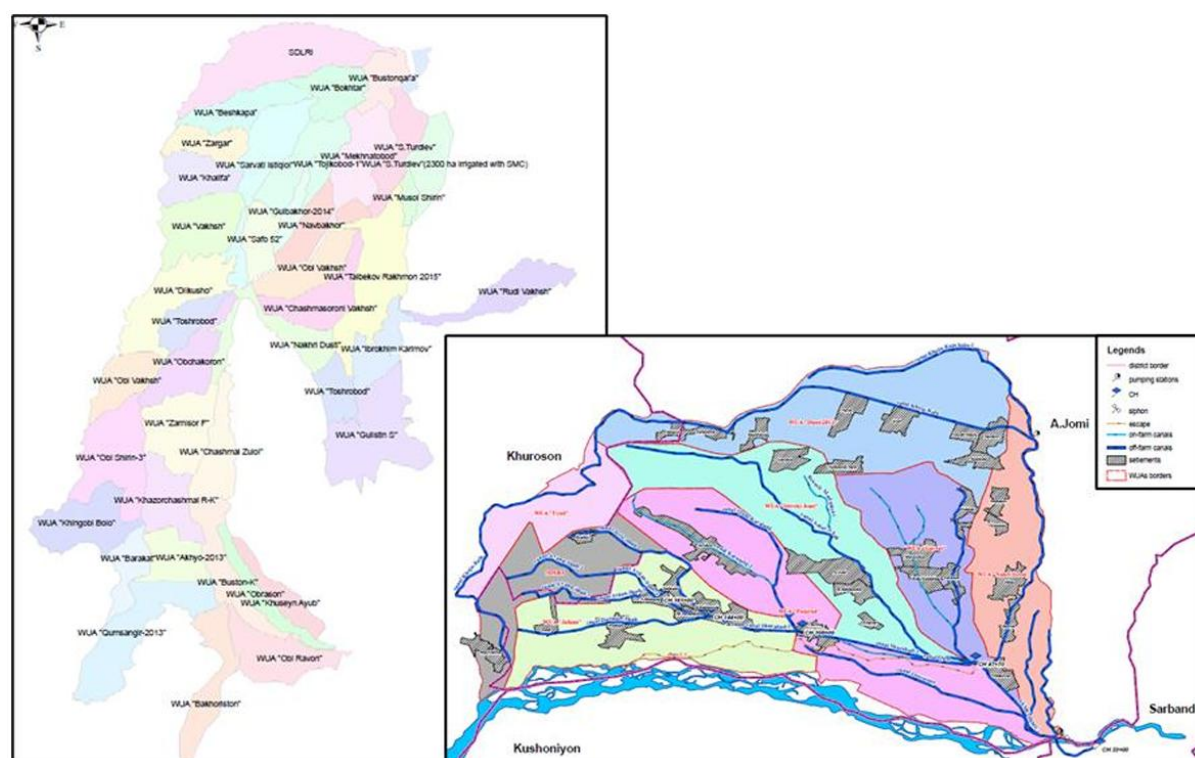


Figure 88. Map of WUA areas for VMC (left) and SMC (right)⁵⁵⁴.

Recent procurement activity further demonstrates continued large-scale investment in irrigation modernisation and climate-resilient water infrastructure. In April 2025, the State Institution Project Management Unit for Fergana Valley Water Resources Management issued a Request for Bids for the rehabilitation of the VMC subsystem of the Kumsangir Canal. Funded by the World Bank, this project aims to improve irrigation system efficiency within the Vakhsh and Zarafshan river basins while enhancing national and basin-level water resources planning and management capacity. Rehabilitation works will restore hydraulic functionality, increase water delivery reliability, and strengthen resilience to climate variability, including seasonal droughts and extreme precipitation events. The initiative also provides local employment through infrastructure rehabilitation activities, aligning with broader efforts to modernise Tajikistan's irrigation networks and support climate-resilient agricultural productivity⁵⁵⁵. In July 2025, the State Institution Project Management Unit for Fergana Valley Water Resources Management issued a Request for Bids under the World Bank and European Union-supported SWIM for the rehabilitation of irrigation systems, pumping stations, and canals in Tajikabad, Lyakhsh, and Rasht Districts. The procurement covers three lots, including the rehabilitation of the Fatkhobod, Kuglik, and Surkhkul canals in Tajikabad District, the Karasoy and Kashkaterak pumping stations, and the Dombrachi Duker in Lyakhsh District, as well as the Karashahr, Hisorak, and Begi Siyoh canals in Rasht District. These works focus on restoring hydraulic functionality, improving conveyance efficiency, and strengthening resilience to floods, sedimentation, and drought stress. The World Bank provides financing with co-financing from the European Union Grant Trust Fund, underscoring sustained international support for upgrading ageing irrigation infrastructure to enhance agricultural water security and climate resilience across vulnerable river basins⁵⁵⁶.

Additional investments under SWIM further illustrate systematic upgrading of irrigation infrastructure across key river basins. Complementing these large-scale, government-led infrastructure investments, smaller-scale community-based rehabilitation initiatives are also underway in Tajikistan's Districts of Republican Subordination. In early 2026, the World Food Programme issued a Call for Applications for the rehabilitation of irrigation canals in Tojikobod and Rasht Districts, targeting climate-vulnerable, agriculture-dependent rural communities. With an indicative grant budget of US\$72,360, the initiative focuses on restoring damaged irrigation infrastructure, improving water-use efficiency, and strengthening food security and livelihoods in areas affected by recurrent climate shocks and natural hazards, including earthquakes. Interventions prioritise the cleaning and rehabilitation of irrigation canals to reduce water losses, improve equitable access to irrigation, and bring underutilised land back into productive use. Delivery is anchored in cash-for-work modalities, providing short-term income support while strengthening community ownership, maintenance capacity, and long-term resilience of local water and agricultural systems. This programme demonstrates how decentralised, labour-based irrigation rehabilitation complements national irrigation modernisation efforts by addressing last-mile infrastructure gaps and supporting adaptive capacity at household and community levels⁵⁵⁷.

A best-practice methodology from Egypt further illustrates approaches for prioritising irrigation rehabilitation. The study applied a Project Execution Priority Index to assess canals based on condition, water demand, environmental factors, and socioeconomic considerations, systematically identifying canals requiring immediate attention. The stepwise method also evaluated beneficiaries' satisfaction with canal performance, helping guide field-level

<https://documents1.worldbank.org/curated/en/191641663678738939/pdf/Tajikistan-Strengthening-Water-and-Irrigation-Management-Project.pdf>

⁵⁵⁵ <https://tajikistan.un.org/en/289844-rehabilitation-vmc%C2%A0-subsystem-kumsangir-canal-swim>

⁵⁵⁶ <https://tajikistan.un.org/en/297566-rehabilitation-irrigation-system-pumping-stations-and-canals-tajikabad-lyakhsh-and-rasht>

⁵⁵⁷ <https://www2.fundsforngos.org/community-development/cfas-rehabilitation-of-irrigation-canals-in-tojikobod-and-rasht-districts-of-districts-of-republican-subordination-tajikistan/>

decision-making. Results demonstrated improved alignment between project execution and priority needs, highlighting the value of structured, evidence-based approaches for efficient and effective canal rehabilitation programs. This methodology offers transferable lessons for prioritising irrigation investments in climate-vulnerable regions, including Tajikistan⁵⁵⁸. Evidence from South Kyrgyzstan demonstrates the measurable impacts of targeted irrigation canal rehabilitation. An impact evaluation conducted between 2016 and 2019 assessed three rehabilitated canals (Ak-Tatyr, 1-2 Maya, Alysh) using baseline and endline household surveys and land-plot transects in pilot and control villages. The study applied a difference-in-differences methodology to analyse crop production, biomass, agricultural income, and livestock holdings. Rehabilitation works included mechanised canal cleaning, partial concreting, and emergency strengthening of damaged sections, complemented by farmer training and strengthened water management through local institutions and Water Users Associations. Results showed improved water distribution and canal throughput, increases in crop yields for select crops, expansion of productive land use, and growth in livestock numbers. Local water management institutions also gained capacity in fee collection, dispute resolution, and maintenance coordination. The evaluation confirmed that combining infrastructure rehabilitation with institutional and community engagement improves agricultural productivity, livelihoods, and climate resilience, offering transferable lessons for Tajikistan and other Central Asian contexts⁵⁵⁹.

Across many regions, smallholder farmers increasingly rely on solar and diesel-powered pumps to access water from storage tanks, shallow wells, or small reservoirs, enhancing irrigation reliability during dry periods⁵⁶⁰. USAID's Market Driven Rural Development (MDRD) Activity, implemented by ACDI/VOCA, introduces advanced irrigation solutions, including pivot and hose-reel systems, supported by the Lindsay Corporation and local partners⁵⁶¹. These systems enhance water-use efficiency, increase yields by 20–50% compared to traditional flood irrigation, and incorporate digital tools (FieldNet app) for remote monitoring and irrigation management. MSDSP and AKF programmes address water scarcity and irrigation challenges by expanding climate-smart water management systems. Over the past six years, the programme has constructed or rehabilitated 1,600 rural infrastructure projects, including irrigation channels, storage facilities, and community water systems. To enhance efficiency and sustainability, MSDSP and AKF introduced optimised fertiliser and water use in crop and livestock farming. In addition, cash-for-work schemes have enabled communities to repair and maintain irrigation channels, strengthening local ownership and water security in remote mountain areas⁵⁶².

ii. Water saving techniques: low-tech solutions

Irregular irrigation in Tajikistan exposes crops to alternating drought and overwatering, typically on a 10-day cycle, causing plant stress and increasing pest risk. Regular, optimised watering is essential for maximising yields. Low-cost measures to preserve water before adopting drip or tubular irrigation include⁵⁶³:

- Contour lines and soil ridges to reduce runoff
- Planting trees and shrubs to conserve soil moisture
- Increasing soil cover with cover crops
- Mulching
- Mixed cropping, crop rotation, intercropping, and plant diversification

⁵⁵⁸ Ashour, M.A., *et al.* 2024. New approach for the rehabilitation of irrigation canals based on implementation priority. *Arabian Journal of Science and Engineering*, Available at: <https://doi.org/10.1016/j.asej.2024.102831>

⁵⁵⁹ https://lifeinkyrgyzstan.org/wp-content/uploads/2022/11/1_2_9_Kanat-Tilekeyev.pdf

⁵⁶⁰ World Bank 2023. Modernising Irrigation Infrastructure under the SWIM Project. [Available online.](#)

⁵⁶¹ *Shaping the Tajikistan Agricultural Landscape with American Tech and Money* - ACDI/VOCA

⁵⁶² <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

⁵⁶³ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Selecting crops suited to available water

These measures improve water-use efficiency, support plant health, and enhance climate resilience. Some of the measures have already been discussed under relevant sections in soil and plant management.

*Counter-lines and soil ridges*⁵⁶⁴

Small soil ridges (10–15 cm) and contour lines are built to collect rainwater, reduce runoff, and stabilise soils in hilly areas. Living contour lines also develop vegetation, improve infiltration, and prevent erosion. Initial watering may be needed in the first year.

- Practice details:
 - Location: Rasht and Zarafshon valleys
 - Implementing agencies: Farmers, UNDP Rasht, MSDSP
 - Timeframe: Regular/3–4 years to reach full effectiveness
 - Budget: Low cost
- Climate and adaptation benefits:
 - Improved water retention and reduced stress on crops during low rainfall
 - Enhanced resilience to droughts and high temperatures
- Economic and environmental benefits:
 - Avoids expensive irrigation systems
 - Increases yield and diversifies production (fruit, fodder, fuelwood, timber)
 - Reduces dependence on single crops
- Knowledge management and inclusiveness:
 - Field days, exchange visits
 - Youth and local farmers engaged
- Documentation:
 - Handouts

*Increasing water retention through trees and bushes*⁵⁶⁵

Planting trees and bushes along streams and gutters slows water flow, increases infiltration, prevents erosion, and gradually restores degraded land. Trees can also provide firewood, timber, food, and other high-value products. Cuttings such as poplar or tugai are fast-growing and effective.

- Practice details:
 - Location: Rasht and Zarafshon valleys
 - Implementing agencies: UNDP Rasht, MSDSP
 - Timeframe: 3–4 years to reach full effectiveness
 - Budget: Low cost
- Climate and adaptation benefits:
 - Reduces impact of droughts and heavy rains
 - Promotes soil fertility and moisture retention
- Economic and environmental benefits:

⁵⁶⁴ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁶⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Supports diversified production systems and food security
- Provides commercial products even in years of crop failure
- Knowledge management and inclusiveness:
 - Exchange visits, field days
 - Youth farmers included
- Documentation:
 - Handouts

*Cleaning drainage networks*⁵⁶⁶

Periodic maintenance of collector-drainage networks removes excess moisture, lowers groundwater levels, reduces salinity, and allows drainage water to be reused for irrigation. Cleaning is particularly important in irrigated areas affected by salinisation.

- Practice details:
 - Location: Aksu and Khoja Bakirgon watersheds
 - Implementing agency: Helvetas
 - Timeframe: Annual activity
 - Budget: Medium cost
- Climate and adaptation benefits:
 - Supports sustainable irrigation
 - Reduces soil salinity and risk of waterlogging
- Economic and environmental benefits:
 - Increases yields and soil quality
 - Restores degraded land
 - Enables cultivation of more profitable crops
 - Supports sustainable flood protection
- Knowledge management and inclusiveness:
 - Training of Trainers (ToT), Farmer Field Schools (FFS), field days, meetings
 - Targeted Water User Associations (WUAs)
- Documentation:
 - Handouts

iii. Water saving techniques: high-tech solutions

*Water storage in reservoirs*⁵⁶⁷

Rainwater harvesting collects and stores rainwater in natural or constructed reservoirs. It provides clean, low-salinity water, reduces dependence on groundwater, mitigates droughts, supports supplemental irrigation, and reduces flood risk. Reservoirs are particularly valuable under variable rainfall patterns.

- Practice details:
 - Location: Sughd region, Rasht and Zarafshon valleys
 - Implementing agencies: GERES, UNDP, MSDSP

⁵⁶⁶ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁶⁷ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Timeframe: Seasonal activity
- Budget: High cost
- Climate and adaptation benefits:
 - Provides reliable water supply under variable rainfall
 - Supports crop, livestock, and agricultural productivity during drought
- Economic and environmental benefits:
 - Can increase yields by over 100% through supplemental irrigation
 - Reduces pressure on wells and groundwater resources
- Knowledge management and inclusiveness:
 - Practical training events, Farmer Field Schools (FFS)
 - All local farmers
- Documentation:
 - Posters, manuals, booklets

*Drip and tubular irrigation*⁵⁶⁸

Drip irrigation delivers water directly to plant roots in controlled doses, improving water use efficiency and reducing labour (Figure 89). Tubular irrigation ensures a uniform water supply along furrows, limiting losses. Both methods are effective on sloping or permeable soils and help prevent erosion.

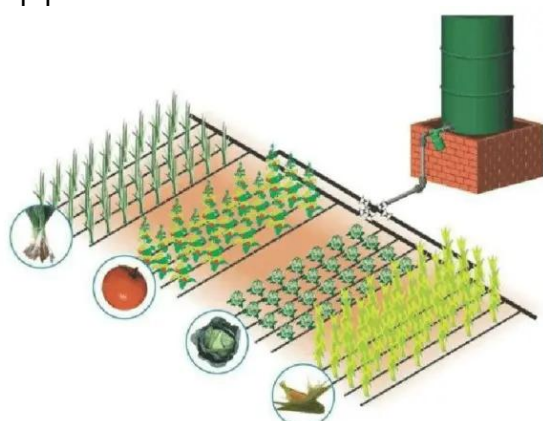


Figure 89. Basic drip irrigation set-up⁵⁶⁹.

- Practice details:
 - Location: Sughd and Khatlon regions
 - Implementing agency: Helvetas
 - Timeframe: One-time installation with ongoing maintenance
 - Budget: High cost
- Climate and adaptation benefits:
 - Reduces crop stress from drought and higher temperatures
 - Minimises the spread of pests and diseases
- Economic and environmental benefits:
 - Reduces water use by 3–10 times

⁵⁶⁸ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁶⁹ <https://healthy-food-near-me.com/do-it-yourself-drip-irrigation-of-potatoes/>

- Increases yields by 30–50% and improves crop quality
- Reduces fertiliser use by 50–60%
- Lowers labour and energy costs for irrigation
- Knowledge management and inclusiveness:
 - ToT, FFS, exchange visits, field days
 - Target Water User Associations (WUAs)
- Documentation:
 - Presentations, booklets, brochures, manuals, online articles

Drip-irrigation and micro-irrigation systems have also been piloted by UNDP (with support from Russia) in Urmetan and Yori villages since 2020: drip systems in orchards to complement earlier tree planting activities on desert slopes within a disaster risk reduction and ecosystem restoration initiative. The project improved yields on degraded slopes, reduced irrigation losses from canal damage, saved water, fuel and fertilisers, and reduced risk from mudflows and flooding⁵⁷⁰. FAO and World Bank on-the-job training (OTJ) programmes in 2025 on fertiliser, irrigation, and pest management for wheat seed farms covered modern irrigation techniques to optimise water use under drought stress⁵⁷¹. AKDN and MSDSP programmes have piloted solar-powered drip irrigation, micro-irrigation, and improved water use strategies⁵⁷². Programmes such as the World Bank’s SWIM project, FAO’s home garden initiatives, and UNDP’s climate-resilient watershed interventions demonstrate how targeted investment in small-scale water assets can drive systemic adaptation in Tajikistan’s vulnerable agricultural landscapes.

*Water accounting*⁵⁷³

Water accounting involves monitoring and recording water use to ensure optimal irrigation. Devices such as Thompson (BT-90) or Chipoletti (VCh-50) spillways help quantify water flow and ensure crops receive the right volume at the right time.

- Practice details:
 - Location: Aksu and Khoja Bakirgon watershed
 - Implementing agencies: Helvetas, PO Neksigol Mushovir
 - Timeframe: Regular maintenance
 - Budget: High cost
- Climate and adaptation benefits:
 - Enables efficient water use under changing climate conditions
 - Reduces water stress on crops
- Economic and environmental benefits:
 - Lowers production costs by reducing over-irrigation
 - Optimises resource use and enhances yield
- Knowledge management and inclusiveness:
 - ToT, FFS, field days, exchange visits
 - Farmers from target WUAs
- Documentation:

⁵⁷⁰ <https://www.preventionweb.net/news/drip-irrigation-helps-farmers-tajikistan-grow-crops-adapt-climate-change>

⁵⁷¹ <https://tajikistan.un.org/en/290836-fao-scales-wheat-seed-farm-sustainability-tajikistan-through-fertilizer-irrigation-and-pest>

⁵⁷² <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

⁵⁷³ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Handbooks, booklets, posters

6.2.4. Knowledge management practices

iv. Local community agricultural extension agents

Agricultural extension provides rural communities with access to knowledge, technical advice, and practical information to improve agricultural productivity, livelihoods, and resilience. In Tajikistan, public and private extension services alone do not sufficiently reach remote farmers, who often rely on traditional knowledge and peer-to-peer learning⁵⁷⁴.

Community-based extension strengthens local capacity to select and implement strategies responsive to climate variability and associated risks.

- Extension agents:
 - Support crop and livestock productivity improvements
 - Enhance family nutrition and food security
 - Assist in developing locally marketable products
 - Generate additional income by providing fee-based advisory services
- Practice details:
 - Target: Smallholder farmers in remote areas
 - Implementing agencies: Local community networks, NGOs, government extension units
 - Timeframe: Continuous, seasonal activities
 - Budget: Medium, scalable with community involvement
- Climate and adaptation benefits:
 - Builds local capacity to respond to climate variability
 - Facilitates adoption of climate-resilient practices
- Economic and environmental benefits:
 - Increases agricultural yields and livestock productivity
 - Improves local livelihoods and income diversification
- Knowledge management and inclusiveness:
 - Training, workshops, peer-to-peer learning, demonstrations
 - Inclusive of women, youth, and marginalised farmers
- Documentation:
 - Training manuals, field guides, brochures

v. Farmer Field Schools (FFS)

The FFS approach is a participatory, group-based learning method that integrates agroecology, experiential learning, and community development (Figure 90). Farmers gain knowledge through field observations, experiments, and group analysis, enabling locally appropriate crop and livestock production decisions⁵⁷⁵.

- FFS emphasises:
 - Understanding environmental processes affecting agriculture

⁵⁷⁴ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

⁵⁷⁵ Sustainable Agricultural Practices Under a Changing Climate 2024. [Available online.](#)

- Experimenting with and adapting production systems under climate variability
- Facilitating knowledge exchange on new practices, species, and crop varieties
- Building resilience through continuous adaptation and practical problem-solving
- Practice details:
 - Target: Smallholder farmers, particularly in rural and high-risk areas
 - Implementing agencies: NGOs, extension services, local community facilitators
 - Timeframe: Seasonal cycles, repeated annually
 - Budget: Medium, dependent on scale
- Climate and adaptation benefits:
 - Strengthens farmers' adaptive capacity to climate change
 - Supports sustainable and resilient farming systems
- Economic and environmental benefits:
 - Improves productivity and resource efficiency
 - Encourages diversified, climate-resilient agricultural practices
- Knowledge management and inclusiveness:
 - On-site learning, demonstrations, exchange visits, experiential exercises
 - Accessible to women, youth, and marginalised groups
- Documentation:
 - Field guides, training materials, manuals



Figure 90. Farmer Field School in Hamadoni district, Khatlon, Tajikistan⁵⁷⁶.

vi. Demonstration plots

The Tanzila Demonstration Plot in 8-Marta village, Vakhsh district (Kirov jamoat) represents a practical example of sustainable and climate-resilient agriculture in Tajikistan^{577,578}. Officially opened in April 2025 as part of the second phase of the Green Economy Financing Facility (GEFF II) Tajikistan programme, the project is supported by the European Bank for Reconstruction and Development (EBRD) and funded by the Green Climate Fund, the Federal Ministry of Austria, and the Republic of Korea. The demonstration plot showcases innovative solutions that improve productivity while conserving natural resources.

- Technologies and solutions:
 - Greenhouses with drip irrigation, which reduce water use by 50–70%
 - Solar panels, which provide energy efficiency and an independent power supply
 - Biogas systems, which convert organic waste into valuable energy and fertiliser
 - Vertical farming, which increases yields on limited land and strengthens economic resilience
- Implementation and oversight
 - Farm partner: Tanzila Farm, a client of Arvand Bank, receiving technical support and guidance

⁵⁷⁶ <https://www.flickr.com/photos/undpeuropeandcis/12979266914/in/photostream/>

⁵⁷⁷ <https://ebrdgeff.com/tajikistan-agri/demoplot/tanzila-demonstration-plot/>

⁵⁷⁸ <https://ebrdgeff.com/tajikistan-agri/grand-opening-of-the-innovative-demo-plot-at-tanzila-farm/>

- Technical supervision: NGO Neksigol Mushovir ensures quality construction and installation
- Infrastructure: Modern 140 m² greenhouse integrating the above technologies
- Contribution to Sustainable Development
- Demonstrates practical application of climate-smart and resource-efficient technologies
- Increases production efficiency while reducing resource intensity and environmental impact
- Serves as a learning site for farmers and entrepreneurs to observe and adopt green solutions
- Scaling and Replication
 - GEF II Tajikistan, with EBRD support, plans to establish additional demonstration plots nationwide
 - These sites aim to expand knowledge sharing, strengthen the adoption of sustainable technologies, and promote resilient agricultural practices across Tajikistan
- Knowledge Management
 - Demonstration plots provide hands-on learning opportunities and technical guidance for farmers
 - Videos, field visits, and technical workshops document practices and results for wider dissemination
- Key Outcome

The Tanzila Demonstration Plot illustrates that green technologies are already transforming agricultural practices in Tajikistan, offering a model for climate-resilient and resource-efficient farming

A CAREC demonstration plot in 2017 highlighted the cultivation of drought-resistant wheat varieties with 3–4 times lower water use, river-coast forestry to control flood risk, mudflow drainage, and mini-hydropower to ensure energy for irrigation during power outages⁵⁷⁹. MSDSP and AKF programmes complement direct farm interventions with strong knowledge and capacity-building support. The programme identifies and promotes climate-smart agricultural practices appropriate for local contexts through research partnerships with the University of Central Asia, the Pamir Botanical Institute, the Kulob Botanical Garden, and Khorog State University. Farmer capacities are further enhanced through training in veterinary care, fodder production, and sustainable farming practices. In parallel, MSDSP and AKF integrate nutrition education into agricultural programmes to address maternal and child malnutrition, ensuring that gains in food security are matched with improved dietary diversity and health outcomes⁵⁸⁰.

6.3. *Processing, storage and value chain development in Tajikistan*

MSDSP and AKF programmes strengthen agricultural value chains by improving rural infrastructure and livestock systems. Over the past six years, they have supported the construction and rehabilitation of storage facilities, which reduce post-harvest losses and ensure food security for rural households. In parallel, market roads and bridges have been built to expand farmer access to regional markets and critical supply chains. MSDSP and AKF also support livestock value chain development by providing improved breeds, high-quality fodder seeds, veterinary services, and animal shed improvements, enhancing productivity and

⁵⁷⁹ <https://www.ca-climate.org/eng/news/adaptation-to-climate-change-in-practice-in-tajikistan/>

⁵⁸⁰ <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

income resilience for smallholder farmers⁵⁸¹. The World Bank's Tajikistan Agriculture Commercialisation Project (ACP, 2014–2022) gave matching/small grants and credit to agribusinesses and farmer groups for value-addition and agri-infrastructure and delivered entrepreneurship and technical training⁵⁸². World Bank further has a current sector programme, Strengthening Resilience of the Agriculture Sector Project (approved 2021), that explicitly pushes value-chain development beyond on-farm production, including horticulture, to improve export orientation and post-harvest logistics⁵⁸³. The USAID Agribusiness Competitiveness Activity in Tajikistan (ACAT, 2018–2023) focused on horticulture and dairy value chains, provided equipment and grants, including fruit-drying kits⁵⁸⁴. The EU SWITCH–Asia–REAP (Resource–Efficient Agri-food Production)–Tajikistan and Uzbekistan builds MSME capacity in agri-food processing to cut energy, water use, and waste. It provides training and support to develop bankable efficiency upgrades in processing lines, utilities, etc.⁵⁸⁵. A workshop was held in mid-2025 for farmers and dried fruit producers from Khatlon at the International Trade Centre (ITC) in Abdurahmon-Jomi district. The workshop was hands-on and focused on the basic principles of fruit drying and included sulphuring, drying, safe storage and tailored advisory to exporters⁵⁸⁶. Other relevant drying and storage projects are discussed below.

- Apricot Solar Dryer Investment (Kanibadam District)⁵⁸⁷
A small-scale yet impactful project enabled a local apricot farmer, Mr. Nishonov, in Kanibadam District to install a modern solar fruit dryer capable of drying up to 300 kg of apricots at a time. This investment of only US\$450 is estimated to yield annual savings of US\$110, with a payback period of just 4 years. The project was supported by the CLIMADAPT facility, developed by the European Bank for Reconstruction and Development (EBRD) with funding from the Climate Investment Funds (CIF) PPCR, the United Kingdom, and the EBRD Early Transition Countries (ETC) Fund.
- Solar-Drying Workshop for Mountain Women (Gorno-Badakhshan Region)⁵⁸⁸
In November 2017, under the Pure Energy and Women on the Roof of the World initiative, a workshop was held in the high mountain village of Nisur (Gorno-Badakhshan Autonomous Region). Ten women from vulnerable households learned to construct simple solar dryers—wooden boxes with shelving covered by glass—for dehydrating fruit. Post-workshop, the participants built four solar dryers, with villagers taking turns using them during the drying season. The dryers were praised for keeping fruit clean, protecting against birds and insects, and accelerating the drying process compared to traditional methods.
- World Bank–Funded Drying Tunnel (Muminabad District)⁵⁸⁹
As part of the Tajikistan Agriculture Commercialisation Project (World Bank–funded), a contract was issued in late 2020 to construct a solar-powered drying tunnel at a dekhan farm in Buston, Dehi Baland jamoat, Muminabad District. The contract began on September 29, 2020, and lasted 60 days, with the Ministry of Agriculture acting as the contracting authority.

⁵⁸¹ <https://the.akdn/en/where-we-work/central-asia/tajikistan/agriculture-and-food-security-tajikistan>

⁵⁸² <https://documents1.worldbank.org/curated/en/099925001192329460/txt/BOSIB06480a86d0530a3560cc3a51dc55ec.txt>

⁵⁸³ <https://documents1.worldbank.org/curated/en/285651624327302472/pdf/Tajikistan-Strengthening-Resilience-of-the-Agriculture-Sector-Project.pdf>

⁵⁸⁴ <https://winrock.org/projects/acat/>

⁵⁸⁵ <https://www.switch-asia.eu/project/reap/>

⁵⁸⁶ <https://old.asiaplustj.info/en/news/tajikistan/economic/20250707/itc-strengthens-khatlon-dried-fruit-sector-with-foundational-drying-workshop>

⁵⁸⁷ <https://ebrdgeff.com/projects/supporting-apricot-production-with-a-new-solar-fruit-dryer/>

⁵⁸⁸ <https://www.fao.org/mountain-partnership/news/newsroom/news-detail/Solar-dryers-made-by-mountain-women/en>

⁵⁸⁹ <https://www.developmentaid.org/organizations/awards/view/189151/agriculture-commercialization-project-construction-of-drying-tunnel-using-solar-energy-to-dry-various>

- Modern Cold Storage for Fresh Fruit Supply⁵⁹⁰
LLC Zarnisori Shahrinav, managing 200 ha of orchards and 220 permanent jobs (55 for women), constructed a modern cold storage using sandwich panels. The facility reduces energy use, maintains fruit quality, and allows the company to offer storage services to other regional farmers.
 - Source: GEFF Tajikistan, supported by EU, GCF, and South Korea
 - Investor / Company: LLC Zarnisori Shahrinav
 - Location: Shahrinav, Tajikistan
 - Investment: Cold storage facility (500 tons capacity, 5 independent chambers)
 - Investment Size: US\$51,582 (GEFF loan, EU 30% co-investment)
 - Financial Results: Payback in 3 years
 - Energy and CO2 Savings: 44,112 kWh/year; 662 kg CO2/year
 - Donors / Support: European Union, Green Climate Fund, South Korea
 - Impact: Ensures regular supply of fresh fruits to local and regional markets (Russia, Kazakhstan, Afghanistan); Reduces maintenance costs and energy consumption; Strengthens agricultural value chains and business diversification; Supports sustainable production and post-harvest loss reduction
- Modern Cold Storage Infrastructure for Agricultural Products⁵⁹¹
Safarbek Sultonov's cold storage facility represents a modern agro-processing infrastructure project designed to benefit local farmers and suppliers. The facility combines energy-efficient design with operational functionality, supporting sustainable agricultural production and regional food security.
 - Source: GEFF, European Bank, South Korea, Green Climate Fund, Federal Ministry of Finance, Austria
 - Investor / Entrepreneur: Safarbek Sultonov Rahmonovich
 - Location: Tursunzoda, Hisor, Tajikistan
 - Investment: High-tech cold storage facility (up to 600 tons capacity)
 - Key Technologies:
 - Energy-efficient cold storage chambers using Bitzer technology and polyurethane foam panels
 - Chambers 6 m high × 9 m long with truck access for direct loading/unloading
 - Impact:
 - Minimises post-harvest crop losses
 - Improves storage conditions and logistics efficiency
 - Increases productivity and reliability of agricultural value chains
 - Creates employment and promotes the adoption of green technologies

The World Bank summary report, Tajikistan Agrifood Security Policies Advice and Analytics 2024, analysed and recommended agricultural solutions for scaling up to boost productivity and address climate change⁵⁹². A range of climate-smart agricultural (CSA) solutions, targeting crops, orchards, livestock, and associated value chains, was identified and piloted. Key CSA interventions include:

- Crop and Grain Production
 - Conservation agriculture: minimum soil disturbance, permanent soil cover, and crop diversification to enhance soil fertility, water efficiency, and resilience.

⁵⁹⁰ <https://ebrdgeff.com/tajikistan-agri/projects/modern-cold-storage-leads-to-offer-fresh-fruits-for-tajik-and-foreign-consumers/>

⁵⁹¹ <https://ebrdgeff.com/tajikistan-agri/projects/safarbek-sultonov-develops-modern-agricultural-storage-infrastructure/>

⁵⁹² <https://documents1.worldbank.org/curated/en/099062724065045896/pdf/P179616-eaf35fbb-ccb2-41cd-8cdd-959e7d9257d0.pdf>

- Improved seeds: drought- and disease-tolerant seeds to increase yields and adaptation.
- Enhanced irrigation efficiency: modernising public and private irrigation systems, including drip irrigation, to reduce water loss and improve crop productivity.
- Precision nutrient management: soil testing and tailored fertiliser application to optimise inputs and reduce GHG emissions.
- Orchard and Fruit Production (apricots, pistachios, apples)
 - Frost protection and orchard diversification to reduce climate-induced crop loss.
 - Soil cover and mulching for moisture retention, erosion control, and soil health.
 - Water-efficient irrigation through drip systems and improved irrigation management.
 - Integrated pest management and protective nets to limit crop damage and pesticide use.
 - Cold storage and value chain integration to reduce post-harvest losses and maintain market access.
 - Silvopastoral pistachio systems on marginal lands to combine carbon sequestration, income generation, and erosion control.
- Livestock (dairy, beef, and poultry)
 - Sustainable intensification: diversified grass species, improved feeding, balanced rations, and rangeland management to maintain productivity under heat stress.
 - Herd and manure management: dietary additives, controlled herd growth, and semi- or zero-grazing systems to reduce methane emissions by 28–38% while maintaining protein production.
 - Input and service centres: linking smallholders to technical advice, inputs, finance, and markets.
 - Transition to lower-emission species: promoting poultry and alternative protein sources to reduce sectoral emissions and support healthier diets.
- Enabling factors and barriers
 - Existing policy frameworks (NDC, National Climate Change Adaptation Strategy, Agrifood Sector Development Program) provide a foundation for scaling CSA.
 - Key barriers include low institutional capacity, limited public funding, outdated advisory services, weak coordination, and high perceived investment risks.
 - Scaling CSA requires investment in public goods (research, extension, irrigation, digital advisory tools), blended finance, capacity building, and private-sector engagement.

6.4. Farmers' experience of price volatility, income security, and adaptive capacity. Experience in Tajikistan shows that addressing price volatility and income insecurity is central to strengthening farmers' adaptive capacity. Good practices include diversifying value chains, investing in post-harvest infrastructure, and improving market linkages, which help reduce reliance on a single commodity price and smooth household incomes. For example, the World Bank's *Agriculture Commercialisation Project* (2014–2022), with additional financing approved in 2017, aimed to increase the commercialisation of farm and agribusiness products by strengthening value chains and productive partnerships. This was pursued through improved access to finance and enhanced capacity of beneficiaries, including producer associations, farmers, agro-processors, agribusiness enterprises, input dealers, financial institutions, and relevant public and academic institutions. It provided matching grants for processing and storage, enabling farmers' groups to reduce losses and secure higher, more stable

returns^{593,594}. Building on this, the ongoing *Strengthening Resilience of the Agriculture Sector Project* integrates climate-resilient production with value-chain services, supporting farmers to adapt through better market access and crop diversification⁵⁹⁵. To follow on TRIGGER, the GIZ implemented the *Towards Rural Inclusive Growth and Economic Resilience (TRIGGER II)* project 2019–2021, commissioned by BMZ in partnership with Tajikistan's Ministry of Economic Development and Trade. The project:

- aimed to strengthen the economic resilience of MSMEs, including smallholder farmers, young entrepreneurs, and women;
- focused on agriculture and agro-processing;
- enhanced business enabling environments;
- promoted inclusive value-chain development;
- supported export promotion;
- and fostered entrepreneurship.

Interventions included capacity building for evidence-based policymaking, improved extension services, digital tools for market information, climate-resilient farming practices, post-harvest management, and access to niche markets through certification and marketing support. By linking producers with processors and promoting sustainable and climate-adapted agricultural methods, TRIGGER II increased rural incomes, strengthened biodiversity and ecosystem services, and enhanced private sector competitiveness in Tajikistan⁵⁹⁶.

Complementary initiatives have reinforced these gains by combining finance, skills, and export readiness. IFAD's *Community-based Agricultural Support Project* (CBASP; 2017–2024) promoted inclusive rural growth and poverty reduction by improving access to productive infrastructure, services, and modern farming technologies. It strengthened rural institutions through farmer group development and capacity-building of service providers, while improving agricultural productivity and market linkages through the adoption of modern technologies and infrastructure⁵⁹⁷. USAID's *Agribusiness Competitiveness Activity* upgraded horticulture and dairy value chains with training and equipment⁵⁹⁸. Similarly, ITC's work with dried-fruit processors⁵⁹⁹ and the EU SWITCH-Asia REAP programme⁶⁰⁰ improved quality standards and efficiency, expanding access to regional markets. These practices demonstrate that income stability, market integration, and financial access are critical enablers of adaptive capacity, allowing farmers to invest in climate-resilient practices and avoid erosive coping during climate and market shocks. Limited access to affordable credit has historically constrained the adoption of CSA technologies. USAID's MDRD partnerships with AV Ventures and FINCA Tajikistan are expanding microfinance and loan opportunities for farmers, with special attention to women and youth⁶⁰¹.

6.5. Training of Extension Workers and Smallholder Farmers on Applying Climate Forecasts to Agricultural Decisions

Under the Green Climate Fund (GCF) project, the World Food Programme (WFP) in Tajikistan, in collaboration with the Committee of Environmental Protection and the Agency of Hydrometeorology (TJHM), conducted a Training of Trainers workshop on the Participatory

⁵⁹³ <https://www.worldbank.org/en/news/loans-credits/2014/06/10/tajikistan-agriculture-commercialization-project>

⁵⁹⁴ <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/767891513180321759/tajikistan-agriculture-commercialization-project-additional-financing>

⁵⁹⁵ <https://documents1.worldbank.org/curated/en/285651624327302472/pdf/Tajikistan-Strengthening-Resilience-of-the-Agriculture-Sector-Project.pdf>

⁵⁹⁶ <https://www.giz.de/en/downloads/TRIGGER%20II%20factsheet%2026%2005%202019%20EN.pdf>

⁵⁹⁷ IFAD 2024. Community-Based Agricultural Support Project. Available online.

⁵⁹⁸ Making Cents International 2023. Agribusiness Competitiveness Activity in Tajikistan (ACAT). Available online.

⁵⁹⁹ <https://old.asiaplustj.info/en/news/tajikistan/economic/20250707/itc-strengthens-khatlon-dried-fruit-sector-with-foundational-drying-workshop>

⁶⁰⁰ <https://www.switch-asia.eu/project/reap/>

⁶⁰¹ [Shaping the Tajikistan Agricultural Landscape with American Tech and Money - ACDI/VOCA](#)

Integrated Climate Services for Agriculture (PICSA) approach. The workshop trained ten experts from government agencies, non-governmental organisations (NGOs), and WFP to serve as PICSA facilitators. These trained experts are tasked with further training district-level stakeholders, who will directly engage with smallholder farmers to support the application of climate forecasts to planning climate-resilient agricultural practices and improve food security. WFP has also implemented complementary resilience-building activities as part of the GCF project. By July 2022, one drinking water supply system was rehabilitated, with four more in progress. Chain-link fence equipment was provided for orchard establishment sites across 11 districts, and rehabilitation of irrigation infrastructure included completion of 7 km and ongoing work on a 25 km canal. Greenhouse construction and vertical agriculture initiatives were completed in Shahrinav, Yovon, Varzob districts and Vahdat town, and 92 km of irrigation canals were rehabilitated or constructed, improving water availability for 1,500 hectares of agricultural fields and 11 hectares of agroforestry. Under the GCF-supported PICSA training, 670 farmers in Fayzobod and Khovaling districts received direct training on incorporating climate information into their agricultural decisions. Additional capacity-strengthening training was completed in Ishkoshim and Roshtqala districts to mainstream climate change adaptation and resilience into district-level social and economic development plans. By March, the development plans of two districts were finalised and submitted to authorities for review and endorsement, demonstrating integration of climate services into local planning^{602,603}.

Complementing this initiative, the GCF-approved Community-based Agriculture Support Programme 'plus' (CASP+) aims to enhance climate resilience at both national and local levels in Tajikistan. It focuses on improving public sector coordination, strengthening technical capacity for climate-resilient natural resource management, and investing in community capacity for adaptation. The project also seeks to improve market-based approaches to strengthen livelihoods, directly benefiting smallholder farmers⁶⁰⁴. The GEF-funded Tajikistan Ecosystem Restoration and Resilient Agriculture (TERRA) project focuses on restoring degraded grassland ecosystems in the Lower Panj River sub-basin. The project involves training local farmers and extension workers on sustainable land management practices, integrating climate-smart agriculture techniques to enhance resilience against climate change impacts⁶⁰⁵. The United Nations' Early Warnings for All initiative, in collaboration with Tajikistan's government, aims to strengthen early warning systems and disaster risk reduction. This initiative includes training local communities, extension workers, and farmers on interpreting and responding to climate forecasts, enhancing their capacity to make informed agricultural decisions⁶⁰⁶. The World Bank-financed project Strengthening Resilience of the Agriculture Sector aims to support the Ministry of Agriculture in implementing the Multisectoral Action Plan for Nutrition in the Republic of Tajikistan for 2021–2025. While the primary focus is nutrition, the project also includes components that enhance agricultural resilience through improved practices and capacity building for extension workers and farmers⁶⁰⁷. These initiatives collectively contribute to building the capacity of extension workers and smallholder farmers in Tajikistan, enabling them to effectively apply climate forecasts to agricultural decisions and enhance climate resilience in rural communities.

6.6. *Digital access to climate and market information and early warning systems*

Smallholder farmers in Tajikistan face limited access to locally relevant climate and market information through digital channels. While short message service (SMS) and internet-based systems have the potential to translate meteorological data into actionable advice, most

⁶⁰² [WFP Tajikistan Country Brief, July 2022 - Tajikistan | ReliefWeb](#)

⁶⁰³ [WFP Tajikistan Country Brief, March 2024 - Tajikistan | ReliefWeb](#)

⁶⁰⁴ <https://www.greenclimate.fund/project/fp233>

⁶⁰⁵ <https://www.thegef.org/projects-operations/projects/11398>

⁶⁰⁶ <https://tajikistan.un.org/en>

⁶⁰⁷ <https://tajikistan.un.org/en/289845-consulting-services-strengthening-resilience-agriculture-sector-project>

farmers remain unaware of the value of agrometeorology and market information, and dissemination mechanisms remain fragmented. The Tajik Hydrometeorological Agency (TJHM), supported by the Food and Agriculture Organisation of the United Nations (FAO) and the European Union (EU), has initiated efforts to deliver forecasts via SMS and mobile applications. Caritas Switzerland's (CACH) Weather Water Climate Services (WWCS) initiative has shown how decentralised, farmer-hosted low-cost weather stations can provide real-time data and tailored advisories through national telecom networks. Despite these advances, uptake is constrained by affordability under a fee-for-service model, limited digital literacy, and weak institutional coordination between TJHM, the Ministry of Agriculture (MoA), Rural Advisory Services (RAS), and the Committee on Emergency Situations and Civil Defence (CoESCD). Without systematic government endorsement and a scaled roll-out, the majority of smallholders remain without timely and practical climate information, limiting their ability to adapt practices and safeguard productivity^{608,609,610}.

Digital and ICT access also remains constrained by infrastructure, cost, and socio-cultural factors. While mobile broadband coverage is relatively high (90% 3G and 80% LTE), penetration remains low at 23%, and internet costs are high due to licensing and taxation. As of 2019, only 22% of the population used internet services. This figure increased by 39% in 2020–2021. Only three out of ten households have internet access. A limited number of businesses offer digital services, and cultural norms hinder adoption, particularly for women, youth, and farmers with disabilities. Medium-scale farmers are better served, with access to advisory services and digital platforms such as AGROINFORM.TJ, which provides integrated market and weather information via web and SMS, but the majority of smallholders remain outside these services. These barriers restrict the potential of SMS and internet-based tools for improving climate and market decision-making at the farm level^{611,612}. Furthermore, the design of digital climate services often overlooks integrating local ecological knowledge with scientific forecasts. Studies in the Pamir region indicate that traditional knowledge provides critical insights into environmental change and resource management, but is frequently marginalised in formal climate information systems. Without combining farmers' observations and perceptions with scientific data, SMS- and internet-based platforms risk reducing the relevance and uptake of climate and market services, limiting their contribution to adaptive decision-making and resilience⁶¹³.

To enhance market access, digital interventions must also address gaps in information on export markets, standards, certification, and logistical planning. Current initiatives by the Committee for Food Security, input suppliers, and private sector actors such as Neksigol Group, cooperative Sarob, and the Association of Agriculture Producers of Tajikistan are beginning to provide advisory services, market intelligence, and digital marketplaces connecting farmers to buyers. USAID's MDRD partnerships with AV Ventures and FINCA Tajikistan use innovative mobile loan platforms and e-wallet systems to improve accessibility, enabling farmers to invest in irrigation, seeds, fertilisers, and other CSA inputs⁶¹⁴. With EU support, the FAO deployed automated weather stations in 2019 in Tursunzoda, Konibodom, and J. Balkhi, regions characterised by intensive production of grapes, apricots, and cotton. These support advisories, disease/pest alerts, and forecasts to guide planting and irrigation

⁶⁰⁸ [Advanced weather data benefit Tajik smallholder farmers](#)

⁶⁰⁹ [Weather Water Climate Services for Tajikistan - Adaptation At Altitude](#)

⁶¹⁰ [Combining scientific and local knowledge to understand climate change effects in high mountains: A case study from Porshinev Jamoat, Tajikistan](#)

⁶¹¹ [external-usaid-digital-agriculture-ecosystem-tajikistan-230522.pdf](#)

⁶¹² [World Development Report 2016: Digital Dividends](#)

⁶¹³ [Combining scientific and local knowledge to understand climate change effects in high mountains: A case study from Porshinev Jamoat, Tajikistan](#)

⁶¹⁴ [Shaping the Tajikistan Agricultural Landscape with American Tech and Money - ACIDI/VOCA](#)

scheduling are key for drought preparedness and response⁶¹⁵. Regional UNCCD / CAREC cooperation (2023 conference in Dushanbe) emphasised regional cooperation and knowledge sharing as a priority in building drought resilience and fighting land degradation⁶¹⁶. Early warnings for glacial lake outburst floods (GLOFs), heat waves, and water variability are critical in managing seasonal water for agriculture. Integration of these platforms with weather and climate services and building databases and tools to inform land use, input management, and export opportunities would strengthen the overall utility of digital services for smallholder farmers, particularly those traditionally marginalised⁶¹⁷. The USAID ACAT supported advisory services and market facilitation for processors and MSMEs⁶¹⁸. With a large number of young people, a proliferation of bank accounts, and a SIM card penetration of 105%, Tajikistan is a suitable environment for digital agricultural transformation (Table 14).

Table 14. Communication indicators Tajikistan, 2021.

Indicator	Tajikistan
Number of mobile phone subscribers	10.04 million
Number of internet users	2.42 million
Number of mobile network operators	5
Percentage of mobile broadband users	21.96%
Number of SIM penetration	10.14 million

7. Recommendations for the project

The pre-feasibility study confirms that the proposed GCF project in Tajikistan is technically sound, financially viable and aligns with national policies such as the NDC and National Adaptation Strategy. It proposes to benefit over 75,000 people directly (prioritising women-headed households and youth) by supporting smallholder farmers and local institutions to adopt climate-resilient practices, enhance irrigation infrastructure and diversify livelihoods, while an additional 100,000 people will benefit indirectly through institutional reforms and improved climate-information services. The programme is structured around three components: i) building an enabling environment for climate adaptation at the district and local level; ii) strengthening household and community resilience through water-asset management, climate-resilient agriculture and livelihood diversification; and iii) knowledge management and awareness-raising. The recommendations below link to and inform the broader design of the project.

7.1. Strategic & policy-level recommendations

Deepen alignment with national frameworks. The Feasibility Study notes that the project aligns with Tajikistan's NDC, National Adaptation Strategy and several SDG targets. To maintain this alignment, the Concept Note and Funding Proposal should clearly articulate how the District Adaptation Plans (DAPs) will operationalise national adaptation commitments (decentralising the National Adaptation Planning process) and how lessons from the project will inform national-level planning. A mechanism for feedback between district plans and national strategies (e.g., through the NAP process) will ensure that locally generated evidence influences policy.

Refine the Theory of Change. The ToC diagram should explicitly state assumptions, causal links and success indicators for each component. This will help evaluators assess coherence and will guide monitoring and evaluation. Assumptions might include continued political

⁶¹⁵ <https://www.fao.org/europe/resources/stories/details/Advanced-weather-data-benefit-Tajik-smallholder-farmers/en>

⁶¹⁶ <https://www.unccd.int/news-stories/stories/central-asia-female-leadership-key-climate-and-drought-resilience>

⁶¹⁷ <external-usaid-digital-agriculture-ecosystem-tajikistan-230522.pdf>

⁶¹⁸ <https://winrock.org/projects/acad/>

support, sustained access to financing, community willingness to adopt new practices and stable climate information systems. For each barrier identified in Section 8.4, the ToC should trace how proposed activities (e.g., training extension agents, building water infrastructure) lead to outputs, outcomes and impacts.

Plan for scaling and replication. The Feasibility Study emphasises that the project's components could be scaled across Tajikistan. The Concept Note and Funding Proposal should outline criteria and mechanisms for expansion (e.g., performance triggers, budget envelopes and knowledge-sharing platforms) to replicate effective interventions in non-target districts. This includes strengthening institutional coordination and establishing a national adaptation learning hub to host data, manuals and training materials.

7.2. Technical & design recommendations

7.2.1. Strengthen district-level adaptation planning (Barrier 1)

Co-develop District Adaptation Plans (DAPs). District governments lack capacity for climate adaptation planning. The project should finance participatory development of DAPs that integrate climate-risk profiling, watershed information and gender analysis. Embedding anticipatory action and disaster-risk reduction (DRR) into these plans will address the identified gap between reactive responses and proactive adaptation. DAPs should include costed implementation plans, resource-mobilisation strategies and clear links to district development plans.

Capacitate local institutions. Training for local authorities, including District Development Committees and the Agency of Hydrometeorology, should cover climate-risk assessments, participatory planning, budget formulation and monitoring. Exchange visits with other GCF-financed projects (e.g., in Central Asia) will foster peer learning.

7.2.2. Improve extension services and climate information (Barriers 2 & 3)

Invest in extension capacity. Weak extension systems and underfunding limit farmers' access to agronomic and climate information. Building on the Participatory Integrated Climate Services for Agriculture (PICSA) approach, the project should train extension workers and smallholder farmers, with at least 30 % women and youth participation. Training should cover the interpretation of climate advisories, adaptive farming practices, nutrition-sensitive agriculture and ICT tools.

Digital climate-information platforms. Support the Agency for Hydrometeorology in expanding SMS-based and AI-powered tools (mobile applications, Telegram channels or similar) to deliver tailored climate and market information. User-centred design is key: information should be translated into local languages, consider literacy levels and be co-developed with women and marginalised groups to ensure accessibility. A commercialisation strategy for these services, including cross-subsidies or public-private partnerships, should be elaborated during proposal development.

Enhance hydro-met networks. Strengthen hydrometeorological stations and data-sharing agreements with regional initiatives to ensure that downscaled forecasts are reliable and timely. At the district level, simple rain gauges and community monitoring networks can supplement official data.

7.2.3. Promote community-level adaptation (Barrier 4)

Demonstration plots and farmer field schools. To overcome limited awareness of and access to adaptation options, the project should establish demonstration plots and farmer field

schools. These should showcase drought-tolerant crops, agroforestry, water-efficient irrigation (sprinkler/drip), renewable-energy pumps, and integrated livestock–crop systems. In addition to technical training, modules should include gender empowerment, nutrition and disability inclusion.

Participatory awareness campaigns. Conduct gender-responsive Social and Behaviour Change campaigns using local theatre, radio, digital media and school-based activities to raise awareness of climate–nutrition linkages and adaptation options. Emphasise the role of youth and disabled persons as agents of change and ensure materials are accessible (e.g., using sign language, Braille or pictorial instructions).

7.2.4. Develop water assets and climate-resilient production systems

Climate-proofed water infrastructure. The study highlights outdated irrigation systems and poor coordination among dehkan farms, Water User Associations and the Agency for Land Reclamation and Irrigation. The project should prioritise rehabilitation and climate-proofing of canals (including green–grey infrastructure to stabilise banks, reduce siltation and improve flood attenuation) and installation of water-efficient irrigation such as drip and sprinkler systems. Renewable-energy pumps and small reservoirs should be piloted to reduce operating costs and greenhouse-gas emissions.

Water asset funds. Create local water-asset funds in each district (potentially funded through modest tariffs and supported by matching GCF grants) to finance operations and maintenance. Design tariffs to be affordable and progressive; cross-subsidise vulnerable households and ensure that fees do not disincentivise use. The feasibility of these funds should be studied during the Funding Proposal stage.

Resilient crop systems and diversification. Support establishment of demonstration plots and greenhouses, using drought- and flood-resistant varieties, mixed orchards and agroforestry. Provide inputs (seedlings, drip kits) and training for women and youth to create home gardens and micro-enterprises. Integrate nutrition-sensitive agriculture to improve household diets.

7.2.5. Expand livelihood diversification and value-addition (Barrier 5)

Storage, processing and bulking. Limited market access, storage and processing hinder farmers' ability to capture value. Construct or rehabilitate storage units with natural cooling in high-lying areas and solar-powered cooling in low-lying areas. Provide solar dryers and processing equipment to women and persons with disabilities, coupled with training on post-harvest handling. Support the establishment of bulking centres where producer groups can aggregate produce and negotiate with buyers.

Market information and linkages. Develop market information services that deliver price alerts and demand data via SMS and digital platforms. Facilitate contracts between producer groups and institutional buyers (e.g., school feeding programmes, WFP procurement) to stabilise prices and guarantee off-take. Promote women-led cooperatives and youth-run enterprises to strengthen collective organisation.

Financial services and insurance. High-cost credit and absence of insurance expose farmers to risk. The Concept Note and Funding Proposal should explore partnerships with microfinance institutions and insurers to pilot affordable credit lines and index-based crop insurance. Incorporate financial literacy training and savings schemes to build resilience.

7.3. Institutional & capacity-building recommendations

Clarify governance arrangements. The Feasibility Study names WFP as the Accredited Entity and CEP and WFP as co-Executing Entities, with roles for hydrometeorology, forestry and irrigation agencies. The Concept Note and Funding Proposal should elaborate a governance structure that clearly delineates responsibilities, decision-making processes and accountability mechanisms among these actors. Establish a multi-stakeholder steering committee, including representation from women's organisations, youth networks and disabled persons' associations.

Enhance extension and technical services. Strengthen national extension systems by developing a long-term extension strategy, increasing budget allocations and integrating digital advisory services. Encourage partnerships between public institutions, NGOs and private sector providers to expand reach. Support the recruitment and training of women extension agents to improve gender responsiveness.

Capacity strengthening of community organisations. Support the formation and strengthening of Water User Associations, farmer cooperatives and disaster-management committees. Provide training on governance, record-keeping, financial management and conflict resolution. Ensure inclusive participation (women, youth, and disabled) in leadership roles.

7.4. Financial & economic recommendations

Blended finance and co-financing. While the programme is financially viable, long-term sustainability requires diversified funding sources. Pursue blended finance models combining GCF grants with concessional loans from MDBs, in-kind contributions from government and communities, and private investment (e.g., pay-per-use irrigation equipment). Highlight how each component leverages co-financing and outline strategies to attract private sector partners for renewable-energy pumps, digital tools and agribusiness.

Cost-recovery mechanisms. Design tariffs for water services, greenhouse management and digital advisory subscriptions with safeguards for vulnerable users. Explore community-managed revolving funds to finance inputs and equipment. These mechanisms should be piloted and evaluated within the project timeframe.

Economic viability and value-chain analysis. Conduct detailed cost-benefit analyses for proposed interventions (water infrastructure, greenhouses, storage units) during Funding Proposal development. Identify high-potential value chains (e.g., horticulture, dried fruits, nuts) and ensure that interventions support market demand, quality standards and export opportunities.

7.5. Risk management & safeguards

Environmental and social safeguards. Undertake full environmental and social impact assessments for infrastructure activities (canal rehabilitation, reservoirs, greenhouses). Mitigation measures should address potential impacts on biodiversity, water rights and land ownership. Ensure that benefit sharing is equitable and that vulnerable groups are not displaced.

Climate and disaster-risk management. Integrate climate-risk screening into all infrastructure designs, accounting for glacial melt, landslide risk and flood extremes. Develop contingency plans for extreme events and incorporate a flexible design to allow for adaptive management.

Gender, youth and disability inclusion. Implement gender-action plans and youth engagement strategies to address persistent inequalities identified in the sector. Ensure that

disabled persons are recognised as agents of change and provided with accessible training and technologies. Monitor participation of these groups and adjust activities as needed.

7.6. Implementation roadmap

The recommendations above should be translated into a phased implementation plan:

1. **Preparatory phase (Year 0–1).** Finalise site selection using baseline data; conduct detailed assessments (hydro-met needs, irrigation systems, extension capacity, gender analysis); develop DAPs; and establish project governance structures. Design financial mechanisms (water-asset funds, revolving funds) and commence capacity-building for local authorities and extension workers.
2. **Early implementation (Year 1–2).** Roll out digital climate-information platforms; commence training of extension workers and farmers; establish demonstration plots; and rehabilitate priority irrigation infrastructure. Launch gender-responsive awareness campaigns and start procuring greenhouses and renewable-energy pumps.
3. **Scaling and integration (Year 2–4).** Expand demonstration plots and training programmes; construct storage units and bulking centres; implement market information services and institutional linkages; pilot microfinance and insurance schemes; and begin dissemination of lessons learned through policy briefs and knowledge products.
4. **Consolidation and replication (Year 4–5).** Evaluate interventions, refine the ToC and DAPs based on monitoring results; scale successful models to additional districts; integrate findings into national adaptation planning; and solidify partnerships for long-term financing and technical support.

8. Project information

8.1. Climate rationale

The rationale for the project is presented below, including a summary of the national and sectoral contexts, relevant climate change hazards and impacts, baseline challenges and vulnerabilities, adaptation needs, and the overall problem the project seeks to address.

National context

Tajikistan is a landlocked country in Central Asia, with 93% of its territory covered by mountains, making it one of the most mountainous countries in the world⁶¹⁹. Tajikistan's climate is marked by high aridity, extreme seasonal temperatures, and strong variability across time and regions⁶²⁰. Its diverse topography creates distinct climate zones — from hot, dry lowland valleys (cold semi-arid) to arid eastern deserts (cold desert), snowy central mountains (humid continental), and tundra conditions in the high Pamirs, where summer temperatures stay below 10°C⁶²¹. Precipitation also varies considerably, with central regions receiving over 1,800 mm annually, while the eastern mountains, southern lowlands remain extremely dry⁶²².

⁶¹⁹ Tajikistan's National Strategy and Action Plan on Conservation and Sustainable Use of Biodiversity 2003. Part 1. [Available online.](#)

⁶²⁰ World Bank Group 2021. Tajikistan Climate Risk Country Profile. [Available online.](#)

⁶²¹ <https://climateknowledgeportal.worldbank.org/country/tajikistan>

⁶²² FAO/WFP 2023. Crop and Food Security Assessment Mission to the Republic of Tajikistan. Special Report. [Available online.](#)

The country is the main glacial centre of Central Asia, with glaciers covering ~6% of its land area and playing a critical role in storing water and regulating river flows that replenish the Aral Sea basin⁶²³. The population has grown rapidly in recent decades, seeing a ~70% increase since 2000 and reaching over 10.4 million in 2024, with around 72% living in rural areas^{624,625}. Tajikistan's agro-industrial economy is rooted in agriculture but remains highly vulnerable to external shocks, including climate change, global commodity fluctuations, and a heavy reliance on remittances from migrant labour, which account for 28% of GDP. Despite improvements in poverty reduction and HDI, the country remains one of the poorest countries in the region, with 22.5% of the population living below the national poverty line and significant disparities between regions⁶²⁶. The country is also marked by persistent gender inequality regarding health, education and command over economic resources.

Sectoral context

Agriculture is a major basis for the country's economy, employing over 60% of the workforce and contributing around 24.6% of GDP. The sector is divided into corporate farms (17%), subsistence farms (23%), and mid-sized dehkan farms⁶²⁷ (60%) which contribute 6.0%, 30.6%, and 63.4% of national agricultural output, respectively, demonstrating the prominent role of household-level and smallholder agriculture in national food production⁶²⁸. For example, smallholder farms, which make up nearly 90% of all farms, operate mostly on marginal land averaging just 0.2 ha, yet cultivate over 60% of farmland and supported 48% of the rural workforce in 2018⁶²⁹. Agriculture in Tajikistan is generally highly dependent on irrigation, with 745,000 hectares equipped as of 2021 — 74% of which were actively cultivated. While rainfed agriculture exists, it poses risks due to low and variable precipitation that lead to fluctuating yields, particularly in the livestock subsector which depends heavily on favourable rainfall. Water User Associations (WUAs) are central to local irrigation management in Tajikistan, but their effectiveness is constrained by limited institutional capacity, unclear mandates, and insufficient financial and technical resources⁶³⁰. Many WUAs struggle to operate and maintain irrigation infrastructure, and poor service quality and low farmer trust hinder fee collection. Strengthening WUAs through clearer legal frameworks, capacity building, and improved coordination with government agencies is necessary for sustainable, community-based water management. The quality of agricultural extension services is another key factor influencing productivity and resilience. Tajikistan's agricultural extension services face challenges of limited capacity, underfunding, and lack of specialisation, with ongoing efforts to improve them⁶³¹. Additionally, given that 75% of employed women work in agriculture, addressing gender barriers — such as restrictive norms and unequal access to training and resources — is essential to ensure women benefit equally and can fully contribute to agricultural development⁶³².

Climate change trends, hazards and impacts

Tajikistan has already experienced a ~1.4°C increase in average temperatures since 1950, with the rate of increase accelerating progressively for 1971–2020 and 1991–2020⁶³³. By

⁶²³ <https://unfccc.int/resource/docs/natc/tainc2.pdf>

⁶²⁴ [Tajikistan. National Communication \(NC\). NC 4. | UNFCCC](#)

⁶²⁵ [Tajikistan - Rural Population - 2025 Data 2026 Forecast 1960-2023 Historical](#)

⁶²⁶ <https://www.researchgate.net/publication/341072775/figure/fig8/AS:886350869966848@1588333923229/Poverty-distribution-map-of-Tajikistan-in-percent-of-the-population-Source-Bredigkei.jpg>

⁶²⁷ Tajikistan's dehkan farms are legally defined midsize family/peasant farms (~20 ha) created from the privatization of former collective farms. They dominate national crop production, face development hurdles, and benefit from state regulation and organizational support via national farmers' associations.

⁶²⁸ <https://www.fao.org/family-farming/countries/tjk/en/>

⁶²⁹ FAO 2018. Small Family Farms Country Factsheet Tajikistan. [Available online.](#)

⁶³⁰ ALRI 2019. State support of the Water Users Associations (WUA). [Available online.](#)

⁶³¹ <https://www.fao.org/family-farming/detail/en/c/284746/>

⁶³² FAO 2021. Towards gender equality in Tajikistan's extension services. [Available online.](#)

⁶³³ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

2050, average temperatures may increase by 1.7°C (SSP1-2.6) or up to 2.6°C (SSP5-8.5), with the number of extreme heat days (>35°C) increasing from ~11 to ~16 annually under SSP5-8.5⁶³⁴. Regarding precipitation, Tajikistan has seen increased variability in precipitation since 1951, with a 5–10% average rise in annual rainfall driven by more intense events. At the same time, an increase in the maximum number of consecutive dry days has been observed since 1991, indicating longer dry spells and more extreme fluctuations between wet and dry conditions⁶³⁵. These trends are expected to continue, with more intense but less frequent rainfall projected, with a possible increase in average precipitation offset by higher evaporation rates and reduced summer rainfall⁶³⁶. Winter precipitation is projected to rise slightly, while extreme single-day rainfall events are expected to intensify across all SSPs. At the same time, consecutive dry days are projected to increase from 40–45 to 45–50 by 2100, indicating longer dry spells⁶³⁷.

Drought

The primary climate hazard faced by rural communities in Tajikistan is more frequent and intense drought events. Tajikistan's reliance on glacial meltwater, seasonal rainfall, and agriculture makes it increasingly vulnerable to drought, as erratic rainfall and reduced snowfall shrink the snowpack and undermine seasonal water availability. Shifting precipitation patterns and rising temperatures, linked in part to ENSO cycles, are driving more frequent and severe droughts⁶³⁸. Historically rare (1-in-100 year) droughts are now recurring more often, with major events in 2000, 2001, and 2008⁶³⁹. These years saw rainfall fall 30–50% below average, with the 2000–2001 drought causing near-total failure of rainfed wheat and widespread irrigation shortfalls⁶⁴⁰. In the Amudarya basin, water access dropped by 50%, crippling rural livelihoods. It is projected that by 2050 severe droughts could occur every 15 years, with annual probability rising from 3% to over 25%. Droughts will strain water and fodder supplies, increase wildfire and erosion risks, and raise heat-related illness, while reducing beef and lamb production by up to 20%⁶⁴¹. Crop yields and agricultural labour productivity are projected to decline, irrigation demand may rise 5–8%, and without adaptation, crop output could drop by up to 8% annually.

Heatwaves

Tajikistan faces rising heatwave risks, especially in lowland areas where temperatures often exceed 35°C, straining agriculture, health, and labour. Such heat disrupts crop flowering, reduces yields, impairs outdoor work capacity, and limits overnight cooling, intensifying public health and productivity threats. The frequency and intensity of heatwaves have increased notably since the 2000s⁶⁴². Events in the 2010s and 2020s exceeded 2.5 standard deviations above historical norms — once rare, now increasingly common. Heatwaves are projected to become more frequent, with the duration of annual warm spells increasing from ~24 to ~84 days by 2050⁶⁴³. National maximum temperatures will exceed 35°C, with days above 40°C becoming common in lowland regions. Under RCP8.5, extreme heat events are expected to more than double by late century.

Glacial retreat

⁶³⁴ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

⁶³⁵ <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

⁶³⁶ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

⁶³⁷ <https://climateknowledgeportal.worldbank.org/country/tajikistan/climate-data-projections>

⁶³⁸ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

⁶³⁹ <https://www.fao.org/4/x7844e/x7844e00.htm>

⁶⁴⁰ <https://www.fao.org/4/x7844e/x7844e00.htm>

⁶⁴¹ <https://crva.centralasiacclimateportal.org/tajikistan-impacts-sectors-agriculture>

⁶⁴² <https://climateknowledgeportal.worldbank.org/country/tajikistan/trends-variability-historical>

⁶⁴³ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

Glaciers are a major source of summer water for irrigation, hydropower, and river flow in Tajikistan. Tajikistan has already lost over 20 billion cubic metres of glacier ice — approximately 2.5% of its total volume. Since the mid-20th century, glacier coverage has dropped from 6% to 5% of land area, with a 30% loss in total volume⁶⁴⁴. Over 1,000 glaciers have disappeared in the past three decades⁶⁴⁵. Major glaciers like Fedchenko have shrunk by over 1 km in length, with marked thinning. By 2050, up to 30% of glacier mass could be lost under current trends, with Central Asia's total losses reaching 50–70% by century's end. In southern Tajikistan and parts of the Pamirs, glacier retreat may reach 2 km per year⁶⁴⁶. Runoff from melting will likely peak by 2040, followed by steep declines, especially from small tributaries⁶⁴⁷. Glacial retreat will further reduce summer water availability when irrigation needs are highest and disrupt hydropower generation. Seasonal runoff patterns will shift — peaking earlier (April–June) and becoming more erratic. This will affect reservoir management and increase risks of drought, flood, and land surface warming due to reduced snow cover and albedo.

Floods and mudflows

Tajikistan's mountainous terrain, snowmelt, and erratic rainfall make it highly vulnerable to floods and mudflows, including river floods, flash floods, and Glacier Lake Outburst Floods (GLOFs). These hazards threaten infrastructure, farmland, and settlements — especially in central valleys and lowland areas — with GLOFs and landslides often combining to cause severe, sudden damage. Floods occur most commonly due to rain in spring and snowmelt in summer. Flash floods often affect steep valleys during intense storms. GLOFs — caused by the failure of moraine-dammed lakes — pose growing risk in glacial areas. In 2008 and 2009, floods and landslides damaged 14,000 ha of land, costing around US\$1 million⁶⁴⁸. Climate change is expected to increase flood risk, with an additional 5,000 people projected to be affected annually by 2030, and GDP losses projected to rise by US\$30 million under high-emission scenarios⁶⁴⁹. Urban areas and major river basins are especially at risk, according to GFDRR projections⁶⁵⁰.

Baseline challenges and vulnerability to climate change

Tajikistan faces acute climate vulnerability due to its mountainous terrain, high exposure to natural hazards, and limited adaptive capacity. Ranked 131st in vulnerability and 144th in readiness by the ND-GAIN Matrix, the country experiences frequent floods, droughts, landslides, and erosion⁶⁵¹. The 2023 ICA identified that over half of Tajikistan's 47 districts face medium to high exposure to these climate-related hazards. Specifically, 13 districts are classified as having high risk and 15 as medium risk. Much of the country's agriculture — on steep slopes and in hazard-prone valleys — depends on snow and glacial melt, making it highly sensitive to changing water availability⁶⁵². Agriculture is constrained by outdated irrigation systems, with up to 65% water losses and 70% of irrigated areas affected by salinisation and waterlogging⁶⁵³. Most infrastructure dates from the Soviet era and is inefficient and energy-intensive. Land degradation is widespread, particularly in arid regions with minimal

⁶⁴⁴ <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

⁶⁴⁵ <https://ca-climate.org/eng/news/pulsating-glaciers-of-tajikistan/#:~:text=He%20noted:%20%E2%80%9COver%20the%20past,have%20melted%20and%20completely%20disappeared.>

⁶⁴⁶ <https://www.undp.org/sites/g/files/zskgke326/files/migration/eurasia/UNDP-RBEC-Tajikistan-Climate-Change-and-Disaster-Risk-Reduction-Snapshot.pdf>

⁶⁴⁷ <https://www.adb.org/sites/default/files/publication/736661/climate-risk-country-profile-tajikistan.pdf>

⁶⁴⁸ <https://openknowledge.fao.org/server/api/core/bitstreams/58e8af31-8455-4cca-8b14-f69c1ccba024/content>

⁶⁴⁹ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

⁶⁵⁰ <https://thinkhazard.org/en/report/239-tajikistan/UF>

⁶⁵¹ https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf

⁶⁵² <https://openknowledge.fao.org/server/api/core/bitstreams/58e8af31-8455-4cca-8b14-f69c1ccba024/content>

⁶⁵³ <https://www.adb.org/sites/default/files/institutional-document/32199/taj-july-2004.pdf>

rainfall. Productivity is undermined by fragmented landholdings, low mechanisation, poor access to inputs, feed shortages in winter and overgrazed pasturelands — 85% of which are eroded. Additionally, smallholder farmers have limited resilience to climate shocks due to low uptake of climate-resilient practices, driven by limited access to climate information, skills, markets, investment capacity, and low public awareness of adaptation options. Institutional limitations further exacerbate vulnerability; local agencies lack the capacity to conduct climate risk assessments or deliver timely, actionable forecasts and advisories. Coordination between institutions remains limited, and early warning systems for climate-related hazards are underdeveloped. Local development plans often rely on outdated baselines and do not integrate climate risks, with limited ability to address threats to agriculture, food security, and natural resources. Food insecurity remains widespread, with poor households spending the 70–80% of income on food. Labour migration has left many rural communities in the care of women and elderly with limited resources. Gender inequality restricts women's access to land, finance, and decision-making, compounding vulnerability. Institutional capacity is limited, with under-resourced local authorities and agricultural services unable to effectively integrate climate risk into planning. High dependence on remittances from migrant labour exposes the economy to external shocks, while limited market access and policy inertia hinder resilience^{654,655}. Without targeted investment in infrastructure, ecosystem restoration, and inclusive systems, Tajikistan remains highly exposed to worsening climate impacts.

Adaptation needs

Given the above-mentioned escalating climate risks in Tajikistan, there is a need to equip rural communities — especially smallholder farmers and women — with the tools, systems and support required to anticipate, absorb and adapt to the impacts of climate change. Intensifying droughts, erratic rainfall, glacial retreat, and extreme heat undermine water security, degrade agricultural productivity, and threaten rural livelihoods. These hazards intersect with structural vulnerabilities, including degraded infrastructure, limited land and water management capacity, low uptake of resilient practices, and institutional gaps in planning and service delivery. To address these interlinked challenges, communities require strengthened local governance systems to integrate climate risk into planning and deliver coordinated, risk-informed development. Without improved institutional capacity, climate adaptation will remain fragmented and reactive, leaving districts ill-equipped to manage worsening shocks. At the same time, farmers require timely, actionable climate and market information to inform production decisions in the face of increasingly unpredictable and extreme weather patterns. At the smallholder production level, climate-smart technologies, efficient water infrastructure, and resilient inputs are needed to address the pressures of drought and flood, reduce input losses, and stabilise yields. Households also need support to add value to agricultural products, improve storage, and connect to reliable markets to build income buffers against climate-induced volatility. Additionally, gender-responsive approaches to these interventions are required as women are disproportionately affected by climate risks, yet face barriers to accessing resources, training, and decision-making spaces. Moreover, building broad-based awareness and knowledge on the health, nutrition, and livelihood implications of climate change is required to ensure the sustained scalability and replicability of these interventions. This knowledge will support communities in adopting adaptive behaviours and advocating for responsive policies. These needs form the basis for the proposed interventions, which aim to build a more resilient rural development system through integrated, locally led and inclusive adaptation measures.

Problem statement

⁶⁵⁴ CGIAR 2025. IFPRI Discussion Paper 02329. Tajikistan's agrifood system: The past performance and future opportunities and challenges. [Available online.](#)

⁶⁵⁵ IFPRI 2025. Central Asia policy brief 23. Tajikistan's Agrifood System Structure. [Available online.](#)

Tajikistan is experiencing rapidly intensifying climate change impacts, driven by rising temperatures — projected to increase by over 2°C by 2050 — and declining, increasingly erratic precipitation. These trends are causing more frequent and intense droughts, heatwaves, flash floods, and glacial retreat, with glacial runoff projected to drop sharply as up to 30% of glaciers may disappear by 2050. Snowline retreat is already drying springs and reducing feeder stream flows, intensifying seasonal water stress during the key March–May growing period and threatening water supplies for irrigation, livestock, and households. These climate hazards are compounding baseline challenges, including: i) widespread rural poverty; ii) degraded land and desertification (50,000 ha lost annually); iii) reliance on rainfed agriculture; iv) degraded or nonfunctional irrigation infrastructure and storage facilities; and v) limited institutional and farmer capacity to manage climate risks. As a result, rural communities — particularly smallholder farmers and women — are highly vulnerable to the impacts of climate. Agricultural productivity is declining due to crop losses, degraded pastures, vulnerable livestock systems, and reduced water availability. At the same time, erosion, biodiversity loss, forest degradation, and rising wildfire risk are accelerating ecosystem decline. Increasingly severe mudflows and flash floods are damaging agricultural land, infrastructure, and livelihoods. The combined effect of these hazards and vulnerabilities is undermining agricultural productivity, reducing water availability for irrigation and livestock, and threatening food security through falling crop yields, degraded pastures, and weakened livelihoods. Without urgent adaptation measures, Tajikistan's most vulnerable communities will face deepening food insecurity, livelihood loss, and environmental degradation.

Problem Tree and climate change impact pathways

The problem tree for the proposed project in Tajikistan is presented in

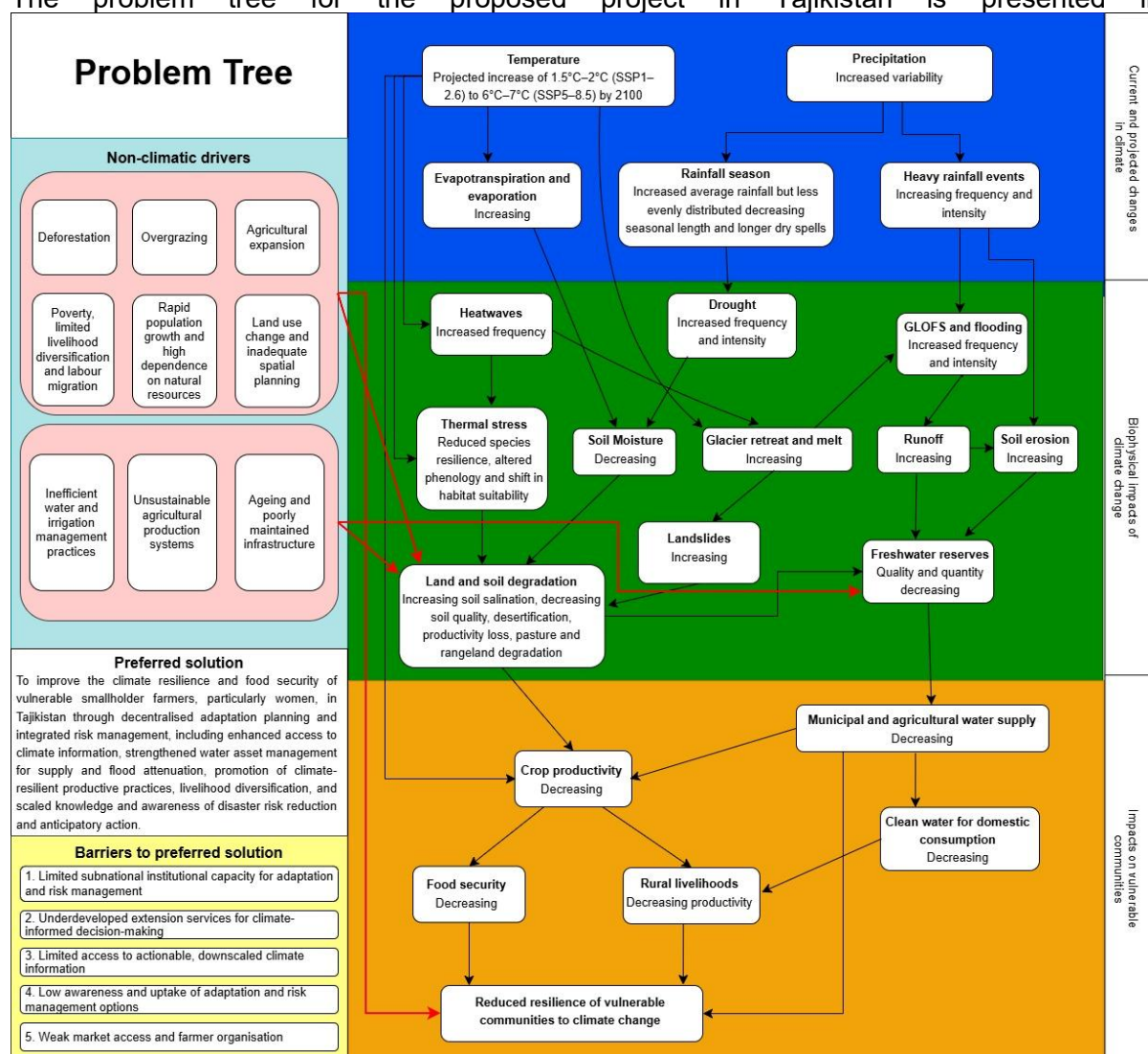


Figure 91 below. The diagram illustrates the causal relationships between climatic drivers, biophysical impacts of climate change, and the resulting impacts on vulnerable rural communities. It also identifies points along key climate change impact pathways where the proposed project interventions will disrupt or reduce climate-induced risks. Tajikistan is already experiencing the effects of rising temperatures, increasing precipitation variability, and more frequent extreme weather events. These impacts are projected to intensify considerably under future climate change scenarios, as described in Section 2 and 3.

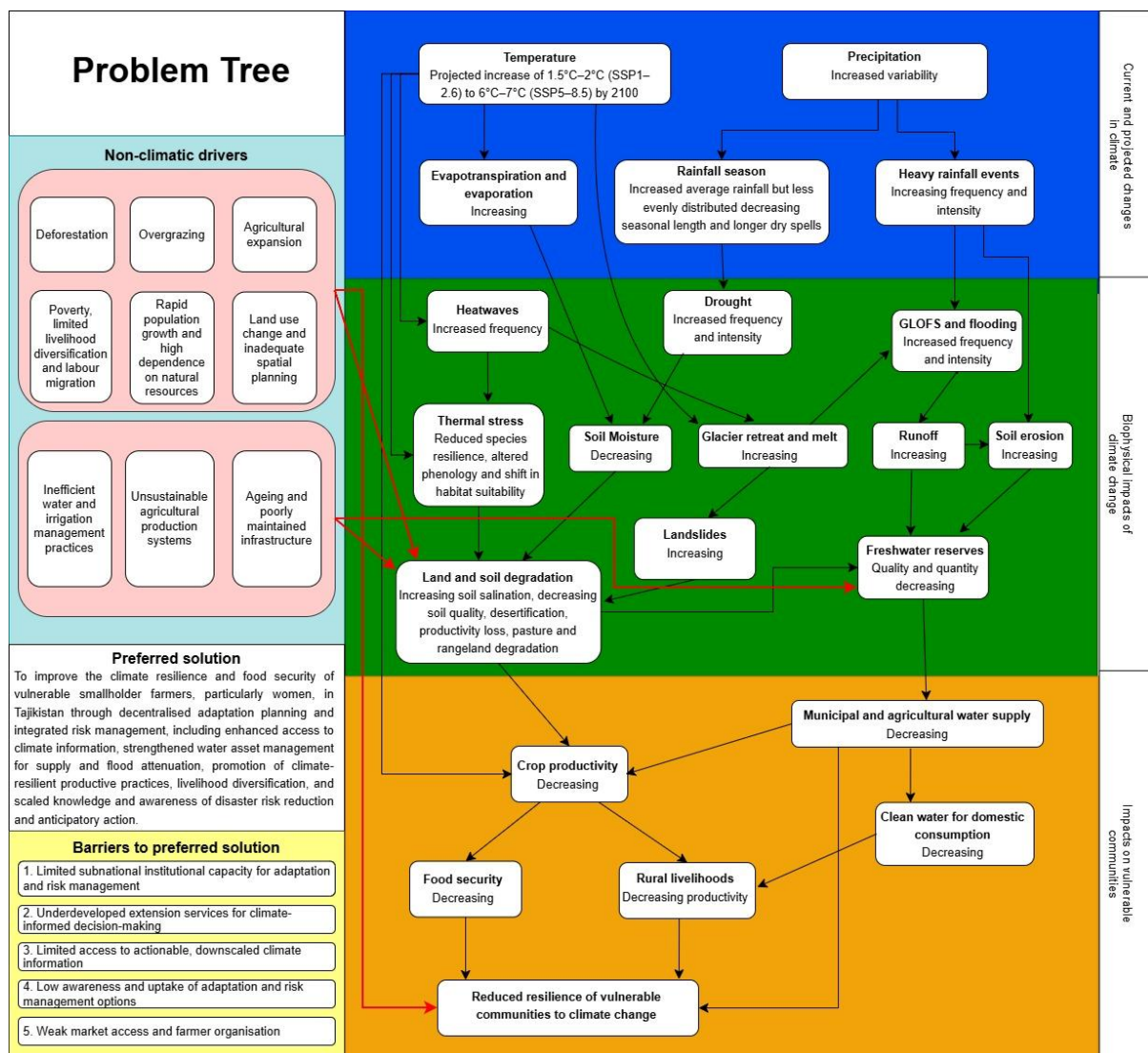


Figure 91. Project problem tree.

Biophysical impacts of climate change

In Tajikistan, two primary climate trends are projected, namely increasing mean annual temperatures and increased variability in precipitation patterns. Temperatures are projected to increase by approximately 1.5°C to 2°C under lower emission scenarios and up to 6°C to 7°C under higher emission scenarios by 2100. Precipitation is expected to become more variable, characterised by changes in rainfall distribution, a decreasing seasonal length, longer dry spells, and an increase in the frequency and intensity of heavy rainfall events.

Rising temperatures will lead to increasing evapotranspiration and evaporation rates (IP1), contributing to more frequent and intense heatwaves (IP2). Concurrently, increasing evapotranspiration, combined with longer dry spells, will contribute to more frequent and severe drought events (IP3). Drought conditions will directly reduce soil moisture levels (IP4), impairing infiltration and exacerbating land and soil degradation.

Land and soil degradation will intensify through increasing soil salinisation, declining soil quality, desertification, productivity losses, and pasture and rangeland degradation (IP5). These impacts will be further exacerbated by glacier retreat and melt (IP6), which will alter

hydrological regimes. Increasing precipitation variability and more intense rainfall events will increase the frequency and intensity of glacial lake outburst floods and flooding (IP7). These events will lead to increasing runoff and soil erosion (IP8), which reduces infiltration, increases sediment transport, and degrades water quality. Together, these processes will result in a decline in the quality and quantity of freshwater reserves, including both surface water and groundwater resources (IP9).

Impacts on vulnerable communities

The biophysical impacts described above will translate into significant adverse effects on vulnerable rural communities in Tajikistan. Reduced water availability for irrigation and domestic use (IP9) will lead to declining crop productivity (IP10). Decreasing crop productivity will, in turn, undermine food security (IP11) and reduce the productivity of rural livelihoods (IP12). These impacts are mutually reinforcing, as reduced food security and livelihood productivity further constrain household capacity to cope with climate shocks.

Intervention points along the impact pathways

The proposed project directly interrupts several of the climatic impact pathways identified above, and the associated activities are described in more detail in 8.4.3 Project Description:

- Reduced water availability (IP9–Activities 2.1.1, 2.1.2, 2.1.3, 2.1.4)
Establishing climate-resilient water asset demonstration plots, strengthening water infrastructure, climate-proofing canals, and establishing local water asset funds restore a reliable water supply for domestic use and agriculture.
- Declining agricultural productivity (IP10–Activities 2.2.1, 2.2.2, 2.2.3, 2.2.4)
Climate-resilient agricultural production demonstration plots, greenhouses, mixed orchards, and farmer training mitigate the effects of drought, heat stress, and soil degradation.
- Increased food insecurity (IP11–Activities 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.3.3, 2.3.4).
Stabilising production through demonstration plots, training, storage units, solar dryers, bulking centres, and value-chain support reduces pathways linking production losses to household food insecurity.
- Livelihood losses and reduced income (IP12–Activities 2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5)
Strengthening smallholder farming systems, improving value-chain participation, and providing market information services support rural income and economic resilience.
- Land degradation and ecosystem decline (IP5, IP8–Activities 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.2.1, 2.2.3)
Soil conservation, reforestation, water-efficient irrigation, and climate-proofed canals disrupt pathways where land degradation and erosion undermine ecosystem services.

By targeting these critical climatic impact pathways through specific activities, the project strengthens the resilience of vulnerable rural communities, enhances ecosystem services, and supports sustainable livelihoods in the face of increasing drought, heat stress, flooding, and glacier-related hydrological changes.

Figure 92 presents the principal climate change impact pathways affecting water resources, ecosystems, agricultural productivity, livelihoods, and food security. In this Feasibility Study, particular emphasis is placed on the increasing impacts of drought, heat stress, flooding, and glacier-related hydrological changes, as well as their cascading effects on water availability and rural livelihoods.

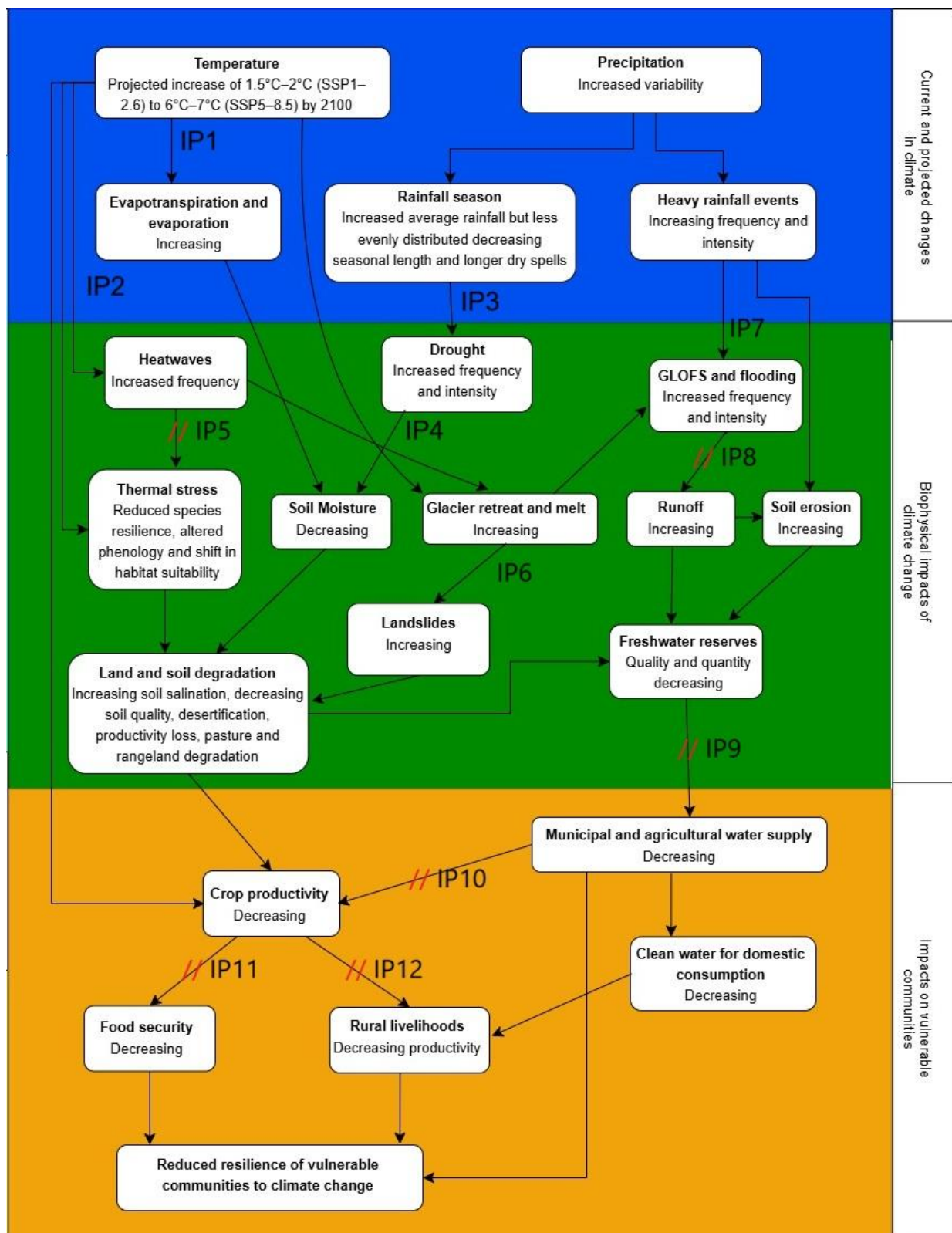


Figure 92. Schematic representation of potential climate change impact pathways (IPs) on vulnerable communities in Tajikistan. The direction of the arrows shows the direction of the causal pathway. The red “//” symbol represents points along relevant impact pathways.

Adaptation benefits

The project adopts a results-based approach to adaptation, explicitly linking climate risks, interventions and measurable resilience outcomes. Each category of investment contributes to quantifiable adaptation benefits. For example, climate-resilient irrigation systems are expected to improve water-use efficiency and reduce vulnerability to drought; greenhouse and orchard systems contribute to reduced yield variability and increased production stability under changing climatic conditions; and post-harvest infrastructure reduces losses associated with climate-related shocks. These contributions are captured through indicators related to adoption of climate-resilient technologies, improved productivity under climate stress and increased stability of agricultural incomes. This structured approach ensures that resilience outcomes are measurable, attributable and aligned with GCF adaptation results areas.

The quantification of adaptation benefits is based on a structured linkage between climate risks, project interventions and measurable resilience outcomes. For each investment category, expected adaptation benefits are defined and, where possible, quantified. Irrigation investments are expected to increase water-use efficiency and reduce sensitivity to drought conditions; greenhouse and orchard systems are expected to reduce yield variability and enhance production stability under climate stress; and post-harvest infrastructure is expected to reduce losses associated with extreme weather events.

The analysis considers both direct and indirect beneficiaries, including the number of farmers adopting climate-resilient practices and the area of land under improved management. In addition, institutional benefits are captured through improved climate-informed planning and increased utilisation of climate information services. These metrics are aligned with the project's Logical Framework and GCF adaptation indicators, ensuring consistency between technical design, economic analysis and monitoring systems (see Section E in the Funding Proposal).

The table below provides a summary of climate hazards and related risks and impacts, as well as relevant adaptation interventions and related benefits.

Table 15. Climate change hazards, impacts and adaptation interventions and benefits overview.

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
Agriculture	<u>Flooding and Landslides</u>	<ul style="list-style-type: none"> Soil erosion; Destruction of cropland and topsoil loss. Measured and modelled studies in Tajikistan report topsoil losses ranging from a few tonnes per hectare per year on gentle slopes up to tens of tonnes per hectare per event on steep, unprotected plots; typical annual erosion on sloping cultivated land is often in the order of 5 to 30 t/ha/yr, with event peaks substantially higher where floods or mudflows occur^{659, 660}. Fast flows strip topsoil and bury fields under coarse sediment, reducing short-term- yields and requiring costly rehabilitation of terraces and fields; localised events have destroyed entire 	Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.	<ul style="list-style-type: none"> Communities can better plan and manage crop production, adapt livelihoods and diversify income to reduce vulnerability to flooding and landslides⁶⁶⁷; Improved forecasting and sharing of climate information ensures enhanced capacity to plan production cycles and prepare for flood events⁶⁶⁸; Access to equipment and climate data promotes planning of crop production and thus reduces crop losses and food insecurity⁶⁶⁹. Improving access to weather forecasts through mobile applications increases transparency and traceability, strengthens planning and equips producers with the knowledge and tools needed to sustainably participate in value chains⁶⁷⁰.
	Intensified precipitation will increase the likelihood of more frequent flooding and landslides ⁶⁵⁶ .		Train extension workers and smallholder farmers to understand and apply climate information using the PICSA approach.	
	Most river basins across Sughd, Republican Subordinate and Khatlon are expected to experience increased flooding by 2050 ⁶⁵⁷ .		Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.	
	At least 36% of the land, including agricultural land, is affected by landslides, with		Build the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as mobile apps, Telegram channels, or other locally appropriate digital tools, for the provision of climate and market information.	

⁶⁵⁶ [Country Climate Risk Portal: Tajikistan – CACIP Central Asia Climate Information Portal](#)

⁶⁵⁷ [Country Climate Risk Portal: Tajikistan – CACIP Central Asia Climate Information Portal](#)

⁶⁵⁹ Journal of Soil and Water Conservation .[Available here](#).

⁶⁶⁰ Influence of different cultivation methods on surface runoff and soil loss in Tajikistan – merging monitoring and modeling. Christine Stumpp & Stefan Strohmeier. [Available here](#).

⁶⁶⁷ [Tajikistan Country Climate and Development Report](#)

⁶⁶⁸ [Tajikistan Country Climate and Development Report](#)

⁶⁶⁹ [How Climate Change Is Damaging Agriculture and Food Security in Tajikistan - The Times Of Central Asia](#)

⁶⁷⁰ [Tajikistan adopts programme for the digitalization of the agricultural sector with FAO support](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	50,000 potential landslide sites identified. Landslides pose a risk to 728,000 people, or 11% of the population in the near future ⁶⁵⁸ .	village plots and food stocks. ⁶⁶¹ <ul style="list-style-type: none"> • Production losses; • Food insecurity; • Increased vulnerability of rural communities; • Reduction in income and rural livelihoods. Floods affect at least 100,000 Tajik people per year because of losses to crops, homes, and infrastructure ⁶⁶² . The annual GDP loss is estimated at US\$100 million. By 2035–2044, at least 300,000 people will be affected each year due to river flooding resulting from the proximity of agriculture and settlements to rivers or mountainous terrain ⁶⁶³ .	Climate-proof canals to strengthen their durability to damage from flooding, landslides and mudslides, and to improve their contribution to flood attenuation. Establish climate-resilient agricultural production demonstration plots to showcase innovative practices and technologies.	<ul style="list-style-type: none"> • Enhanced water availability for crop production through enhanced irrigation management⁶⁷¹; • Reduced production losses due to improved soil integrity, diversion of run off, decreased peak discharge and water conservation⁶⁷²; • Increased food security because of improved crop productivity⁶⁷³; • Increased rural livelihoods and income due to reduced losses⁶⁷⁴. <ul style="list-style-type: none"> • Enhance crop productivity due to improved soil management and crop health⁶⁷⁵; • Improved skills and knowledge sharing to reduce losses resulting from waterlogged soil or flooding⁶⁷⁶; • increase rural livelihoods and income due to enhanced productivity⁶⁷⁷; • Increase food security due to value chain development and enhanced productivity⁶⁷⁸.

⁶⁵⁸ [National Disaster Risk Management Project \(Additional Financing\): Sector Assessment \(Summary\) - Agriculture, Natural Resources, and Rural Development \(Disaster Risk Management\)](#)

⁶⁶¹ TAJIKISTAN Anticipatory: Flooding/landslides in the Rasht Valley (Lakhsh, Tojikobod and Rasht districts). [Available here](#).

⁶⁶² [National Disaster Risk Management Project \(Additional Financing\): Sector Assessment \(Summary\) - Agriculture, Natural Resources, and Rural Development \(Disaster Risk Management\)](#)

⁶⁶³ [National Disaster Risk Management Project \(Additional Financing\): Sector Assessment \(Summary\) - Agriculture, Natural Resources, and Rural Development \(Disaster Risk Management\)](#)

⁶⁷¹ [Flood Management Guideline Tajikistan](#)

⁶⁷² [Flood Management Guideline Tajikistan](#)

⁶⁷³ [Flood Management Guideline Tajikistan](#)

⁶⁷⁴ [Flood Management Guideline Tajikistan](#)

⁶⁷⁵ [The RESILAND Tajikistan Project: Revitalizing Landscapes for Prosperity and a Sustainable Future – CACIP Central Asia Climate Information Portal](#)

⁶⁷⁶ [The RESILAND Tajikistan Project: Revitalizing Landscapes for Prosperity and a Sustainable Future – CACIP Central Asia Climate Information Portal](#)

⁶⁷⁷ [The RESILAND Tajikistan Project: Revitalizing Landscapes for Prosperity and a Sustainable Future – CACIP Central Asia Climate Information Portal](#)

⁶⁷⁸ [The RESILAND Tajikistan Project: Revitalizing Landscapes for Prosperity and a Sustainable Future – CACIP Central Asia Climate Information Portal](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
		<p>Heavy rains and ensuing flash floods inflict significant damage on agriculture, irrigation and other infrastructure, with the city of Penjikent in northwestern Tajikistan, being an example⁶⁶⁴.</p> <ul style="list-style-type: none"> Decreased water quality; <p>Floods commonly breach earthen canals, block intakes with debris, and collapse small dams—disrupting irrigation for weeks to months and reducing planted area in the following season^{665,666}.</p>	<p>Establish 300 ha of mixed orchards using flood-resistant species, including the installation of green fencing using appropriate species to prevent livestock damage to orchards.</p>	<ul style="list-style-type: none"> Enhanced water availability for crop production due to reduced water runoff⁶⁷⁹; Reduced productivity losses due to reduced soil erosion and enhanced soil coverage⁶⁸⁰; Increased food security due to lesser production losses⁶⁸¹; Increased rural livelihoods and income due to diversified crop and fruit production⁶⁸².
			<p>Train farmers, inclusive of women and young farmers, in climate-resilient practices and technologies using participatory and digital methods.</p>	<ul style="list-style-type: none"> Enhance crop productivity and food security due to improved land preparation, timely sowing, proper fertilization, and irrigation⁶⁸³; Reduce vulnerability of rural communities due to improved communication and knowledge sharing on flood risks and preparing for such impacts⁶⁸⁴; Increase rural livelihoods and income⁶⁸⁵.
	<p><u>Drought</u></p> <p>According to the FAO, global</p>	<ul style="list-style-type: none"> Reduced soil productivity; Decreased crop production; 	<p>Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.</p>	<ul style="list-style-type: none"> Reduced vulnerability of rural communities due to enhanced food production, food security and risk mitigation planning⁶⁹³;

⁶⁶⁴ [Flash Floods Severely Damage Irrigation Infrastructure and Crops in Tajikistan - The Times Of Central Asia](#)

⁶⁶⁵ Flash Floods Severely Damage Irrigation Infrastructure and Crops in Tajikistan. [Available here.](#)

⁶⁶⁶ The World Bank. Tajikistan: Economic and Distributional Impact of Climate Change. [Available here.](#)

⁶⁷⁹ [GEFF-Tajikistan-Podcast-transcript -4 eng.pdf](#)

⁶⁸⁰ [GEFF-Tajikistan-Podcast-transcript -4 eng.pdf](#)

⁶⁸¹ [GEFF-Tajikistan-Podcast-transcript -4 eng.pdf](#)

⁶⁸² [GEFF-Tajikistan-Podcast-transcript -4 eng.pdf](#)

⁶⁸³ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁶⁸⁴ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁶⁸⁵ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁶⁹³ [New Drought Monitoring System Could Save Tajikistan Millions - The Times Of Central Asia](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	drought events increased by 29% between 2000 and 2023, with Central Asia among the worst-affected regions ⁶⁸⁶ . Between 2000 and 2016, droughts inflicted over US\$2 billion in damages across Central Asia, with crop losses in Tajikistan reaching up to 30% ⁶⁸⁷ . UN estimates suggest up to 1.3% of Central Asia's GDP could be lost annually to droughts by 2050 ⁶⁸⁸ .	<ul style="list-style-type: none"> Increased vulnerability of rural communities; Decreased water quality and availability; Food insecurity; Reduction in income and rural livelihoods. <p>Irrigation shortfalls during critical growth stages (tillering/heading in cereals; boll filling in cotton) reduce potential yields even when total seasonal rainfall is near normal; earlier snowmelt can leave mid-summer months drier when crops need water most^{689, 690}. Soil moisture deficits and heat stress reduce germination, flowering success and tuber bulking in potatoes, increasing crop failure risk for both staples and high-value horticulture⁶⁸⁹.</p>	<p>Train extension workers and smallholder farmers to understand and apply climate information using the PICSA approach.</p> <p>Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.</p> <p>Enhance the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as mobile apps, telegram channels, or other locally appropriate digital tools for the provision of climate and market information.</p> <p>Establish climate-resilient water asset demonstration plots to showcase innovative water use, management technologies and nature-based methods for agricultural and domestic use.</p> <p>Develop and strengthen climate-resilient water assets (for example, drip irrigation, sprinkler irrigation, energy-efficient/renewable energy-powered pumps, reservoirs, and irrigation channels) to improve the productivity of smallholder production systems.</p>	<ul style="list-style-type: none"> Reduced crop losses and food insecurity due to efficient water use and timely response to droughts⁶⁹⁴; Enhanced access to diverse climate and forecasting channels improves accurate and fast sharing of climate information to reduce drought-related losses⁶⁹⁵. Improved water management contributes to enhanced crop production⁶⁹⁶; Enhanced crop production promotes livelihood and income⁶⁹⁷; Knowledge sharing enhances drought risk preparedness and improved rural community resilience⁶⁹⁸. Previous projects in Tajikistan showed that drip irrigation systems effectively conserved water resources during periods of drought, while and facilitated restoration of the delicate ecosystem. This EbA solution exceeded outcomes by restoring approximately 4,000 m² of land

⁶⁸⁶ <https://asiaplustj.info/en/news/tajikistan/society/20250625/in-the-danger-zone-un-warns-of-growing-drought-risk-in-tajikistan-and-central-asia>

⁶⁸⁷ <https://asiaplustj.info/en/news/tajikistan/society/20250625/in-the-danger-zone-un-warns-of-growing-drought-risk-in-tajikistan-and-central-asia>

⁶⁸⁸ <https://asiaplustj.info/en/news/tajikistan/society/20250625/in-the-danger-zone-un-warns-of-growing-drought-risk-in-tajikistan-and-central-asia>

⁶⁸⁹ Tajikistan Country Climate and Development Report. World Bank Group. [Available here](#).

⁶⁹⁰ Climate Risk Country Profile Tajikistan. World Bank Group. [Available here](#).

⁶⁹⁴ [New Drought Monitoring System Could Save Tajikistan Millions - The Times Of Central Asia](#)

⁶⁹⁵ [New Drought Monitoring System Could Save Tajikistan Millions – CACIP Central Asia Climate Information Portal](#)

⁶⁹⁶ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁶⁹⁷ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁶⁹⁸ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
		Post-drought- land degradation (salinisation from poor irrigation management, loss of soil organic matter) lowers productivity in subsequent seasons unless rehabilitation is undertaken ⁶⁹⁰ .		and, effectively mitigating the risk of further degradation. Furthermore, it nurtured a diverse arboreal population, encompassing as many as 2,000 trees of varying species ⁶⁹⁹ .
		In the Khatlon and Sogd regions, farmers experience 15 to 30% reduction in income during intense droughts ⁶⁹¹ . Intensive rainfall events will contribute to increased pest prevalence, diseases, and thus crop losses ⁶⁹² .	Support the establishment of local water asset funds in each target district to finance the ongoing maintenance of water assets.	<ul style="list-style-type: none"> Improved water management and water supply to rural and farming regions⁷⁰⁰.
			Construct or rehabilitate greenhouses	<ul style="list-style-type: none"> Promote food security and enhanced crop production through controlling the conditions crops are grown in⁷⁰¹; Reliable food production despite unreliable rainfall ensures a stable income source and food security⁷⁰²; Diversified livelihoods and value chains due to a variety of crops planted in greenhouses year-round⁷⁰³.
			Establish climate-resilient agricultural production demonstration plots to showcase innovative practices and technologies.	<ul style="list-style-type: none"> Improved drought awareness and risk preparedness, which enhances farmer climate change resilience⁷⁰⁴; Knowledge sharing through demonstration plots and farms has assisted in improving crop productivity and reducing losses due to droughts and water scarcity⁷⁰⁵.
			Train farmers, inclusive of women and young farmers, in climate-resilient practices and	<ul style="list-style-type: none"> Enhance crop productivity and food security due to improved land preparation,

⁶⁹¹ [Tajikistan and Central Asia Face Escalating Water Crisis - The Times Of Central Asia](#)

⁶⁹² World Bank: Tajikistan Food Security Policies. Available :[World Bank Document](#)

⁶⁹⁹ [ProjectStory Tajikistan October2023-1.pdf](#)

⁷⁰⁰ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁷⁰¹ [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)

⁷⁰² [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)

⁷⁰³ [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)

⁷⁰⁴ [TANZILA DEMONSTRATION PLOT – GEFF Tajikistan](#)

⁷⁰⁵ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
			technologies using participatory and digital methods.	timely sowing, proper fertilization, and irrigation ⁷⁰⁶ ; <ul style="list-style-type: none"> • Reduce vulnerability of rural communities due to improved communication and knowledge sharing on drought and preparing for such impacts⁷⁰⁷; • Increase rural livelihoods and income⁷⁰⁸.
			Establish 300 ha of mixed orchards using drought/flood-resistant species, including the installation of green fencing using appropriate species to prevent livestock damage to orchards.	<ul style="list-style-type: none"> • Enhanced water availability for crop production due to improved water management during drought⁷⁰⁹; • Reduced productivity losses due to reduced soil desiccation and improved soil coverage⁷¹⁰; • Increased food security due to reduced production losses⁷¹¹; • Increased rural livelihoods and income due to diversified crop and fruit production⁷¹².
	Heatwaves Tajikistan's average annual temperature has increased by at least 1.2°C, double the global	<ul style="list-style-type: none"> • Reduced soil productivity; • Decreased crop production; • Decreased water quality and availability; • Food insecurity; 	Construct or rehabilitate greenhouses.	<ul style="list-style-type: none"> • Promote food security and enhanced crop production through controlling the conditions crops are grown in⁷²⁰; • Reduce crop losses due to less exposure to extreme heat⁷²¹; • Reliable food production despite extreme heat ensures a stable income source and food security⁷²²;

⁷⁰⁶ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)
⁷⁰⁷ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)
⁷⁰⁸ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)
⁷⁰⁹ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)
⁷¹⁰ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)
⁷¹¹ [GEFF-Tajikistan-Podcast-transcript -4_eng.pdf](#)
⁷¹² [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)
⁷²⁰ [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)
⁷²¹ [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)
⁷²² [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	<p>average of 0.6°C, in the last 60 years⁷¹³. It is projected that the number of days exceeding 30°C will increase by 40 to 70 days per year by 2050⁷¹⁴. Cold days are projected to decrease by 35 days by 2050⁷¹⁵.</p>	<ul style="list-style-type: none"> Reduction in income and rural livelihoods. Increased vulnerability of rural communities. <p>Shifted rainfall onset and duration. Earlier snowmelt and more erratic spring rains mean the historical timing farmers use for sowing is less reliable; crops sown at traditional dates may face moisture deficits during critical growth stages or conversely be exposed to late frosts if seasons remain variable⁶⁸⁹. Altered irrigation timing. Because much summer irrigation depends on meltwater, earlier runoff can</p>	Construct or rehabilitate storage units to support community storage of agricultural produce.	<ul style="list-style-type: none"> Diversified livelihoods and value chains due to a variety of crops planted in greenhouses year-round⁷²³. Reduced post-harvest losses due to protection from extreme heat⁷²⁴; Enhance food security due to reduced losses⁷²⁵; Increased livelihoods, value chain diversification and income because of reduced losses⁷²⁶; Reduced vulnerability of small-scale farmers to extreme heat impacts⁷²⁷.
			Provide training and equipment to 800 women and disabled persons to support processing, preservation, and marketing of agricultural products. This will include the distribution of 800 solar dryers, along with training on their safe and efficient use. Training will cover product quality, food safety, storage, packaging, basic business skills and market engagement, and this will also be supported by an online learning research hub.	<ul style="list-style-type: none"> Enhance crop productivity and food security due to improved land preparation, timely sowing, proper fertilization, and irrigation⁷²⁸; Reduce vulnerability of rural communities due to improved communication and knowledge sharing on extreme heat and adaptation to such impacts⁷²⁹; Increase rural livelihoods and income of women and disabled persons⁷³⁰.

⁷¹³ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷¹⁴ <https://asiaplustj.info/en/news/tajikistan/society/20250717/extreme-heatwaves-threaten-central-asia-impact-on-economy-and-public-health>

⁷¹⁵ [Country Climate Risk Portal: Tajikistan – CACIP Central Asia Climate Information Portal](#)

⁷²³ [Green thumbs in the greenhouse as climate change buffets Tajikistan | World Food Programme](#)

⁷²⁴ [Safarbek Sultonov Develops Modern Agricultural Storage Infrastructure – GEFF Tajikistan](#)

⁷²⁵ [Safarbek Sultonov Develops Modern Agricultural Storage Infrastructure – GEFF Tajikistan](#)

⁷²⁶ [Safarbek Sultonov Develops Modern Agricultural Storage Infrastructure – GEFF Tajikistan](#)

⁷²⁷ [Safarbek Sultonov Develops Modern Agricultural Storage Infrastructure – GEFF Tajikistan](#)

⁷²⁸ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)

⁷²⁹ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)

⁷³⁰ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
		leave mid-summer months drier, creating irrigation shortfalls during flowering and grain filling- that reduce yields ⁶⁸⁹ . Cumulative heat exposure. Repeated hot seasons also accelerate soil moisture depletion and increase evapotranspiration, compounding drought risk for both rainfed and irrigated plots ⁷¹⁶ . High reliance on glacial meltwater is increasingly threatened by extreme heat, resulting in reduced irrigation capacity across vital farming regions ⁷¹⁷ . Farmers report shrinking harvests, with essential crops such as cotton, wheat, and fruits suffering	<p>Enable value addition and reduce food loss, the activity increases income stability and reduces vulnerability to climate shocks.</p> <p>Develop and strengthen climate-resilient water assets (for example, drip irrigation, sprinkler irrigation, energy-efficient/renewable energy-powered pumps, reservoirs, and irrigation channels) to improve the productivity of smallholder production systems.</p> <p>Establish climate-resilient agricultural production demonstration plots to showcase innovative practices and technologies.</p>	<ul style="list-style-type: none"> Value-added activities greatly reduce losses to fresh produce due to heat spoilage⁷³¹; Enhanced food security due to reduced losses⁷³²; Increase rural livelihoods and income of vulnerable communities⁷³³. Improved water management contributes to enhanced crop production despite extreme heat⁷³⁴; Enhanced crop production promotes livelihood and income⁷³⁵; Knowledge sharing enhances risk preparedness and improved rural community resilience⁷³⁶. Improved awareness on the impacts of extreme heat and risk preparedness, which enhances farmer climate change resilience⁷³⁷; Knowledge sharing through demonstration plots and farms has assisted in improving crop productivity and reducing losses due to extreme heat and water scarcity⁷³⁸.

⁷¹⁶ The Impact of Climate Change on the Environment in Tajikistan: The Case of the Agricultural Sector (2014–2023). Idiev Mahmashoh, Tinega Nyamoko Joseph. [Available here.](#)

⁷¹⁷ [Tajikistan's Vanishing Farmland: How Water Scarcity & Mismanagement Threaten Agriculture](#)

⁷³¹ Assessing Agrifood System Growth Outcomes in Tajikistan. 2025. Available at: [Template WorkingPaper](#)

⁷³² Assessing Agrifood System Growth Outcomes in Tajikistan. 2025. Available at: [Template WorkingPaper](#)

⁷³³ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁷³⁴ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁷³⁵ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁷³⁶ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁷³⁷ [TANZILA DEMONSTRATION PLOT – GEFF Tajikistan](#)

⁷³⁸ [In Central Asia, female leadership is key to climate and drought resilience | UNCCD](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
		from a variable water supply ⁷¹⁸ . Rising temperatures will significantly reduce winter and spring pasture productivity, reducing the carrying capacity of grasslands and forage availability for large and small ruminants ⁷¹⁹ .	<p>Train farmers, inclusive of women and young farmers, in climate-resilient practices and technologies using participatory and digital methods.</p> <p>Support the establishment of local water asset funds in each target district to finance the ongoing maintenance of water assets.</p> <p>Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.</p> <p>Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.</p> <p>Enhance the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as</p>	<ul style="list-style-type: none"> Enhance crop productivity and food security due to improved land preparation, timely sowing, proper fertilization, and irrigation⁷³⁹; Reduce vulnerability of rural communities due to improved communication and knowledge sharing on heatwave risks and preparing for such impacts⁷⁴⁰; Increase rural livelihoods and income⁷⁴¹. Improve access to potable water⁷⁴²; Improved water quality⁷⁴³; Improved access to water and enhanced water quality improves crop productivity⁷⁴⁴; Enhanced infrastructure development improves crop productivity and hence food security⁷⁴⁵. Communities can better plan and manage crop production, adapt livelihoods and diversify income to reduce vulnerability to heatwaves⁷⁴⁶; Improved forecasting and sharing of climate information ensures enhanced

⁷¹⁸ [Tajikistan's Vanishing Farmland: How Water Scarcity & Mismanagement Threaten Agriculture](#)

⁷¹⁹ World Bank: Tajikistan agrifood security policies. Available: [World Bank Document](#)

⁷³⁹ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁷⁴⁰ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁷⁴¹ [Transforming village through modern agritech: The story of a women farmer in Tajikistan - ComDevAsia](#)

⁷⁴² [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁷⁴³ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁷⁴⁴ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁷⁴⁵ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁷⁴⁶ [Tajikistan Country Climate and Development Report](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
			mobile apps, telegram channels, or other locally appropriate digital tools for the provision of climate and market information.	<p>capacity to plan production cycles and prepare for heatwaves⁷⁴⁷;</p> <ul style="list-style-type: none"> • Access to equipment and climate data promotes planning of crop production and thus reduces crop losses and food insecurity⁷⁴⁸. • Improving access to weather forecasts through mobile applications increases transparency and traceability, strengthens planning and equips producers with the knowledge and tools needed to sustainably participate in value chains⁷⁴⁹.
Water	<p><u>Glacier lake outbursts (GLOFs)</u></p> <p>Out of the country's 14,000 glaciers, over 1,000 have already disappeared and many small ones are expected to melt in the next 40 years⁷⁵⁰. The country has lost more than 20 billion cubic</p>	<p>Glacier retreat and altered runoff timing. Recent field-based modelling shows that formerly resilient Pamir glaciers have begun tipping toward rapid decline, reducing late summer surface water flow that many irrigation systems depend on and increasing interannual variability -in water security⁷⁵². New and expanding moraine-dammed lakes (GLOF sources). Warming</p>	<p>Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.</p> <p>Enhanced climate change adaptation and risk management (including DRR and anticipatory action) preparedness across district governments and food-insecure vulnerable communities.</p>	<ul style="list-style-type: none"> • Improves early warning systems for GLOFs, reducing loss of life and property⁷⁵⁵. • Enhances scientific accuracy in predicting glacial melt and flood risks. • Builds institutional resilience by equipping staff with modern tools and training⁷⁵⁶. • Supports evidence-based decision-making for government and communities. <ul style="list-style-type: none"> • Strengthens disaster risk reduction (DRR) capacity at the local level. • Ensures anticipatory action (e.g., evacuation, resource pre-positioning) before hazards strike⁷⁵⁷.

⁷⁴⁷ [Tajikistan Country Climate and Development Report](#)

⁷⁴⁸ [How Climate Change Is Damaging Agriculture and Food Security in Tajikistan - The Times Of Central Asia](#)

⁷⁴⁹ [Tajikistan adopts programme for the digitalization of the agricultural sector with FAO support](#)

⁷⁵⁰ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷⁵² The tipping of the last resilient glaciers: Filling in years of missing data from Tajikistan. [Available here.](#)

⁷⁵⁵ UNESCO's Regional Project on Glacial Lake Outburst Floods (GLOFCA). [Available here.](#)

⁷⁵⁶ Reducing vulnerabilities of populations in the Central Asia region from glacier lake outburst floods in a changing climate (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan). [Available here.](#)

⁷⁵⁷ National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030. [Available here.](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	<p>meters, or approximately 25% of the glaciers' ice volume, during the twentieth century⁷⁵¹.</p>	<p>and glacier retreat create and enlarge hazardous lakes whose sudden failure can generate catastrophic downstream floods and debris flows⁷⁵³. Glacial Lake Outburst Floods (GLOFs): GLOFs can deliver sudden, high velocity- floods that destroy irrigation intakes, bridges and villages, bury arable land under coarse sediment, and cut off markets and relief routes; regional hazard mapping identifies numerous high-risk catchments in the Pamir with downstream exposure to settlements and irrigation networks⁷⁵⁴.</p>	<p>Train extension workers and smallholder farmers to understand and apply climate information using the PICSA approach.</p> <p>Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.</p> <p>Enhance the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as mobile apps, Telegram channels, or other locally appropriate digital tools, for the provision of climate and market information.</p>	<ul style="list-style-type: none"> Builds community resilience, especially among food-insecure households who are most at risk. Empowers farmers with practical climate-smart decision-making tools. Improves agricultural productivity and food security by aligning farming practices with climate forecasts⁷⁵⁸. Builds local capacity through extension workers who act as knowledge multipliers⁷⁵⁸. Reduces vulnerability of rural livelihoods to climate shocks like GLOFs and droughts⁷⁵⁹. Ensures financial sustainability of climate services beyond donor funding⁷⁶⁰. Creates market-driven incentives for innovation and service improvement⁷⁶⁰. Provides real-time, accessible information to communities in remote areas. Increases coverage and inclusivity, reaching vulnerable populations who may lack internet but have mobile phones. Uses AI-powered analytics to tailor forecasts and market information to local needs⁷⁶¹.

⁷⁵¹ [Tajikistan | UNDP Climate Change Adaptation](#)

⁷⁵³ Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals. [Available here.](#)

⁷⁵⁴ Regional-scale analysis of high-mountain multi-hazard and risk indicators in the Pamir (Tajikistan) with GRASS GIS. [Available here.](#)

⁷⁵⁸ PICSA (Participatory Integrated Climate Services for Agriculture). [Available here.](#)

⁷⁵⁹ Developing a Roadmap to Reduce the Risk of Glacier Lake Outburst Floods in Tajikistan. [Available here.](#)

⁷⁶⁰ Weather Water Climate Services for Tajikistan. [Boris Orlowsky.](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
				<ul style="list-style-type: none"> Promotes low-cost, scalable solutions that can be replicated across Tajikistan and Central Asia⁷⁶¹.
			<p>Establish climate-resilient water asset demonstration plots to showcase innovative water use, management technologies and nature-based methods for agricultural and domestic use.</p>	<ul style="list-style-type: none"> Provides practical learning hubs for farmers and communities to observe innovative water-saving and nature-based solutions⁷⁶². Encourages scaling up of tested technologies across districts. Enhances community awareness and adoption of climate-smart practices⁷⁶³.
			<p>Support the establishment of local water asset funds in each target district to finance the ongoing maintenance of water assets.</p>	<ul style="list-style-type: none"> Ensures financial sustainability of water infrastructure through community-driven funding mechanisms⁷⁶⁰. Promotes local ownership and accountability in maintaining assets⁷⁶⁴. Reduces dependence on external donors by creating self-financing systems⁷⁶⁰. Strengthens long-term resilience of water supply and irrigation systems⁷⁶⁴.
			<p>Develop and strengthen climate-resilient water assets (for example, drip irrigation, sprinkler irrigation, energy-efficient/renewable energy-powered pumps, reservoirs, and irrigation channels) to improve the productivity of smallholder production systems.</p>	<ul style="list-style-type: none"> Improves water-use efficiency and reduces losses in irrigation systems⁷⁶⁵. Enhances crop productivity due to improved water security⁷⁶⁶.

⁷⁶¹ UNDP Climate Information & Early Warning Systems Supporting Livelihoods and Protecting Lives in a Changing Climate. [Available here](#).

⁷⁶² GEEF. [Available here](#).

⁷⁶³ Promoting Resilient Communities to Prevent Violent Extremism in Central Asia. [Available here](#).

⁷⁶⁴ Adaptation Story Republic of Tajikistan. [Available here](#).

⁷⁶⁵ Drip Irrigation Helps Farmers In Tajikistan To Grow Crops, Adapt To Climate Change. [Available here](#).

⁷⁶⁶ FAO Regional Office for Europe and Central Asia. Drip irrigation boosts water efficiency for Tajik farmers. [Available here](#).

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
				<ul style="list-style-type: none"> Promotes renewable energy integration (solar/wind pumps), lowering costs and emissions⁷⁶⁶. Reduces soil erosion and land degradation by stabilising water flows⁷⁶⁷.
			Climate proof canals to strengthen their durability to damage from flooding, landslides and mudslides, and to improve their contribution to flood attenuation.	<ul style="list-style-type: none"> Strengthens infrastructure durability against floods, landslides, and mudslides⁷⁶⁸. Improves flood attenuation capacity, reducing downstream disaster risks⁷⁶⁸. Ensures continuous water delivery for agriculture even during extreme events⁷⁶⁹. Protects livelihoods and settlements by reducing canal breaches and erosion.
	<u>Heatwaves</u> The average air temperature in the Pamir Mountain Range is expected to increase 2.0°C by 2050 ⁷⁷⁰ . Higher day and night temperatures change river flow with increases of	Glaciers shrink and snowmelt advances, mid-summer flows decline, producing irrigation shortfalls during critical crop stages (boll filling, grain filling) ⁶⁸⁹ . Reduced summer water availability raises crop failure risk, forces rationing between irrigation and hydropower, and	Construct or rehabilitate 500 greenhouses.	<ul style="list-style-type: none"> Enhances water security despite climate shocks^{776, 777}. Allows for controlled irrigation systems inside greenhouses, reducing water wastage⁷⁶⁵. Promotes efficient water use through drip irrigation and moisture-retention technologies within enclosed environments⁷⁶².

⁷⁶⁷ The World Bank Tajikistan Resilient Irrigation Project. [Available here.](#)

⁷⁶⁸ Integrated approaches to addressing disaster, climate and environmental risks enable impactful UN support to building resilience in Tajikistan. [Available here.](#)

⁷⁶⁹ Why climate resilience is vital for Tajikistan's future. [Available here.](#)

⁷⁷⁰ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷⁷⁶ Green Transition is Key to Tajikistan's Economic Revival and Climate Resilience. [Available here.](#)

⁷⁷⁷ Strengthening Capacities Of Farmers And Rural Population On Greenhouse – Phase Ii Of Tcp/Taj/3603. [Available here.](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	1.6° to 2.7°C in winter and 1.1° to 5°C in summer across regions such as Pamir ⁷⁷¹ .	increases rural vulnerability and migration pressures ⁷⁵³ . Glaciers across the Pyanj and Vakhsh river basins are expected to shrink by 75.5% and 53% respectively ⁷⁷² . Rising temperatures also mean runoff to regions such as the Amu Darya River basin could decrease by about 30% compared to the average of the past decade ⁷⁷³ . Shifts in peak surface water flow from late to early summer with increases in sedimentation, adversely impacting water quality ⁷⁷⁴ . Reservoirs lose storage capacity to sedimentation, adversely impacting water availability and hydro-energy supply to storage units, markets, processing	<p>Provide training and equipment to 800 women and disabled persons to support processing, preservation, and marketing of agricultural products. This will include the distribution of 800 solar dryers, along with training on their safe and efficient use. Training will cover product quality, food safety, storage, packaging, basic business skills and market engagement, and this will also be supported by an online learning research hub.</p> <p>By enabling value addition and reducing food loss, the activity increases income stability and reduces vulnerability to climate shocks.</p>	<ul style="list-style-type: none"> Greenhouses reduce evapotranspiration losses, conserving scarce water resources⁷⁷⁸. Encourages adoption of precision irrigation methods, improving water productivity per unit of crop output⁷⁶⁵. Creates income opportunities for marginalized groups, strengthening social resilience⁷⁷⁹. Solar dryers reduce reliance on fuelwood, lowering pressure on water-intensive biomass production⁷⁸⁰. Training in food safety, packaging, and marketing improves market access and value addition⁷⁸¹. Solar dryers reduce the need for water-intensive preservation methods (e.g., boiling or wet processing)⁷⁸². By lowering food loss, they indirectly reduce water footprints of agriculture (less wasted water embedded in lost crops)⁷⁸³. Value addition (processing, packaging, marketing) increases the profitability of agricultural products, diversifies income

⁷⁷¹ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁷² [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷⁷³ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷⁷⁴ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

⁷⁷⁸ Estimating Evapotranspiration of Greenhouse Tomato under Different Irrigation Levels Using a Modified Dual Crop Coefficient Model in Northeast China. [Available here.](#)

⁷⁷⁹ Using Solar Dryers for Value Addition and the Reduction of Post Harvest Loss. [Available here.](#)

⁷⁸⁰ Harnessing Solar Energy for Sustainable Drying in East Africa. [Available here.](#)

⁷⁸¹ Drying fruits and vegetables using solar dryers: Training manual. [Available here.](#)

⁷⁸² Design, construction and performance testing of solar crop dryers for rural areas. [Available here.](#)

⁷⁸³ Passive solar dryers as sustainable alternatives for drying agricultural produce in sub-Saharan Africa: advances and challenges. [Available here.](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
		facilities, farms and homes ⁷⁷⁵ .		<p>streams, and reduces dependence on raw commodity sales⁷⁸⁵.</p> <ul style="list-style-type: none"> Reducing food loss conserves the embedded water and energy used in crop production. Value addition ensures that fewer resources are wasted, supporting sustainable resource management⁷⁸⁴.
			Construct or rehabilitate 140 storage units to support community storage of agricultural produce. In high-lying areas, the units will be naturally cooled, while in low-lying areas (warmer) solar-powered cooling will be used.	<ul style="list-style-type: none"> Provides community-level resilience through use of water efficient storage means⁷⁸⁵. Solar-powered cooling reduces dependence on fossil fuels, supporting the sustainable energy-water nexus⁷⁸⁶. Naturally cooled units in high-lying areas leverage local climate conditions, minimising energy and water demand⁷⁸⁷. Storage reduces food loss, thereby conserving the embedded water used in crop production⁷⁸⁶. Solar-powered cooling avoids water-intensive cooling systems, promoting climate-smart water management⁷⁸⁸.
	Flooding and landslides The potential flash floods due to intensified rainfall events are expected,	Intense rainfall and rapid snowmelt produce floods and high sediment loads that breach earthen canals, block intakes and silt reservoirs, requiring costly repairs and reducing	Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment. Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.	<ul style="list-style-type: none"> Communities can better plan and manage access to water resources, reducing vulnerability to flooding and landslides⁷⁹⁵; Improved forecasting and sharing of climate information ensures enhanced capacity to prepare for flood events and

⁷⁷⁵ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁸⁴ UNEP's Food Waste and Climate Change Report (2023). [Available here.](#)

⁷⁸⁵ Tajikistan Agrifood Security Policies Advice and Analytics. [Available here.](#)

⁷⁸⁶ Decentralized solar-powered cooling systems for fresh fruit and vegetables to reduce post-harvest losses in developing regions: a review. [Available here.](#)

⁷⁸⁷ Adaptation at Altitude. Taking Action in the Mountains. [Available here.](#)

⁷⁸⁸ Integration of renewable energy resources into the water-energy-food nexus—Modeling a demand side management approach and application to a microgrid farm in Morocco. [Available here.](#)

⁷⁹⁵ [Tajikistan Country Climate and Development Report](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	especially spring across regions of higher elevations ⁷⁸⁹ . Extreme rainfall events are expected to intensify, with 1-in-100-year 24-hour precipitation events becoming 1-in-20-year events in parts such as GBAO and southern Sughd ⁷⁹⁰ .	irrigated area for subsequent seasons; repeated repair cycles strain local budgets and slow agricultural recovery ⁷⁹¹ . Increased sedimentation in rivers and reservoirs is also causing reduced water quality and increasing water available for use in homes, markets, processing facilities, storage facilities and for irrigation ⁷⁹² . Reduced downstream water availability with the maximum capacity of smaller reservoirs breached ⁷⁹³ . Extensive damage to infrastructure, such as smaller reservoirs, further exacerbates water scarcity ⁷⁹⁴ .	<p>Train extension workers and smallholder farmers to understand and apply climate information using the PICSA approach.</p> <p>Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability.</p> <p>Build the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as mobile apps, Telegram channels, or other locally appropriate digital tools, for the provision of climate and market information.</p> <p>Enhance the climate-change resilience of water canals to resist the impacts of flooding and landslides:</p> <p>Climate-proof canals to strengthen their durability to damage from flooding, landslides and mudslides, and to improve their contribution to flood attenuation.</p>	<p>take measures to protect water resources⁷⁹⁶;</p> <ul style="list-style-type: none"> Improving access to weather forecasts through mobile applications increases transparency and traceability, strengthens planning and equips water users and value chain participants with the tools requires to manage water resources sustainably despite floods and landslides⁷⁹⁷; <ul style="list-style-type: none"> Enhanced water security and access to potable water⁷⁹⁸; Diversion of runoff, decreased peak discharge and water conservation⁷⁹⁹; Increased rural livelihoods, value chain development and income due to enhanced access to potable water during flood and landslide events⁸⁰⁰.

⁷⁸⁹ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁹⁰ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁹¹ Glacial Lake Outburst Floods In The Pamir Of Tajikistan: Challenges In Prediction And Modelling. Martin Mergili, Demian Schneider, Raphael Worni & Jean F. Schneider. 2011. [Available here.](#)

⁷⁹² [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁹³ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁹⁴ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁷⁹⁶ [Tajikistan Country Climate and Development Report](#)

⁷⁹⁷ [Tajikistan Country Climate and Development Report](#)

⁷⁹⁸ [Flood Management Guideline Tajikistan](#)

⁷⁹⁹ [Flood Management Guideline Tajikistan](#)

⁸⁰⁰ [Flood Management Guideline Tajikistan](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
	Drought Decrease annual precipitation of up to 8% over eastern Gorno-Badakhshan and 5% over southern Sughd. Decreases are expected to be more significant in summer ⁸⁰¹ .	Adverse impacts on water availability and quality will result in water scarcity across sectors ⁸⁰² . Hydropower generation for markets, processing facilities, storage units and irrigation will decrease ⁸⁰³ .	<p>Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.</p> <p>Train extension workers and smallholder farmers to understand and apply climate information using the PICSA approach.</p> <p>Support the Agency for Hydrometeorology in commercialising the provision of climate information to ensure sustainability.</p> <p>Build the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems, such as mobile apps, Telegram channels, or other locally appropriate digital tools, for the provision of climate and market information.</p> <p>Establish climate-resilient water asset demonstration plots to showcase innovative water use, management technologies and nature-based methods for agricultural and domestic use.</p>	<ul style="list-style-type: none"> Reduced vulnerability of rural communities due to enhanced water management, water security and risk mitigation planning⁸⁰⁴; Efficient water use and enhanced water management are promoted by access to climate information⁸⁰⁵; Enhanced access to diverse climate and forecasting channels improves accurate and fast sharing of climate information to reduce the risk of water scarcity⁸⁰⁶. <ul style="list-style-type: none"> Improved water management contributes to enhanced water security⁸⁰⁷; Improved value chain development due to enhanced access to potable water despite drought⁸⁰⁸; Knowledge sharing enhances drought risk preparedness and improved rural community resilience⁸⁰⁹.

⁸⁰¹ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁸⁰² [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁸⁰³ [Understanding the climate and net zero transition risks and opportunities in Tajikistan. Policy Paper](#)

⁸⁰⁴ [New Drought Monitoring System Could Save Tajikistan Millions - The Times Of Central Asia](#)

⁸⁰⁵ [New Drought Monitoring System Could Save Tajikistan Millions - The Times Of Central Asia](#)

⁸⁰⁶ [New Drought Monitoring System Could Save Tajikistan Millions – CACIP Central Asia Climate Information Portal](#)

⁸⁰⁷ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁸⁰⁸ Nexus Demonstration Project Continues Work on Pumping Stations in Tajikistan. Available from: [Final draft TJ demo project_eng.docx.pdf](#)

⁸⁰⁹ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

Sector or Typology	Hazard	Risk/Impact	Adaptation interventions	Adaptation benefits
			<p>Develop and strengthen climate-resilient water assets (for example, drip irrigation, sprinkler irrigation, energy-efficient/renewable energy-powered pumps, reservoirs, and irrigation channels) to improve the productivity of smallholder production systems.</p>	<ul style="list-style-type: none"> Improved water management contributes to enhanced water security during times of drought⁸¹⁰; Enhanced water security promotes livelihood and income⁸¹¹; Knowledge sharing on sustainable water resource management enhances risk preparedness and improved rural community resilience⁸¹²;
			<p>Support the establishment of local water asset funds in each target district to finance the ongoing maintenance of water assets.</p>	<ul style="list-style-type: none"> Improve access to potable water⁸¹³; Improved water quality⁸¹⁴; Improved access to water and enhanced water quality promotes value chain development and income generation⁸¹⁵; Enhanced infrastructure development reduces vulnerability to the impacts of drought⁸¹⁶.

⁸¹⁰ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁸¹¹ [From Service Delivery to Sustainable Water Management in Tajikistan](#)

⁸¹² Nexus Demonstration Project Continues Work on Pumping Stations in Tajikistan. Available from: [Final draft TJ demo project eng.docx.pdf](#)

⁸¹³ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁸¹⁴ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁸¹⁵ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

⁸¹⁶ [Tajikistan Taps EBRD Funds for Greener Water and Heating Systems - Caspianpost.com](#)

8.2. Target districts

8.2.1. District profiles and climate risk and vulnerability assessments

Administratively, the Republic of Tajikistan is divided into four main regions: the Gorno-Badakhshan Autonomous Region (GBAO), the Sughd Region, the Khatlon Region, and the Districts of Republican Subordination (DRS), which comprise 13 districts located in the central part of the country. Nationally, there are 62 districts, 18 cities, 57 settlements, and 370 rural administrative units (jamoats dehot). The capital, Dushanbe, has a distinct administrative status and is subdivided into four districts. The country's climate is predominantly continental, although its complex topography results in highly variable local climatic zones. Precipitation ranges from less than 100 mm in the Eastern Pamirs to more than 2,000 mm on the southern slopes of the Hissar Ridge. Air temperatures vary sharply with elevation, from +22°C in the lowlands of Shaartuz in winter to -63°C near Lake Bulunkul in the Pamirs. Tajikistan's terrain is dissected by 947 rivers exceeding 10 km in length, accounting for around 60% of Central Asia's total freshwater resources. The country also contains approximately 1,300 lakes and 8,476 km² of glaciers, which contribute roughly 50% of the total annual flow of the Aral Sea. Forest cover remains sparse, occupying about 423,000 ha or 3% of the national territory, while the State Forest Fund encompasses approximately 1.9 million ha. Despite its limited forest extent, Tajikistan is exceptionally rich in biodiversity, with ~5,000 higher plant species, of which more than 1,000 are endemic⁸¹⁷.

Tajikistan has undergone rapid demographic and social change, with its population increasing by 52% between 2000 and 2019, from 6.13 million to 9.31 million people. The average annual growth rate during this period was 2.1%. Rural residents constituted approximately 73.7% of the population in 2019, with children under 17 representing over 40%. Economic development remains constrained by the country's high-altitude terrain, remoteness, and limited access to international markets. The economy is classified as agrarian-industrial, with agriculture and light industry as key sectors. In 2019, Tajikistan's GDP totalled US\$8.1 billion (US\$840 per capita), with agriculture contributing 19.8%, industry 15.1%, construction 15%, services 35%, transport 10%, and taxes 6%. Approximately 46% of the employed population worked in agriculture, followed by 12.2% in trade and services, 8.6% in construction, and 6.8% in industry. Poverty reduction has been significant, with the poverty rate declining from 81% in 1999 to 29.7% in 2017, and extreme poverty decreasing from 73% to 14%. Contributing factors included wage growth, remittances, and improved social protection mechanisms. In 2018, Tajikistan ranked 57th out of 130 countries on the Human Capital Index (HCI). In 2019, it ranked 129th on the Human Development Index (HDI) with a score of 0.656, and 84th on the Gender Inequality Index (GII) with a score of 0.377⁸¹⁸.

Agriculture remains a cornerstone of Tajikistan's economy and livelihoods, contributing nearly one-fifth of GDP and employing over 60% of the workforce. In 2019, crop production accounted for 69.1% and livestock production for 30.9% of total agricultural output. Of total production, 56% originated from household plots, 39% from dehkan (farming) households, and 6% from the public sector. Subsistence farming dominated rural livelihoods, with 93% of livestock products and 39% of crop output produced by households. The total area of agricultural land was approximately 3.67 million ha, of which 18% comprised arable land, 76.8% pastures, and the remainder perennial plantations and hayfields. Dehkan farms averaged 15 ha, including 3.1 ha of arable land. Given that only 0.76% of the country's total area is arable, pressures on productive land are high. Agricultural productivity remains vulnerable to climate variability, land degradation, and water stress. The Government of

⁸¹⁷ Fourth National Communication of The Republic Of Tajikistan. 2022. [Available online.](#)

⁸¹⁸ Fourth National Communication of The Republic Of Tajikistan. 2022. [Available online.](#)

Tajikistan has therefore prioritised increasing agricultural resilience through improved irrigation efficiency, soil protection, and diversification of livelihoods⁸¹⁹.

Tajikistan is highly exposed to natural hazards and climate-induced risks due to its mountainous terrain and active geology (Figure 93 and Figure 94). Recurrent hazards include landslides, mudflows, floods, avalanches, rockfalls, droughts, and glacial lake outburst floods (GLOFs). The frequency and severity of such events have increased in recent decades, largely due to climate change, deforestation, and unsustainable land-use practices. Historical records indicate that extreme temperature variations, seasonal snowmelt, and heavy precipitation frequently trigger hazardous processes affecting rural communities, infrastructure, and farmland. Approximately 44% of the rural population lives in hazard-prone zones. Climate change is projected to intensify floods and mudflows, while glacier retreat and reduced snowpack will impact downstream water availability. These factors compound risks to agricultural production, food security, and livelihoods, particularly in districts such as Ayni, Panjakent, and Kuhistoni Mastchoh, where steep slopes and limited arable land heighten vulnerability⁸²⁰.



Figure 93. Regional level hazard and exposure (left), vulnerability (centre), and lack of coping capacity⁸²¹.

⁸¹⁹ Fourth National Communication of The Republic Of Tajikistan. 2022. [Available online.](#)

⁸²⁰ Fourth National Communication of The Republic Of Tajikistan. 2022. [Available online.](#)

⁸²¹ UNDRR 2025. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

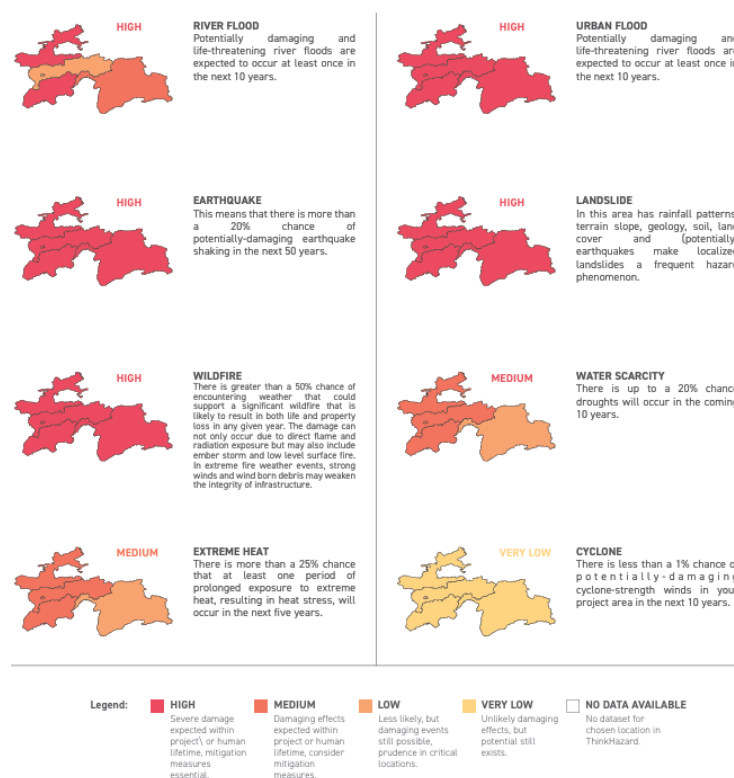


Figure 94. Regional level hazard likelihood (ThinkHazard!)⁸²².

The climate vulnerability and flood risk assessment applies a comparative, district-level climate vulnerability and flood risk screening approach, aligned with the Green Climate Fund (GCF) climate rationale requirements. The analysis integrates national and regional climate evidence, hazard screening tools, disaster occurrence records, and district socio-economic context to characterise flood and mudflow risk pathways across districts. Given the limited availability of consistent, defensible hydrological and loss data at district level in Tajikistan, the assessment does not attempt new hazard modelling or event attribution. Instead, it focuses on identifying differentiated exposure, sensitivity, and adaptive capacity drivers using evidence from climate projections, hazard classifications, and documented disaster impacts. This approach avoids false precision while enabling comparison across districts under a consistent framework.

Three figures are used to support the narrative. Figure 1 provides national-scale, modelled trends in temperature and precipitation change, illustrating the direction and magnitude of climate change signals relevant to flood and mudflow risk, including warming, changing precipitation patterns, and increased likelihood of extreme rainfall events. Figure 2 illustrates the spatial distribution of landslide, mudflow, ice avalanche, and glacial lake outburst hazard indicators, supporting differentiation between mountainous, foothill, and lowland districts in terms of dominant hazard processes. Figure 3 presents ThinkHazard!⁸²³ national risk classifications for river flooding, urban flooding, and landslides, which are used as a screening tool to anchor district-level comparisons rather than as quantitative risk estimates. Together, these figures provide contextual evidence for climate trends and hazard patterns, while district

⁸²² UNDRR 2025. Country Disaster Risk Profile of the Republic of Tajikistan. [Available online.](#)

⁸²³ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

profiles focus on how local geography, livelihoods, infrastructure, and institutional capacity shape vulnerability and adaptation needs.

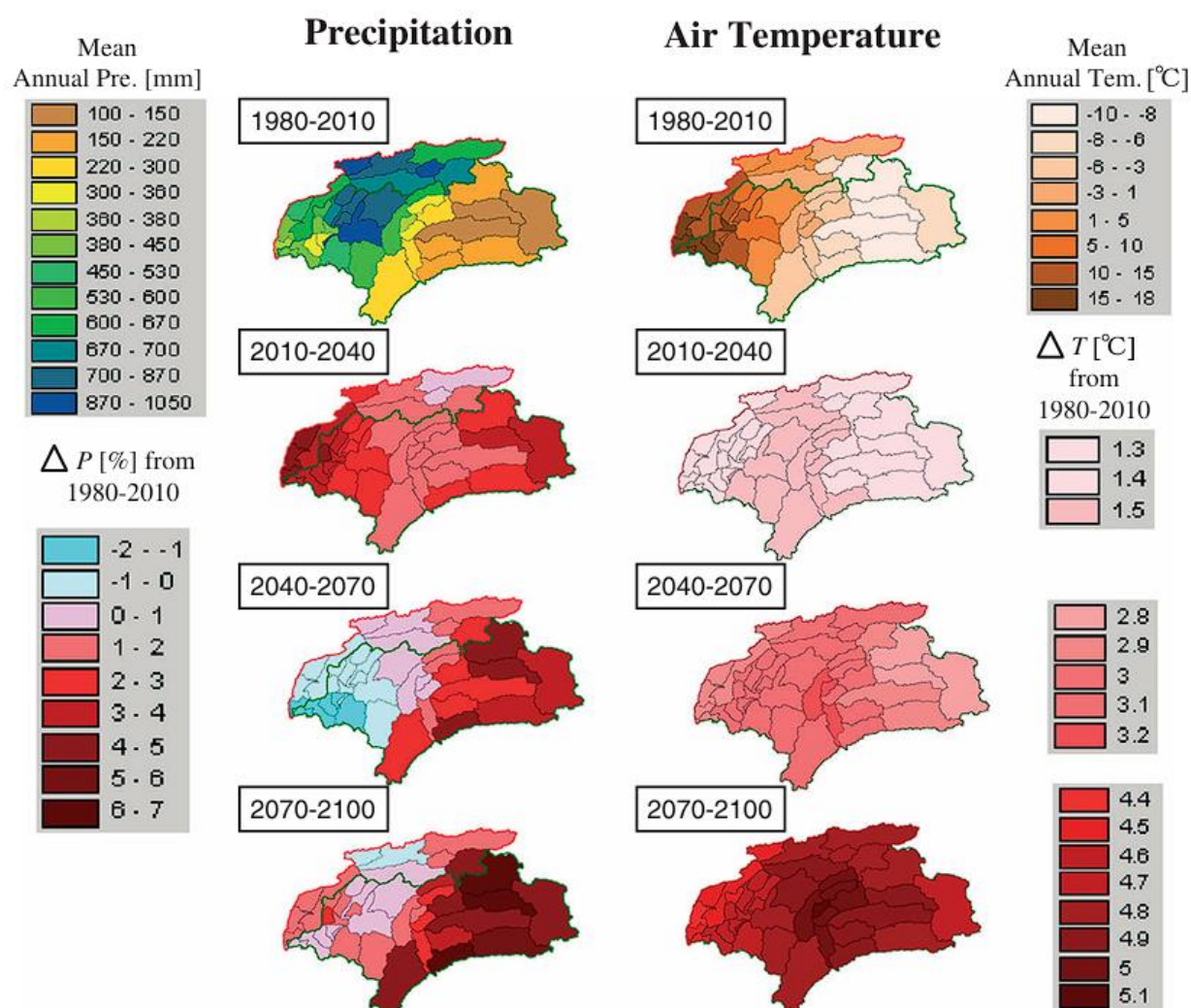


Figure 95. Projected changes in mean air temperature and precipitation extremes for the Vakhsh, Zeravshan, and Panj river basins in Tajikistan, illustrating modelled warming trends, shifts from snowfall to rainfall, and increasing intensity of extreme precipitation relevant to flood and mudflow risk within these basins⁸²⁴.

⁸²⁴ Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

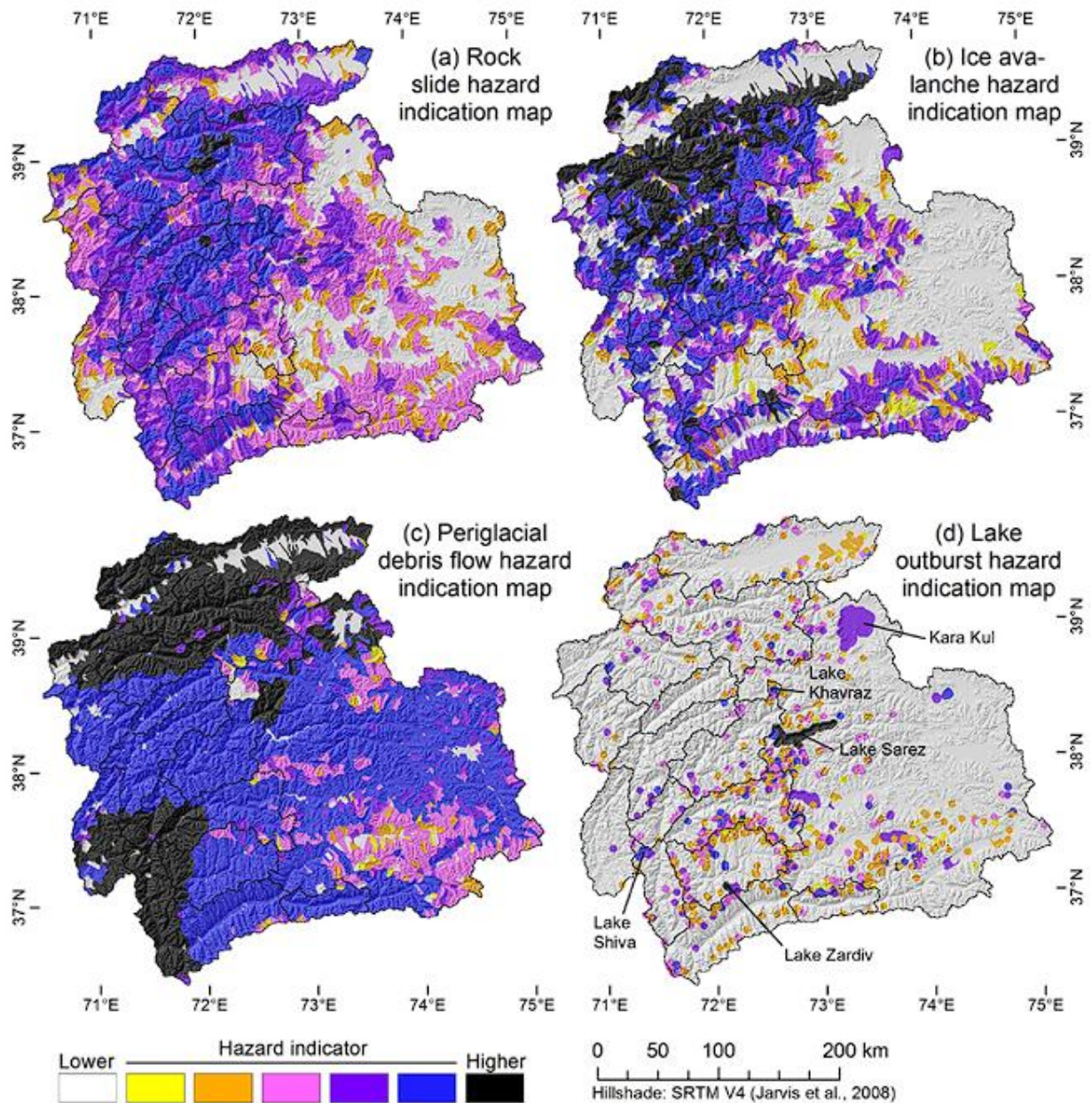


Figure 96. Indicative distribution of landslide, mudflow, ice avalanche, and glacial lake outburst flood (GLOF) susceptibility across mountainous regions of Tajikistan, including the Pamir and upper catchments of the Panj and Zeravshan basins. The figure highlights spatial variation in dominant hazard processes in high-mountain and foothill environments⁸²⁵.

⁸²⁵ Gruber, F. E., and M. Mergili. "Regional-scale analysis of high-mountain multi-hazard and risk indicators in the Pamir (Tajikistan) with GRASS GIS." *Natural Hazards and Earth System Science*, vol. 13, pp. 2779–2796, <https://nhess.copernicus.org/articles/13/2779/2013/>.

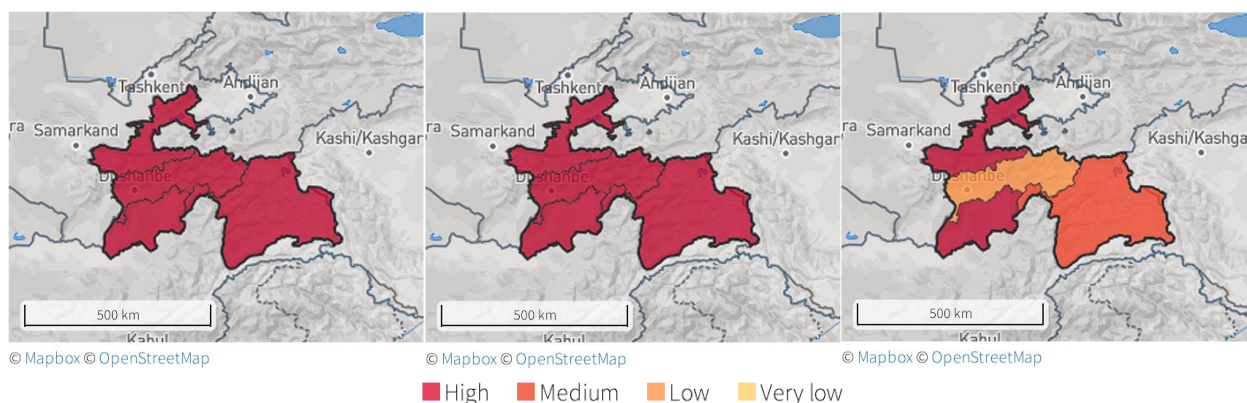


Figure 97. ThinkHazard! Risk classifications for landslide (left), urban flooding (centre), and river flooding (right) in Tajikistan⁸²⁶.

The project will be implemented in 14 districts in the Sughd (Asht, Isfara, Ainy and Panjakent), Khatlon (Vose, Dangara, Temurmalik, Khuroson and Qabodiyon), Districts of Republican Subordination (DRS) (Lakhsh, Sangvor and Tojikobod) and Gorno-Badakhshan Autonomous Oblast (GBAO) (Rostqala and Ishkoshim) regions, which have the highest multi-hazard risk of floods, mudflows and drought as per the 2021 International Consultation and Analysis (ICA) process under the UNFCCC (Figure 98). These districts are discussed further in this document.

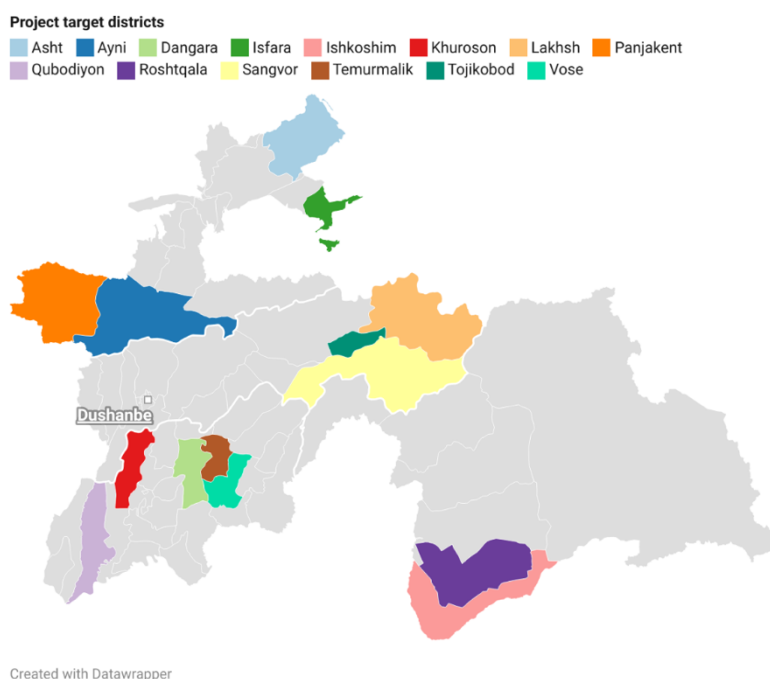


Figure 98. Map indicating the location of the project.

Sughd Region

The Sughd Region occupies the northernmost part of the Republic of Tajikistan, encompassing a diverse landscape that ranges from the fertile plains of the Fergana Valley in the west and north to the foothills and lower slopes of the Turkestan and Kuramin mountain systems in the east and south. It is traversed by key watercourses, including tributaries of the

⁸²⁶ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

Syr Darya, and benefits from extensive irrigation infrastructure that supports concentrated horticulture and crop production⁸²⁷. It is one of Tajikistan's four administrative divisions and one of its three provinces. It is located in the northwest of the country, centred on the historical region of Sogdiana, covering an area of approximately 25,400 km². The provincial capital is Khujand, and the region had an estimated population of 2,707,300 in 2020, up from 2,233,550 in 2010 and 1,871,979 in 2000. Ethnically, the province is predominantly Tajik (84%), with Uzbek (14.8%), Kyrgyz (0.6%), Russian (0.4%), and Tatar (0.1%) minorities. Administratively, Sughd is divided into 10 districts: Asht, Ayni, Devashtich, Ghafurov, Kuhistoni Mastchoh, Mastchoh, Spitamen, Jabbor Rasulov, Shahrison, and Zafarobod. It also includes eight district-level cities: Khujand, Buston, Guliston, Istiqlol, Isfara, Istaravshan, Konibodom, and Panjakent. These cities include both urban areas and surrounding rural localities. The province accounts for 29% of Tajikistan's population and approximately one-third of its arable land, forming the economic backbone of the country. Sughd's population has grown steadily, driven by both natural increase and internal migration, and is concentrated in urban centres such as Khujand and in rural districts with active agricultural economies. Agriculture is a central pillar of the regional economy, with horticulture, cereals, cotton, and other field crops cultivated on irrigated land; horticultural value chains, particularly fruit production, are significant for local employment and food security, while crop yields remain sensitive to irrigation reliability and climatic conditions⁸²⁸.

The region's climate is continental, characterised by hot, dry summers and cold winters, and is marked by seasonal variability in precipitation and temperature that influences agricultural cycles and water availability. Elevations and topography vary significantly, resulting in distinct microclimatic zones that influence both cropping patterns and natural vegetation cover. The region faces multiple natural hazards, including floods, mudflows, landslides, droughts, and soil erosion, with susceptibility heightened by steep terrain, seasonal storm events, and variability in water resources. These hazards affect infrastructure, agricultural productivity and livelihoods, underscoring the need for integrated risk management, improved water resource governance, and climate resilience measures in Sughd's rural and peri-urban communities⁸²⁹. Within the Sughd region, the districts of Asht, Isfara, Ayni and Panjakent have been selected for project interventions.

District Profile of Asht

Geography

Asht District is situated at the northernmost tip of the Sughd Region, Tajikistan, in the northwestern part of the Fergana Valley, bordering Uzbekistan to the north, east, and south (Figure 99). The district is characterised by predominantly flat to gently undulating valley terrain, suitable for intensive agriculture, particularly cotton and apricot cultivation (Figure 100). The elevation ranges from approximately 300 to 500 m above sea level, with fertile alluvial soils deposited by the Syr Darya River and its irrigation canals. The northern boundary of the district rises slightly toward the foothills of the Turkestan Range, providing a modest gradient, while the southern areas blend into the central Fergana Valley. Its administrative centre is the town of Shaydon, and it is approximately 448 km from Dushanbe. The district covers approximately 2,800 km² and had an estimated population of 168,100 as of January 2020. Administratively, Asht is divided into one town (Shaydon) and eight rural jamoats: Asht, Iftikhor, Mehrobod, Oriyon, Oshoba, Ponghoz, Punuk, and Shodoba, with populations ranging from approximately 8,800 to 28,500 per jamoat, based on 2015 data. The population is

⁸²⁷ https://aedpmu.tj/wp-content/uploads/2025/02/en_esia_sughd_17.07.pdf

⁸²⁸ https://en.wikipedia.org/wiki/Sughd_Region https://en.wikipedia.org/wiki/Sughd_Region

⁸²⁹ https://aedpmu.tj/wp-content/uploads/2025/02/en_esia_sughd_17.07.pdf

predominantly Tajik, about 77%, with a significant Uzbek minority, about 21%, reflecting cross-border cultural ties^{830,831,832}.

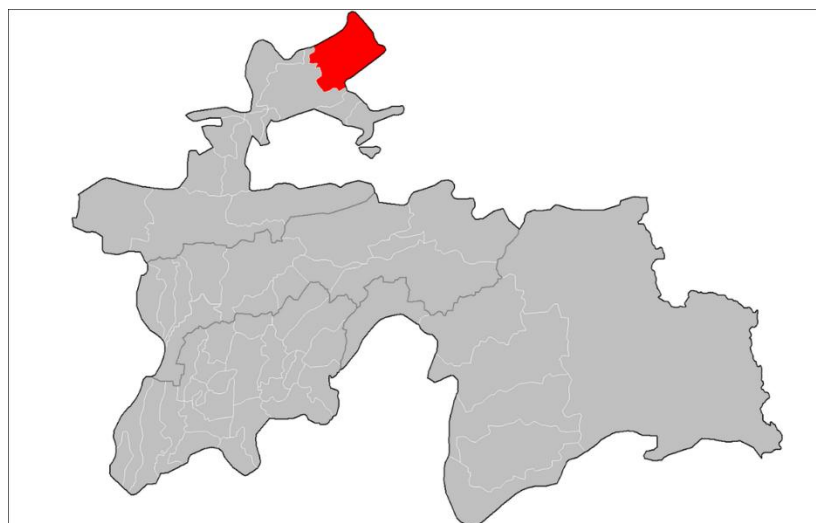


Figure 99. Location of Asht District, Tajikistan.

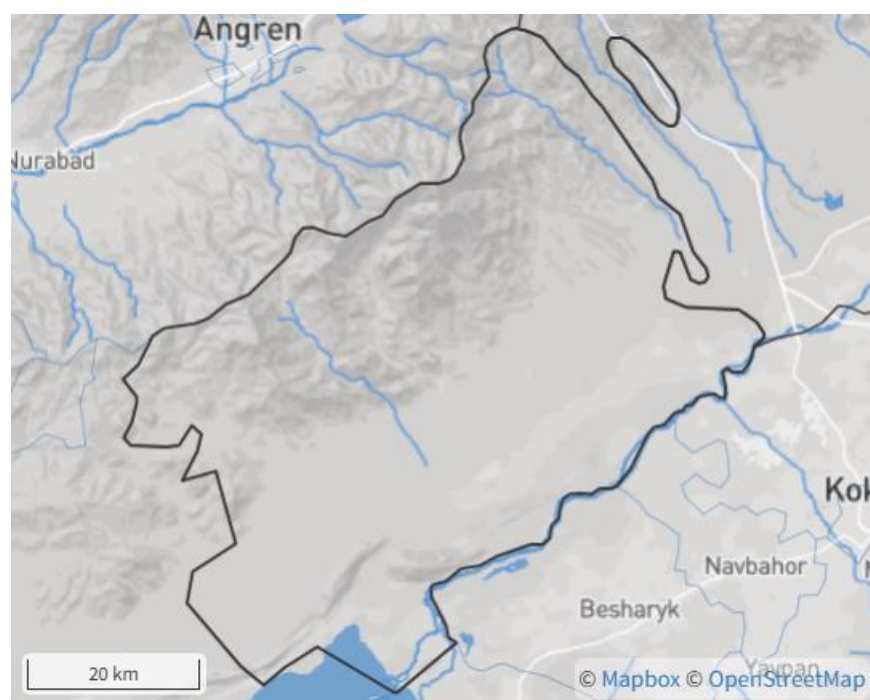


Figure 100. Relief map Asht.

Socioeconomic profile

Asht District's socioeconomic framework is strongly shaped by labour migration and remittances, with approximately 24,000 residents engaged in labour migration abroad as of mid-2024, of which 7,000 are women. This trend has intensified over recent years, contributing to village depopulation and labour shortages in the local economy. Many villages appear partly

⁸³⁰ https://en.wikipedia.org/wiki/Asht_District https://en.wikipedia.org/wiki/Asht_District

⁸³¹ <https://tojikiston.info/>

⁸³² <https://www.britannica.com/place/Fergana-Valley>

abandoned as young working-age adults seek employment opportunities abroad, leaving behind elderly populations and a reduced labour pool for farming and other activities. Industrial development in the district has been expanding modestly. Over recent years, dozens of new industrial facilities, including textile and packaging enterprises, have been established, creating jobs and supporting local manufacturing linked to agricultural value chains such as packaging for cherries and dried apricots^{833,834}.

Agricultural profile

Agriculture is the primary economic sector in Asht District, supported by fertile soils of the Ferghana Valley and extensive irrigated land. The district has approximately 11,000 hectares of arable land, with major crops including cotton (5,163 ha), wheat (852 ha), forage crops (2,720 ha), barley, potatoes, maize, and other staples. Due to local climatic conditions and terrain, cotton production, apricot cultivation, and livestock rearing form the core of the agricultural economy. Fruit production is significant, with 1,638 hectares of orchards dominated by apricots, as well as apples, walnuts, peaches, grapes, cherries, and plums. Fresh and dried fruits are supplied to markets in Khujand and exported to Russia and Kazakhstan. The district produces 15,000–16,000 tonnes of grapes annually, although most are sold fresh due to limited local processing facilities⁸³⁵. Cotton is a significant crop in Asht's agricultural landscape; recent harvest reports indicate active cotton harvests with an annual target of about 12,882 tonnes⁸³⁶ and ongoing field operations, underscoring cotton's role in local employment and regional agricultural output⁸³⁷. Livestock production contributes approximately 54% of total agricultural output, supported by extensive district pastures. Goats and sheep dominate herds, with more than 180,000 head, and livestock sales constitute a key subsistence income source for rural households⁸³⁸.

Irrigation underpins agricultural productivity, with 93% of arable land irrigated via pump stations sourcing water from the Syr Darya and the Northern Ferghana Canal. However, ageing infrastructure and deteriorating pumps pose challenges for a reliable water supply⁸³⁹. Despite robust crop systems, labour constraints related to migration substantially reduce workforce availability for seasonal activities such as apricot harvesting. Reports indicate that out of approximately 20,000 hectares of orchards (90% apricots), labour shortages frequently leave orchards under-harvested, with farmers struggling to find workers even for basic seasonal tasks. Local farmers also faced significant infrastructure constraints, particularly related to irrigation. Although the Fergana Canal irrigated most agricultural land, water availability had declined in recent years, and the deterioration of pumping infrastructure compounded the problem, with only one of four pumps functioning at the time. The district's agricultural lands were additionally affected by land degradation and soil erosion. National assessments indicated that approximately 30% of Tajikistan's agricultural land was considered to be in deteriorating condition, which was the highest proportion among Central Asian countries⁸⁴⁰.

⁸³³ <https://www.asiaplustj.info/en/news/tajikistan/economic/20240822/there-is-no-one-in-asht-to-harvest-apricots-everyone-went-into-exile>

⁸³⁴ <https://en.avesta.tj/2025/09/16/the-number-of-industrial-enterprises-is-growing-in-the-sughd-region/>

⁸³⁵ Japan International Cooperation Agency 2023. Business Incubation Project in the Republic of Tajikistan. Project Completion Report. [Available online.](#)

⁸³⁶ converted from 14,200 tons.

⁸³⁷ <https://en.avesta.tj/2025/09/05/cotton-harvesting-has-begun-in-the-asht-district-with-a-target-of-14-2-thousand-tons/>

⁸³⁸ Japan International Cooperation Agency 2023. Business Incubation Project in the Republic of Tajikistan. Project Completion Report. [Available online.](#)

⁸³⁹ Japan International Cooperation Agency 2023. Business Incubation Project in the Republic of Tajikistan. Project Completion Report. [Available online.](#)

⁸⁴⁰ <https://www.freshplaza.com/asia/article/9653083/severe-labour-shortage-hits-apricot-harvest-in-asht-district-tajikistan/>

Asht has potential for expanded agro-processing, including grape, cotton, leather, and wool processing, though facilities remain limited. Existing enterprises include the Asht cannery, bakery, Namaki Asht salt plant, cold storage facilities, and small-scale fisheries. Opportunities exist to increase value addition, reduce post-harvest losses, and diversify rural employment⁸⁴¹.

Hazard profile

Asht District, like the broader Sughd region, is exposed to a range of natural hazards that affect agriculture, infrastructure, and livelihoods. According to regional disaster risk assessments, Asht registers a high frequency of mudflows, making it one of the most affected districts in Sughd by this hazard type. The region also lies within an active seismic zone, indicating its susceptibility to earthquakes⁸⁴². Extreme weather, including heavy rainfall events, can trigger mudslides and erosion, damaging farmland and rural infrastructure; for example, torrential rains in mid-2020 caused mudslides that damaged homestead lands and rural roads in several jamoats within Asht District⁸⁴³.

Environmental degradation also remains a national concern with implications for Asht. Widespread soil erosion, poor irrigation efficiency and water management issues are reported across Tajikistan's agricultural lands, contributing to declining soil quality, salinisation of irrigated lands, and increased vulnerability to extreme events. Climate change projections for Tajikistan indicate rising temperatures and increased variability in precipitation, which may exacerbate water scarcity and crop stress, thereby compounding existing vulnerabilities in irrigation-dependent agricultural districts, such as Asht^{844,845}.

Major hazards and the risk level for Asht are⁸⁴⁶:

- River flood – High
- Earthquake – High
- Landslide – High
- Wildfire – High
- Water scarcity – Medium
- Extreme heat – Medium
- Urban flood – Low
- Cyclone – Very low

Flood and Mudflow Risk

Flood risk in Asht is dominated by short-duration, high-energy flash floods and rain-induced mudflows originating in steep mountainous catchments, rather than by prolonged riverine flooding. Intense rainfall events generate rapid runoff in narrow valleys, producing sudden flood surges and debris-laden flows that directly impact settlements, roads, bridges, and utility infrastructure located along valley floors and transport corridors⁸⁴⁷.

Historical disaster reporting illustrates the destructive nature of these events. A flood in 2003 in Ponghoz village partially destroyed 53 houses and washed away roads and water supply

⁸⁴¹ Japan International Cooperation Agency 2023. Business Incubation Project in the Republic of Tajikistan. Project Completion Report. [Available online.](#)

⁸⁴² https://aedpmu.tj/wp-content/uploads/2025/02/en_esia_sughd_17.07.pdf

⁸⁴³ <https://www.asiaplustj.info/en/news/tajikistan/society/20200715/mudslides-cause-damage-to-villages-in-asht-and-isfara-districts>

⁸⁴⁴ IFAD 20223. Tajikistan Community-Based Agricultural Support Project Supervision Report. [Available online.](#)

⁸⁴⁵ FDFA 2022. Improving Community Resilience through Sustainable Livelihoods in the Rasht Valley, Tajikistan. [Available online.](#)

⁸⁴⁶ <https://thinkhazard.org/en/report/37604-tajikistan-sogd-ashtskiy>

⁸⁴⁷ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

infrastructure, demonstrating the high damage potential of flash floods even when event durations are short⁸⁴⁸. Subsequent mudflow events have repeatedly damaged local roads, bridges, and power lines, highlighting the recurrent exposure of linear infrastructure to flood and debris-flow hazards in Asht⁸⁴⁹.

Comparative regional assessments indicate that mountainous and foothill districts such as Asht experience lower exposure to riverine flooding than lowland districts, but substantially higher relative risk from flash floods and mudflows driven by steep terrain and limited natural flood attenuation⁸⁵⁰. Sediment transport and mudflows are therefore central components of flood risk in Asht, distinguishing it from valley-bottom agricultural districts in Sughd.

Climate change is expected to exacerbate flash flood and mudflow risk in Asht. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of intense rainfall events⁸⁵¹. Hydrological modelling for snow- and glacier-influenced river basins projects increasing frequencies of heavy precipitation events under future climate conditions, which are associated with heightened flash flood and debris-flow activity in steep mountainous catchments⁸⁵².

In comparative terms, Asht faces higher exposure to flash floods and mudflows than lowland districts in Sughd, but lower exposure to prolonged riverine flooding and waterlogging than districts dominated by broad floodplains.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Asht is shaped by subsistence-oriented livelihoods, limited livelihood diversification, and repeated exposure of housing and infrastructure to flood and mudflow damage. Recurrent damage to roads, bridges, and utilities disrupts market access, service provision, and household coping capacity, even where overall poverty levels are comparable to other districts in Sughd⁸⁵³.

Adaptive capacity is constrained by limited protective infrastructure, high exposure of linear assets along narrow valley corridors, and variable access to timely early warning information. While physical accessibility is moderate compared to more remote mountain districts, repeated infrastructure damage increases recovery burdens for households and local authorities⁸⁵⁴. Poorer households are often disproportionately affected due to limited resources for repairs and recovery following repeated flash flood and mudflow events⁸⁵⁵.

Key Climate Risk Drivers

⁸⁴⁸ *Ibid*

⁸⁴⁹ *Ibid*

⁸⁵⁰ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

⁸⁵¹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁸⁵² Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

⁸⁵³ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

⁸⁵⁴ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

⁸⁵⁵ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

Climate risk in Asht arises from the interaction of steep mountainous terrain, confined valley morphology, and settlement and infrastructure patterns aligned along narrow corridors. These conditions amplify runoff responses during intense rainfall and concentrate impacts on housing and linear infrastructure, increasing sensitivity to flash floods and mudflows⁸⁵⁶. This physical exposure is compounded by livelihood sensitivity and constrained adaptive capacity, resulting in recurrent disruption even from moderate hazard events⁸⁵⁷.

Indicative Adaptation Priorities

Addressing climate risk in Asht will require a combination of flash flood risk reduction, infrastructure resilience, and institutional strengthening measures. Priority needs include improving localised flood and mudflow early warning systems, strengthening the resilience of roads, bridges, and utility infrastructure along valley corridors, and supporting livelihood diversification to reduce sensitivity to recurrent disruptions. Strengthening local institutional capacity for disaster preparedness, rapid response, and risk-informed infrastructure planning will be important to support sustained adaptation outcomes⁸⁵⁸.

District Profile of Isfara

Geography

Isfara is situated in northern Tajikistan, in the southeastern part of the Sughd Region, near the border junction between Tajikistan, Uzbekistan, and Kyrgyzstan (Figure 101). Historically, it was a separate district, but it has since been merged into the city administration. The city is 863 m above sea level in the foothills of the Turkestan Range, with the Isfara River flowing through it (Figure 102). The surrounding terrain is characterised by high, multicoloured mountains, forming part of the Turkestan ridge system, and the city sits at the southwestern edge of the Fergana Valley. The exclave of Vorukh, part of Isfara's administrative territory, is separated from the main city by Kyrgyzstan (Figure 103). Geographically and climatically, Isfara benefits from fertile valley soils and access to irrigation, supporting one of Tajikistan's largest fruit and vegetable-growing regions^{859,860,861}.

The city covers an area of approximately 832 km², including rural settlements and towns, with an estimated population of 290,600 in 2024, yielding a population density of 349.3 people/km² and an average annual growth rate of 1% since 2020. Isfara is located 107 km from the provincial centre and 480 km from Dushanbe. Administratively, the city comprises Isfara proper, three towns, Naftobod, Nurafshon, and Shurob; and nine jamoats, Chilgazi, Chorku, Khonabad, Kulkand, Lakkon, Navgilem, Shahrak, Surkh, and Vorukh. Population by jamoat varies, with Navgilem (38,104) and Chorku (37,065) among the largest⁸⁶².

⁸⁵⁶ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

⁸⁵⁷ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

⁸⁵⁸ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

⁸⁵⁹ https://www.citypopulation.de/en/tajikistan/admin/su/d/215_isfara/

⁸⁶⁰ <https://kis.tj/en/about-isfara/>

⁸⁶¹ <https://en.wikipedia.org/wiki/Isfara>

⁸⁶² <https://en.wikipedia.org/wiki/Isfara>

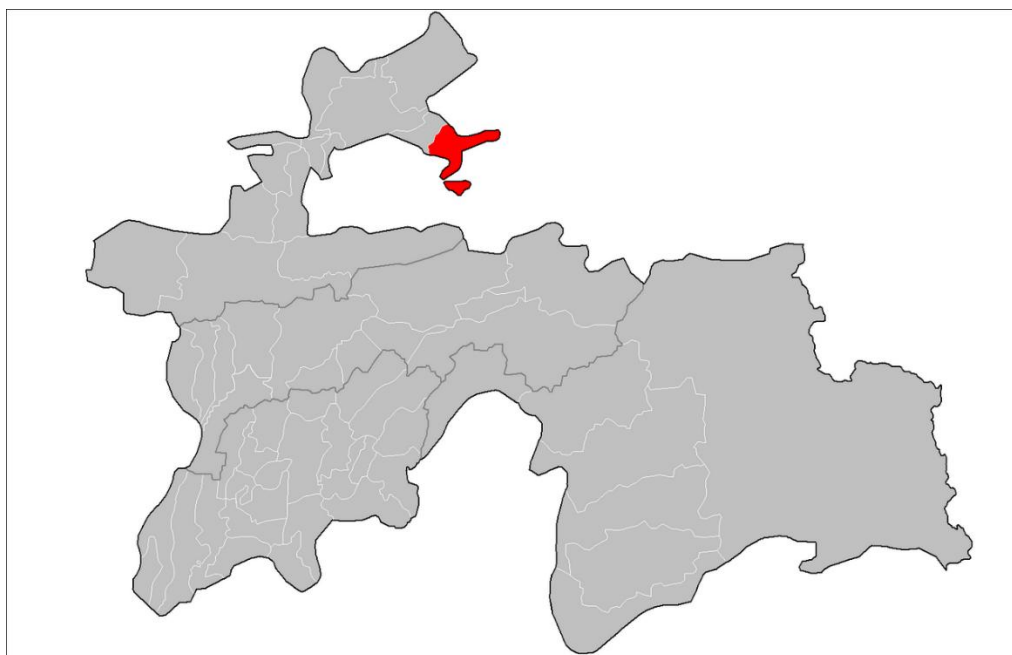


Figure 101. Isfara District, Tajikistan⁸⁶³.



Figure 102. Relief map of Isfara.

⁸⁶³ Marefa 2021. Isfara District. [Available online.](#)

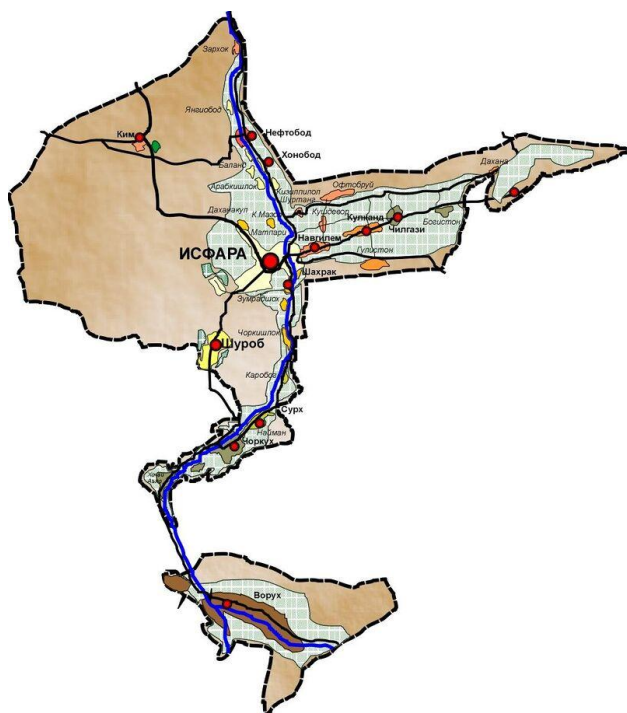


Figure 103. Map of Isfara⁸⁶⁴.

Socioeconomic profile

Apricot cultivation is a critical economic and social activity in Isfara, employing over 100,000 people in Tajikistan's apricot industry, with small-scale processing companies and cooperatives that primarily employ women. The sector underpins household incomes, improves standards of living, and stimulates local trade. Apricot production is considered a strategic product nationally, and a monument in Isfara city symbolises its cultural and economic significance. Market demand for apricots and processed products creates a vital safety net for rural households. However, the average monthly salary in Tajikistan is only US\$260, which limits the capacity of family farmers to invest in adaptation measures. Value-added processing of apricots also strengthens linkages between farmers, local enterprises, and export markets, supporting regional economic resilience⁸⁶⁵.

The Isfara borderlands, straddling Tajikistan and Kyrgyzstan, exhibit complex socioeconomic dynamics shaped by historical, political, and infrastructural factors. Population identities in the region are strongly localised, with citizenship, community affiliation, and historical territorial knowledge shaping perceptions of belonging. Since the collapse of the USSR, nation-building processes have amplified ethno-national distinctions, particularly in Kyrgyzstan, while Tajik communities have emphasised civic and local identities. Cross-border interactions have declined significantly, with half of the Tajik respondents surveyed reporting no contact with Kyrgyz neighbours in 2016. Linguistic barriers exacerbate isolation; only 2% of Tajiks speak Kyrgyz, while 8.8% of Kyrgyz speak Tajik. Ethnic Uzbeks, present in both countries, play a critical role as intermediaries in communication, trade, and the informal economy. Border infrastructure and security measures, including special border legislation and the presence of border guards, influence mobility, trade, and community cohesion, often contributing to tensions and occasional armed clashes. While international organisations and NGOs have implemented peacebuilding initiatives, these efforts have been uneven, sometimes reinforcing

⁸⁶⁴ Marefa 2021. Isfara District. [Available online.](#)

⁸⁶⁵ <https://www.france24.com/en/live-news/20250716-tajikistan-s-apricot-farmers-grapple-with-climate-change>

community isolation. Despite these challenges, interdependence persists through shared infrastructure, including irrigation systems, roads, and local governance mechanisms, as well as cross-border markets and employment networks, particularly in agriculture, which remain vital for livelihoods and local resilience⁸⁶⁶.

Agricultural profile

The Isfara region in northern Tajikistan is a globally significant centre for apricot production, accounting for approximately 10% of the world's orchards. Sughd province serves as the focal point for both cultivation and value-added processing, with Isfara hosting extensive orchards and a thriving dried fruits industry that supplies markets across Central Asia, including Russia and beyond. Despite its remote location and proximity to an unstable border area, the region underpins local livelihoods and rural economic development. Small-scale farms contribute the majority of fruit supply, selling to local markets and processing facilities such as Isfara Food and Mevai Zarrin (MZ). Local processing enterprises, including MZ, employ approximately 50 workers, predominantly women, and collectively over 20 companies employ around 1,000 people. These enterprises typically operate in a cooperative manner to meet high market demand, directly linking with farmers and supporting rural income generation. Over the last five years, approximately 1,500 ha of low-yield land have been regenerated, and producers are diversifying into climate-resilient crops, such as plums, while adopting modern irrigation techniques, including drip systems, to improve water efficiency and enhance production capacity^{867,868}.

Recent interventions by development partners, including USAID-funded MDRD, have demonstrated the potential for transformative improvements in agribusiness operations. Expert support introduced modern food safety practices, sanitation infrastructure, and workflow optimisations, resulting in measurable outcomes: a 35% increase in processing capacity, a 70% reduction in post-harvest losses, and a 30% increase in exports. Investments in worker welfare — such as ergonomic workstations, sanitation facilities, and access to clean water — have enhanced productivity and motivated staff, particularly women, contributing to inclusive economic growth. These improvements also create a ripple effect for local farmers, as higher processing demand for apricots directly increases farm-level income and strengthens the resilience of agricultural livelihoods. The integration of modern techniques, value chain optimisation, and local capacity building positions Isfara's apricot sector as a promising model for climate-resilient and economically sustainable agriculture in border regions.

Agriculture in the Isfara Valley is central to both livelihoods and territorial disputes, reflecting historical and contemporary differences in land tenure systems. During the Soviet era, collectivisation, sedentarisation of Kyrgyz nomads, and large-scale irrigation projects such as the Tort-Kul reservoir and canal reshaped land use and settlement patterns, generating tensions over arable land, pastures, and water resources. Post-independence agrarian reforms further differentiated the two countries: Kyrgyzstan adopted private land ownership, a market for land, and pasture tickets, enabling rapid privatisation and formalisation of previously disputed lands, whereas Tajikistan retained state ownership and slow, state-controlled land redistribution. This divergence has led to persistent disputes over arable land, pastures, and irrigation infrastructure. Irrigation and water management continue to be jointly managed across borders through traditional and modern institutions, including vodokanals, water user associations, and farmer networks, ensuring equitable water distribution and

⁸⁶⁶ Olimova, S. and Olimov, M. (2022). Post-Soviet Borders; A Kaleidoscope of Shifting Lives and Lands paper.

Doi:10.4324/9781003169376-16. [Available online.](#)

⁸⁶⁷ ACDI/VOCA 2023. Turning Orange Apricots Into Green Dollars: A Tale of Triumph From Distant Isfara. [Available online.](#)

⁸⁶⁸ <https://www.france24.com/en/live-news/20250716-tajikistan-s-apricot-farmers-grapple-with-climate-change>

maintenance of shared canals. Cross-border labour mobility and trade, including informal markets and smuggling networks, provide additional agricultural income and reinforce socio-economic ties. However, these channels have been disrupted by recent border closures and regulatory differences. The combined effects of historical land allocation, ethnicised borders, market reforms, and transboundary water and trade interdependence continue to define agricultural practices and community resilience in the borderlands⁸⁶⁹.

Hazard profile

Major hazards and the risk levels for Isfara are⁸⁷⁰:

- Earthquake – High
- Landslide – High
- Wildfire – High
- Water scarcity – Medium
- Extreme heat – Medium
- Urban flood – Low
- River flood – Very low
- Cyclone – Very low

Isfara's apricot sector is highly vulnerable to the impacts of climate change, including rising temperatures, shifting precipitation patterns, glacial melt, and extreme weather events. Water scarcity from the Isfara River, which is shared with Uzbekistan and Kyrgyzstan, is a recurring constraint, forcing farmers to prioritise irrigation for apricots over other crops, such as wheat. Late frosts, temperature extremes, and heavy rainfall events damage fruit quality and reduce market value. Over the past two decades, apricot trees in the region have experienced multiple frost events during or after blooming, resulting in significant harvest losses. Adaptation measures, such as intensified orchard management, crop diversification, and improved irrigation, are being implemented; however, high costs and limited resources hinder their widespread adoption among smallholder farmers. These challenges underscore the need for targeted interventions to strengthen climate resilience in Isfara's agricultural systems⁸⁷¹.

Flood and Mudflow Risk

Flood risk in Isfara is shaped by the interaction of upstream mountainous catchments and downstream irrigated river valleys within a transboundary, glacier-fed river system. Seasonal snowmelt and rainfall in upland areas contribute to elevated flows, while settlements, agricultural land, and irrigation infrastructure concentrated along valley floors increase exposure to riverine flooding⁸⁷². Flood timing and magnitude are therefore sensitive not only to climatic conditions but also to upstream flow regulation and water management decisions outside Tajikistan, distinguishing Isfara from non-border districts in Sughd⁸⁷³.

Regional-scale hazard and susceptibility assessments illustrate how steep catchments draining into populated valleys increase exposure to flooding and sediment-laden flows in

⁸⁶⁹ Olimova, S. and Olimov, M. (2022). Post-Soviet Borders; A Kaleidoscope of Shifting Lives and Lands paper.

Doi:10.4324/9781003169376-16. [Available online.](#)

⁸⁷⁰ <https://thinkhazard.org/en/report/37607-tajikistan-sogd-isfarinskiy>

⁸⁷¹ <https://www.france24.com/en/live-news/20250716-tajikistan-s-apricot-farmers-grapple-with-climate-change>

⁸⁷² Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/link/s/65671531ce88b870311ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

⁸⁷³ *Ibid*

mountainous and foothill settings⁸⁷⁴. While mudflows are less dominant in Isfara than in steeper high-mountain districts, sediment transport and localised erosion remain relevant risks where upstream catchments deliver high sediment loads into valley systems, with potential impacts on agricultural land and irrigation infrastructure⁸⁷⁵.

Climate change is expected to exacerbate flood risk in Isfara. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events⁸⁷⁶. Hydrological modelling for major snow- and glacier-fed river basins in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation events. These processes are particularly relevant for glacier-fed, transboundary basins such as that of the Isfara River, where changes in melt dynamics and precipitation can alter both flood risk and irrigation reliability⁸⁷⁷.

In comparative terms, Isfara faces lower flood risk than lowland districts in Khatlon, but higher exposure to riverine and flash flooding than districts dominated by broad, well-drained floodplains, due to valley confinement and upstream catchment dynamics⁸⁷⁸.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Isfara is driven by reliance on climate-sensitive irrigated agriculture, limited livelihood diversification, and pockets of rural poverty and food insecurity. Orchard-based and irrigated cropping systems are highly sensitive to both flooding and drought, with damage to crops, soils, and irrigation canals directly affecting household incomes and food availability^{879, 880}. Dependence on ageing canal infrastructure further increases sensitivity to flood damage and flow variability⁸⁸¹.

Adaptive capacity is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely early warning information, and uneven local institutional

⁸⁷⁴ Gruber, F. E., and M. Mergili. "Regional-scale analysis of high-mountain multi-hazard and risk indicators in the Pamir (Tajikistan) with GRASS GIS." *Natural Hazards and Earth System Science*, vol. 13, pp. 2779–2796, <https://nhess.copernicus.org/articles/13/2779/2013/>.

⁸⁷⁵ Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/links/65671531ce88b870311ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

⁸⁷⁶ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁸⁷⁷ Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/links/65671531ce88b870311ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

⁸⁷⁸ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

⁸⁷⁹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

⁸⁸⁰ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁸⁸¹ Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/links/65671531ce88b870311ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

capacity for disaster preparedness and response⁸⁸². While Isfara benefits from relatively good access and connectivity compared to more remote mountain districts, the concentration of productive land and settlements along river valleys, combined with transboundary water governance constraints, increases potential impacts and complicates recovery following flood events^{883, 884}.

Key Climate Risk Drivers

Climate risk in Isfara arises from the interaction of catchment-driven flood hazards, transboundary river basin dynamics, and socio-economic vulnerability. Upstream mountainous terrain, glacier-fed hydrology, and valley confinement increase exposure to riverine and flash flooding, while settlement and agricultural patterns along river corridors amplify potential impacts⁸⁸⁵. This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to flood-related damage and climate variability^{886,887}.

Indicative Adaptation Priorities

Addressing climate risk in Isfara will require a combination of flood risk reduction, agricultural resilience, and institutional strengthening measures. Priority needs include strengthening flood monitoring and early warning systems, improving the resilience and maintenance of irrigation and drainage infrastructure, and enhancing coordination and information-sharing related to transboundary water management to reduce sensitivity to both flooding and drought^{888,889}. Strengthening local institutional capacity for disaster preparedness, emergency response, and risk-informed land-use planning will be important to support sustained adaptation outcomes⁸⁹⁰.

District Profile of Ayni

Geography

⁸⁸² Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁸⁸³ Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/links/65671531ce88b87031ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

⁸⁸⁴ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁸⁸⁵ Gruber, F. E., and M. Mergili. "Regional-scale analysis of high-mountain multi-hazard and risk indicators in the Pamir (Tajikistan) with GRASS GIS." *Natural Hazards and Earth System Science*, vol. 13, pp. 2779–2796, <https://nhess.copernicus.org/articles/13/2779/2013/>.

⁸⁸⁶ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁸⁸⁷ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

⁸⁸⁸ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁸⁸⁹ Kulikov, Maksim, et al. "What is the impact of climate on local communities in the Isfara River catchment?" *Mountain Societies Research Institute Research Report* 5, 2020, https://www.researchgate.net/profile/Maksim-Kulikov/publication/376001712_What_is_the_Impact_of_Climate_on_Local_Communities_in_the_Isfara_River_Catchment/links/65671531ce88b87031ed8a8/What-is-the-Impact-of-Climate-on-Local-Communities-in-the-Isfara-River.

⁸⁹⁰ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

Ayni is a mountainous administrative district located in the upper reaches of the Zarafshan Valley within the Sughd Region of Tajikistan (Figure 104). It was established on 23 November 1930 and covers a total area of approximately 5,158.6 km², of which about 97% is mountainous terrain. The district borders the Tajik administrative units of Panjakent, Kuhistoni Mastchoh, Devashtich, Shahrستان, Hisor, Shahrinav, Varzob, Vahdat and Gharm, as well as Uzbekistan's Jizzakh Region to the north and Surkhandarya Region to the southwest (Figure 105)^{891,892}.

Ayni lies about 140 km from Dushanbe and 177 km from Khujand, with its administrative centre, Ayni Village, serving as the main settlement (Figure 106). The district is divided into seven rural jamoats, encompassing numerous small mountain villages scattered across the upper basin of the Zarafshan Valley. The area is part of the Zarafshan mountain system, characterised by steep slopes, rocky ridges, and narrow valleys. The Zarafshan River and its tributaries, including the Mogiyon, Kishtud and Say Kishtudak rivers, flow through the district, providing critical water resources for irrigation and domestic use. The Yaghnob Valley, located within Ayni, is home to a unique ethnolinguistic group of Yaghnobi Tajiks, direct descendants of the ancient Sogdians, who speak Yaghnobi, a living descendant of the Sogdian language.

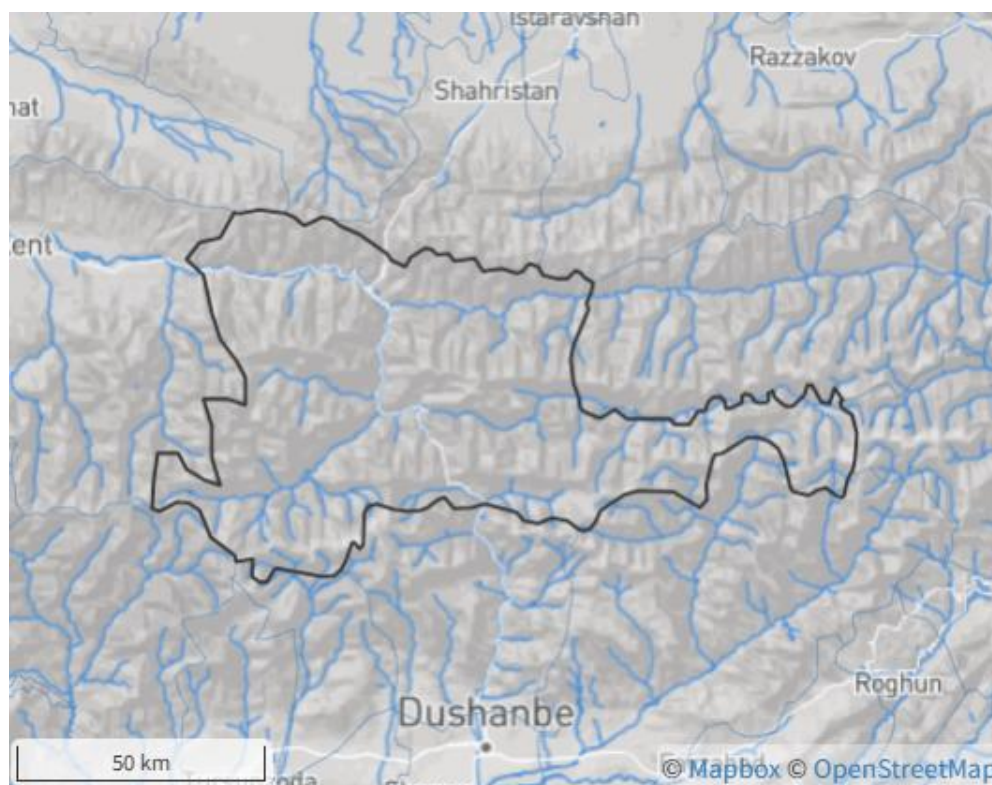


Figure 104. Relief map of Ayni.

⁸⁹¹ <https://tojikiston.info/>

⁸⁹² Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

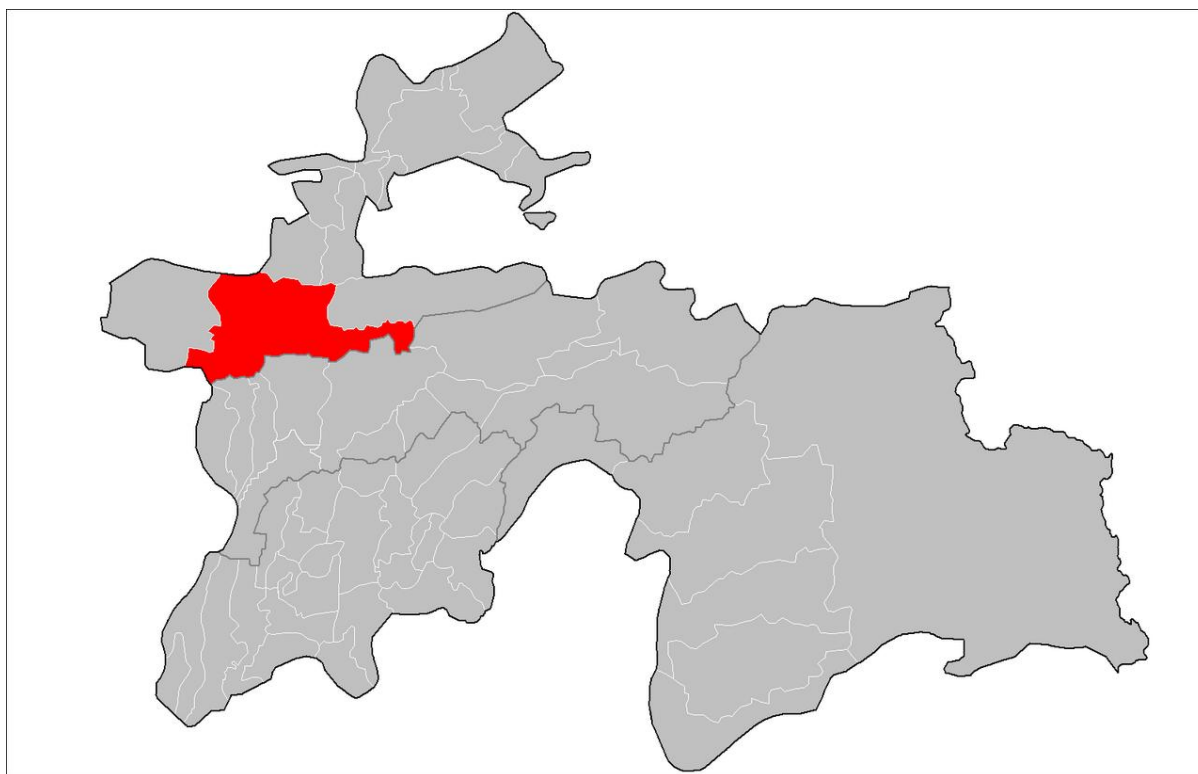


Figure 105. Location of the Ayni District, Tajikistan⁸⁹³.



Figure 106. Ayni village, administrative centre of Ayni District, Tajikistan.

⁸⁹³ <https://alchetron.com/Ayni-Dist>

Socioeconomic profile

As of early 2021, Ayni District had a population of approximately 86,000 people, with over 98% residing in rural areas. The population density is approximately 16 persons per km², reflecting the predominantly mountainous terrain. The district is ethnically homogeneous, comprising 98% Tajik, 0.4% Uzbek, and 1.6% of other ethnic groups. There are eight jamoats, 62 villages, and 19,161 households. The working-age population is estimated at 46,530, with approximately 60% of the population formally employed. Of those employed, approximately 11,500 people, or over half, work in agriculture. The average monthly wage is TJS 1,833.5 (approximately US\$198 at current rates), slightly above the regional average. Ayni's economy is primarily rural and agrarian, complemented by a developing mining industry, given the district's mineral wealth, which includes deposits of gold, silver, antimony, tungsten, and coal. Agriculture holds not only economic but also social importance, as 98.8% of the able-bodied population depends on rural livelihoods⁸⁹⁴.

Agricultural profile

Agriculture is the cornerstone of Ayni's economy. The total land area of the district in 2021 was 515,820 ha, including 3,298 ha of irrigated land. Total agricultural lands were 143,761 ha, including 2,288 ha under irrigation. The land use structure in 2021 was as follows⁸⁹⁵:

- Arable land: 1,441 ha (of which 1,424 ha irrigated)
- Perennial crops: 864 ha (all irrigated)
- Grasslands: 2 ha
- Pastures: 141,454 ha (2.4% or 3,182 hectares of pastures belonging to Ayni district have been transferred to Panjakent district for long-term use)
- Household plots: 1,625 ha (803 ha irrigated)
- Privately-owned lands: 624 ha (207 ha irrigated)

In 2021, Ayni had 1,006 dehkan farms. The cropping pattern is dominated by grain and fodder crops, of which 76.7% comprise sown lands, with major crops including wheat, barley, vegetables, potatoes, and fodder. Potatoes occupy about 518 ha, vegetables 80 ha, fodder crops 460 ha, wheat and barley 680 ha, and fruit trees 399 ha. Yields depend heavily on irrigation and seasonal water availability. Yak breeding is a key livelihood activity in highland areas, providing meat, milk, wool, and other byproducts that are well-adapted to cold alpine conditions⁸⁹⁶. In addition to traditional cropping and livestock practices, Ayni District has benefited from recent government-led initiatives supported by international partners under the Tajikistan Resilient Landscape Restoration Project. A 156-hectare park is being established in the district, including the Barakat orchard in the Dashti Bolo area of Pokhut village. Covering 100 hectares, the orchard comprises 63,310 trees, including apple, apricot, cherry, jujube, and acacia, and is distributed to residents of Pokhut, Sayron, and Fatmovut villages through a joint forest management agreement. These interventions provide permanent employment, land access, and productive garden plots for over 695 rural households. The project also promotes community participation through organised tree planting campaigns and collective labour (hashars). At the same time, ongoing irrigation and park development will support the sustainability and expansion of productive agricultural and horticultural land in the district.

⁸⁹⁴ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁸⁹⁵ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁸⁹⁶ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

Further 56 hectares of park and plantation areas are planned, reinforcing the district's long-term agricultural and rural livelihood resilience⁸⁹⁷.

Irrigation systems in Ayni are small-scale, scattered, and highly dependent on river-fed and snowmelt water sources. Many are gravity-fed or supported by high-lift pumping stations. Due to limited irrigation coverage, most farms rely on rainfed cultivation on marginal lands. Soils in Ayni are mainly meadow-serozem and sandy loams, often affected by erosion and landslides along riverbanks and slopes. The area is also prone to degradation due to overgrazing and limited pasture management. The district's mineral resources are abundant, with deposits of precious and industrial minerals, including gold, silver, antimony, tin, tungsten, fluorite, coal, marble, and limestone⁸⁹⁸.

Hazard profile

Ayni lies within a temperate to subtropical continental climate zone, with hot summers and cold winters. Basic climatic details are as follows⁸⁹⁹:

- Average annual temperature (mountain areas): +12.7°C
- January average: -3.5°C
- July average: +20°C
- Recorded extremes: -35°C to +57°C
- Annual precipitation: 114–400 mm, concentrated in spring and autumn
- Vegetation period: 215–220 days

Overpopulation and extensive deforestation of the Zarafshan valley in the 1990s, which includes Ayni District, led to the vast degradation of watersheds. This resulted in frequent flash flooding and debris flows from the watershed slopes whenever heavy rain or rapid snowmelt occurred. These events have become even more devastating in recent years due to intensified rainfall and drought patterns caused by climate change. They are now identified as one of the highest threats to the local population⁹⁰⁰.

The Zarafshan River basin is glacier- and snow-fed, making Ayni highly dependent on seasonal meltwater for irrigation. However, glacial retreat due to climate change has led to declining river flows and increased water stress during dry months. Main climate and natural hazards include⁹⁰¹:

- floods and mudflows, resulting from rapid snowmelt and heavy rainfall, particularly in spring;
- landslides and soil erosion, common on steep slopes and cultivated hillsides;
- droughts, which are becoming increasingly frequent and intense, affecting crop yields and water supplies;
- cold waves and frost, damaging fruit crops and livestock in high elevations; and
- seismic activity, as Ayni lies within a high mountain zone of moderate to substantial earthquake risk.

Major hazards and the risk level for Ayni are⁹⁰²:

- Urban flood – High

⁸⁹⁷ <https://carececo.org/en/main/news/landscape-restoration-process-in-ayni-district/>

⁸⁹⁸ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁸⁹⁹ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁹⁰⁰ UNDP 2022. Integrated Watershed and Sustainable Land Management to Build the Resilience of Local Communities in Tajikistan. [Available online](#).

⁹⁰¹ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁹⁰² <https://thinkhazard.org/en/report/37603-tajikistan-sogd-aini>

- Earthquake – High
- Landslide – High
- Wildfire – High
- Water scarcity – Medium
- Extreme heat – Low
- River flood – Very low
- Cyclone – Very low

Between 2005 and 2008, the Ayni District experienced 26 emergency events, which included two mudflows, twelve landslides, four avalanches, six snowfalls or light frosts, and two rises in the river waterline. The total economic damage caused by these disasters amounted to 3,117,200 TJS (approximately US\$945,000, using the 2005–2008 average exchange rate), representing 13.7% of the district's total budget over the four years. Analysis of the dynamics of disaster impacts revealed that 2008 was the most severe year, with damages totalling 2,044,600 TJS, surpassing the combined damages of the preceding three years. During this period, the district was highly exposed to hazardous processes. Of the eight jamoats, only Zarafshan jamoat did not contain hazardous zones. The remaining seven jamoats included 1 to 4 villages each with hazardous zones, totalling 26 villages across the district. Frequently, individual villages experienced multiple hazard types, including mudflows, landslides, rockfalls, landslips, avalanches, snowfalls, and frosts. Snowfalls and frosts affected the entire district. Approximately 33,590 people (7,039 dehkan farms), representing 44.38% of the district's population, lived in villages exposed to these hazards. Analysis of disaster impacts on economic sectors revealed that agriculture was the most affected, both in absolute and relative terms. Between 2005 and 2008, agricultural losses totalled 799,800 TJS (approximately US\$244,000, using the average exchange rate for the 2005–2008 period), accounting for 3.3% of the total budget supply side. Considering that arable land accounted for only 0.76% of the district's territory (3,962 ha, approximately 0.05 ha per capita), these damages had significant consequences for both agricultural production and rural livelihoods⁹⁰³.

Due to the limited land resources and recurring disaster losses, protective measures for agricultural lands, such as riverbank reinforcement, mudflow bypass channels, drainage networks, and slope stabilisation, were identified as critical priorities and were recommended for integration into district development planning. Effective disaster prevention and response required adequate material and financial resources, which were not fully available in the district budget during this period. Monitoring of international assistance revealed that, from 2006 to early 2009, development partners primarily focused on providing potable water, rehabilitating roads and bridges, and strengthening mudflow channels and riverbanks, with total expenditures of approximately US\$443,903. Despite these interventions, the district's annual revenues were insufficient to fully implement the mitigation measures. The disaster readiness and response structure of Ayni District was in place to manage these risks; however, further investment in hazard prevention and community resilience remained a priority⁹⁰⁴.

Table 16. Hazardous processes by jamoat and village, Ayni District, Tajikistan, 2005–2008⁹⁰⁵.

Jamoat	Village	Type of hazardous process
Urmetan	Urmetan	Mudflows.
	Yovon	Mudflows and erosive processes.

⁹⁰³ https://www.untj.org/files/Publications/DRMP/resource_page/Ayni_DRR_ENG.pdf

⁹⁰⁴ https://www.untj.org/files/Publications/DRMP/resource_page/Ayni_DRR_ENG.pdf

⁹⁰⁵ https://www.untj.org/files/Publications/DRMP/resource_page/Ayni_DRR_ENG.pdf

Jamoat	Village	Type of hazardous process
	Revad	Mudflows, landslides and rock falls.
	Vashan	Landslides
Dar-Dar	Iskodar	Mudflows.
	Dar-Dar	Collapse of the shore.
	Kum	Mudflows.
	Zerbod	Landslides.
Ayni	Kuhrud	Mudflows and landslides.
	Zindakon	Mudflows and landslides.
	Hushekat	Landslides and rock falls.
	Puthin	Landslides.
Rarz	Fatmev	Landslips and rock falls.
Shamtuch	Guzoribod	Landslides and rock falls
	Pohut	Landslides
	Shavkati poen	Rock falls
	Veshab	Landslides and rock falls
	Shamtuch	Rock falls
	Darg	Rock falls
	Utogar	Rock falls
Fondaryo	Mahshevad	Landslides
Anzob	Takfon	Landslips
	Pishanza	Landslides
	Between the 168 and 170 km section of the Dushanbe–Khujand road.	Landslides
	16 km of the road Ayni- Kuhistoni Mastchoh	Landslides

Environmental degradation, including deforestation and overgrazing, further exacerbates soil instability and reduces ecosystem resilience. The combination of limited irrigation, high dependence on natural water sources, and climate variability makes Ayni particularly vulnerable to climate-induced agricultural losses⁹⁰⁶.

Flood and Mudflow risks

Flood and mudflow risk in Ayni is shaped by steep, high-altitude mountainous catchments and very narrow, confined river valleys along the middle course of the Zeravshan River. Flash floods and rain-induced mudflows are the dominant hazard types, driven by rapid runoff from steep slopes, intense precipitation, and limited channel capacity within V-shaped valley systems^{907, 908}.

The confinement of settlements, roads, and bridge infrastructure within these narrow valleys increases exposure to high-energy flood and mudflow events. With limited space for floodwater and sediment dispersion, even moderate events can damage transport lifelines and important crossings, disrupting connectivity between valley settlements and district centres and amplifying the wider socio-economic impacts of floods and mudflows⁹⁰⁹.

Regional-scale hazard and risk assessments for mountainous and foothill areas of Tajikistan identify moderate to high susceptibility to flash floods and mudflows in terrain settings

⁹⁰⁶ Agency for Land Reclamation and Irrigation Under the Government of The Republic of Tajikistan. 2022. Environmental and Social Management Framework (ESMF). Tajikistan Strengthening Water and Irrigation Management Project, [Available online](#).

⁹⁰⁷ Elevation.city. *Zafarobod, Sughd, Tajikistan Elevation*, 2026, <https://elevation.city/tj/q72m#src2>.

⁹⁰⁸ Topographic-map.com. *Ayni District topographic map*, 2026, <https://en-us.topographic-map.com/map-lvqxzs/Ayni-District/>

⁹⁰⁹ Mustraeva, et al. "Tajikistan: Country situation assessment." *Working Paper*, CAREC, 2014, https://www.carececo.org/upload/02/eng_CSA_Tajikistan.pdf.

comparable to Ayni, particularly where steep slopes and narrow valleys coincide with human settlements. Observational and remote-sensing-based studies further confirm that mudflow activity is widespread across mountain and foothill districts, including in Sughd Region, indicating that such events are recurrent rather than exceptional⁹¹⁰.

Climate change is expected to exacerbate flood and mudflow risks in high-altitude districts such as Ayni through rising temperatures, accelerated snow and glacier melt, and increasing precipitation variability. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events⁹¹¹. Hydrological modelling for major snow- and glacier-fed river basins in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation⁹¹². While basin-specific, these projections reflect climate processes relevant to the upper Zeravshan catchment, where steep terrain and confined valleys amplify runoff responses and associated flood and mudflow risk.

Vulnerability and Adaptive Capacity

National poverty diagnostics indicate that rural households in Tajikistan experience higher poverty rates, greater income volatility, and increased sensitivity to climate and disaster shocks compared to urban households⁹¹³. In Ayni District, socio-economic vulnerability is shaped by a combination of subsistence agro-pastoral livelihoods, limited livelihood diversification, and a high reliance on labour migration and remittance income⁹¹⁴. This livelihood structure increases sensitivity to climate-related disruptions that affect agricultural production, mobility, and access to markets and services.

Remittance dependence represents a key vulnerability pathway in Ayni. With many working-age men engaged in labour migration, the immediate impacts of floods, mudflows, and landslides often fall disproportionately on women, children, and elderly household members who remain in the district. Climate-related disruptions to transport corridors and local access routes can further constrain access to services, markets, and emergency assistance, compounding the impacts of hazard events and increasing recovery burdens for affected households⁹¹⁵.

Livelihoods and basic service access in Ayni are closely linked to the functionality of mountain road networks and bridges connecting dispersed valley settlements to district centres and regional markets. Floods, mudflows, and landslides frequently damage these transport lifelines, disrupting access to health services, employment opportunities, and emergency

⁹¹⁰ Safarov, M., et al. "Mapping the territories of the mountain-foothill zone of Tajikistan exposed to mudflows." *Journal of Mountain Science*, vol. 22, 2025, pp. 16–30, <https://doi.org/10.1007/s11629-024-9020-2>

⁹¹¹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹¹² Kure, et al. "Hydrologic impact of regional climate change for the snowfed and glacierfed river basins in the Republic of Tajikistan: hydrological response of flow to climate change." *Hydrological Processes*, vol. 27, no. 26, 2012, pp. 4057–4070, <https://doi.org/10.1002/hyp.9535>.

⁹¹³ World Bank. "Poverty Reduction and Shared Prosperity in Tajikistan: A Diagnostic." *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/handle/10986/18814>.

⁹¹⁴ Avazov, et al. "The Agro-Pastoral System of the Zarafshan Valley, Tajikistan, and Modelling of Management Options for Improvement." *Natural Resources and Human Welfare in Central Asia*, 2026, https://www.researchgate.net/publication/267506101_The_Agro-Pastoral_System_of_the_Zarafshan_Valley_Tajikistan_and_Modelling_of_Management_Options_for_Improvement

⁹¹⁵ EWS NET. *Livelihoods Zoning Plus Activity in Tajikistan: A special report by the famine early warning systems network*. FEWS NET, 2011, https://fews.net/sites/default/files/metadatalinks/TJ_Livelihood_Zone_Descriptions_English.pdf.

response, and amplifying the socio-economic impacts of climate shocks beyond direct physical damage^{916, 917}.

Adaptive capacity is constrained by the district's rugged terrain, dispersed settlement patterns, and limited coverage of high-altitude early warning and monitoring systems. Landslides, avalanches, and flood-related damage can isolate communities for extended periods, reducing the ability of households and local institutions to anticipate, absorb, and recover from climate-related shocks. These constraints disproportionately affect remittance-dependent households, poorer rural communities, and the elderly, who have fewer resources available for recovery and adaptation^{918, 919, 920}.

Key Climate Risk Drivers

Climate risk in Ayni District is driven by the convergence of high-mountain hazard processes and structural vulnerability linked to isolation and connectivity. Steep, high-altitude catchments and confined valleys generate frequent flash floods, mudflows, landslides, and avalanche-related disruptions, while settlement patterns aligned along narrow valley floors and transport corridors amplify exposure to these hazards^{921, 922}.

These physical risk factors are compounded by socio-economic conditions, including reliance on agro-pastoral livelihoods, remittance dependence, and limited redundancy in access routes and services. Disruption of transport infrastructure during hazard events can rapidly isolate communities, constrain access to markets and emergency support, and extend recovery times, increasing sensitivity to even moderate climate shocks^{923, 924}.

Indicative Adaptation Priorities

Addressing climate risk in Ayni will require a focus on reducing exposure along transport corridors and improving preparedness for high-mountain hazards. Priority needs include strengthening the resilience of roads, bridges, and slope-adjacent infrastructure to withstand floods, mudflows, and landslides, including through targeted stabilisation and maintenance measures⁹²⁵.

⁹¹⁶ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹¹⁷ *Ibid*

⁹¹⁸ Marshall, J.S. *Tajikistan's Path Forward: A Strategic Framework for Coal Mining Transition*. 2025, <https://unece.org/sites/default/files/2026-01/A%20Strategic%20Framework%20for%20Coal%20Mining%20Transition%20%28Final%29.pdf>

⁹¹⁹ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹²⁰ World Bank. *Tajikistan Country Climate and Development Report*. World Bank Group, 2024, <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099102424150519451/p5004609e1a6b79424b8e6bb612b3962f41>

⁹²¹ GERES. *Climate Vulnerability and Resilience Assessment: Adaptation capacity of a remittance based livelihood in the arid Fom mountains*. GERES, 2014, <https://www.geres.eu/wp-content/uploads/2019/10/climate-vulnerability-en-synth.pdf>.

⁹²² United Nations. *Tajikistan Common Country Analysis 2023*. United Nations Tajikistan, 2023, <https://tajikistan.un.org/en/download/137228/238828>

⁹²³ *Ibid*

⁹²⁴ UNDRR. *Climate Change Profile: Tajikistan*. United Nations Office for Disaster Risk Reduction, 2021, <https://www.undrr.org/media/96809/download>.

⁹²⁵ World Bank. *Tajikistan Country Climate and Development Report: Infographics*. World Bank Group, 2024, <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099102924152028139>.

Improving early warning and risk information for floods, mudflows, and related slope hazards is also important, particularly for remote and high-altitude settlements with limited response time. Strengthening district-level disaster preparedness, coordination, and response capacity will be essential to reduce isolation-related impacts and support recovery following hazard events⁹²⁶.

District Profile of Panjakent

Geography

Panjakent District, located in the northwestern part of Tajikistan, within the Sughd province (Figure 107). Covering an estimated land area of ~3,000–3,500 km², the district lies at the western gateway to the Zeravshan Valley, one of the country's most fertile and densely settled regions⁹²⁷. It shares a border with Uzbekistan to the west. It is situated near the ancient Silk Road city of Samarkand. Geographically, the district is defined by its position along the Zeravshan River, which flows westward into Uzbekistan and provides vital irrigation for agriculture. The surrounding landscape is dominated by the Fann Mountains to the south and east, creating a striking backdrop of rugged terrain and high peaks. This combination of river valley and mountain ranges makes Panjakent both agriculturally productive and scenically rich⁹²⁸. The climate is continental, with cold winters and hot summers. The valley's irrigation systems support orchards, crops, and other farming activities that sustain local livelihoods. In addition to its natural features, Panjakent is home to significant cultural and historical sites, including the UNESCO-listed Sarazm archaeological settlement, which represents one of Central Asia's earliest urban centres, and the ruins of Ancient Panjakent, a major Sogdian city. The district is also renowned for natural attractions such as the Seven Lakes (Haft Kul), a chain of mountain lakes that highlight the area's ecological diversity. Together, these geographic features underscore Panjakent's importance as both a fertile agricultural hub and a cultural gateway between Tajikistan and Uzbekistan.



Figure 107. Map of the geographical location of Panjakent, Tajikistan.

Socioeconomic profile

⁹²⁶ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹²⁷ [CIA World Factbook – Tajikistan Geography Overview](#).

⁹²⁸ [CBD First National Report – Biodiversity and Geography of Tajikistan](#).

Panjakent District, located in the Sughd Region of northwestern Tajikistan, is part of Livelihood Zone 10 — the Rice, Fruit, and Vegetable Zone⁹²⁹. The district is characterised by fertile soils and extensive irrigation networks fed by the Zeravshan River, which enable households to cultivate rice, fruits such as apricots, grapes, and apples, as well as a wide variety of vegetables. Agriculture is the backbone of the local economy, and most households rely on crop production for both subsistence and market sales. Livestock ownership, though secondary, supplements household food security and income, with cattle, sheep, and goats providing milk, meat, and occasional cash earnings⁹²⁹.

The population of Panjakent is mainly rural, with villages clustered along river valleys and irrigation canals, while Panjakent city serves as the administrative and commercial hub. Poorer households typically depend on small-scale farming, casual agricultural labour, and remittances from migrant workers abroad, particularly in Russia⁹³⁰. Better-off households, by contrast, generate income from larger-scale crop sales, livestock products, and small businesses. Across wealth groups, remittances remain a critical source of household income, often used to purchase staple foods such as wheat flour, which is not produced in sufficient quantities locally^{930,931}. Food security in Panjakent is closely tied to seasonal cycles. Harvests in summer and autumn provide surpluses of rice, fruit, and vegetables, while lean periods in spring coincide with high staple food prices and limited household reserves. This seasonal vulnerability is exacerbated by exposure to climate hazards, including floods, hail, and locust infestations, which can disrupt agricultural yields and reduce household coping capacity⁹²⁹. Although Panjakent is considered one of Tajikistan's more productive livelihood zones, it remains vulnerable to food insecurity during years of socio-economic strain, particularly when remittance flows decline or agricultural shocks occur⁹³¹.

Agricultural profile

Panjakent District, located in the fertile Zeravshan Valley of Tajikistan's Sughd Region, is one of the country's most productive agricultural zones. Classified by FEWS NET as Livelihood Zone 10: Rice, Fruit, and Vegetable Zone, the district's economy is dominated by irrigated farming systems that support rice cultivation, orchards, and vegetable production⁹²⁹. The Zeravshan River provides the primary source of irrigation, enabling households to grow rice as a staple crop alongside apricots, grapes, apples, and a wide variety of vegetables. These products are consumed locally and marketed both within Tajikistan and across the nearby border with Uzbekistan, particularly in Samarkand⁹²⁹.

Agriculture in Panjakent is highly diversified. Rice cultivation is concentrated in irrigated lowlands, while orchards and vineyards flourish on valley slopes. Apricots and grapes are especially important cash crops, forming a significant part of the district's identity and contributing to its export potential⁹³⁰. Vegetables such as onions, carrots, cucumbers, and tomatoes are grown seasonally, contributing to household food security and market supply. Livestock ownership, though secondary, remains widespread, with cattle, sheep, and goats providing milk, meat, and supplementary income. Better-off households often combine crop sales with livestock product marketing, while poorer households rely more heavily on casual agricultural labour and remittances⁹³⁰.

Recent statistics highlight the broader agricultural strength of the Sughd Region, where Panjakent is located. In 2025, sowing was carried out on 262,800 ha, producing agricultural goods valued at 6.1 billion somoni, representing a 110.5% growth rate compared to the

⁹²⁹ [FEWS NET. \(2011\). *Livelihood Zone Descriptions: Tajikistan*.](#)

⁹³⁰ [IFAD. \(2024\). *Tajikistan Country Profile*.](#)

⁹³¹ [World Bank \(2025\). *Tajikistan Poverty and Equity Assessment*.](#)

previous year⁹³². This regional growth reflects investments in crop diversification and irrigation infrastructure, which directly benefit Panjakent's farming communities. Nationally, agriculture contributes about 20% of GDP and employs 61% of the workforce, underscoring the sector's centrality to livelihoods^{931,933}. Despite its productivity, Panjakent's agriculture faces vulnerabilities. Seasonal cycles create lean periods in spring when staple food prices peak, and households depend more heavily on markets. Climate hazards, such as floods, hail, and locust infestations, pose recurrent risks to yields⁹²⁹. Moreover, the district's reliance on remittances means that external shocks, such as reduced labour migration opportunities, can undermine household resilience. Climate-smart agriculture initiatives promoted nationally emphasise the need for improved water management, crop diversification, and resilience to climate change^{931,934}.

Hazard profile

Panjakent District, located in the fertile Zeravshan Valley of Tajikistan's Sughd Region, is exposed to a range of climatic and non-climatic hazards that shape its socioeconomic and agricultural profile. Among the climatic hazards, floods are a recurring challenge, particularly during spring and early summer when the Zeravshan River overflows, damaging irrigation systems and cropland. Hailstorms are also common in these months, often devastating fruit orchards and vegetable crops that form the backbone of household income. Increasing climate variability has led to more frequent droughts and water scarcity, threatening rice cultivation and orchard productivity⁹³⁴. Locust infestations, although sporadic, remain a significant threat to staple crops and pastures. Meanwhile, extreme cold and frost during winter affect orchards and livestock, with avalanches and landslides occurring in the highland areas south of Panjakent⁹³³. Non-climatic hazards are equally significant. Seasonal price shocks and market volatility undermine household purchasing power, especially during lean periods in spring, when staple food prices peak and reserves are low⁹²⁹.

Remittance dependency is another critical vulnerability, as fluctuations in labour migration opportunities, particularly in Russia, directly affect household income, with remittances accounting for nearly 28% of Tajikistan's GDP^{931,935}. Infrastructure limitations, including poor road networks and gaps in irrigation maintenance, reduce market access and weaken resilience to shocks⁹³⁶. In addition, outbreaks of crop pests and livestock diseases periodically reduce yields and income, disproportionately affecting poorer households⁹³³.

Taken together, Panjakent's hazard profile reflects a district where natural shocks, such as floods, hail, droughts, and locusts, intersect with socioeconomic vulnerabilities, including price volatility, remittance dependency, and weak infrastructure. While the district is one of Tajikistan's most productive agricultural zones, its reliance on irrigated farming and external income sources makes households sensitive to both climatic and non-climatic disruptions. Strengthening resilience through climate-smart practices, improved disaster preparedness, and diversification of livelihoods is therefore essential to reducing risk exposure.

Flood and Mudflow Risk

Flood and mudflow risk in Panjakent is shaped by the district's mountainous catchments, steep slopes, and narrow river valleys. Flash floods and rain-induced mudflows are the dominant hazard types, driven by rapid runoff from upstream areas and the concentration of

⁹³² [Avesta News. \(2025\). Sowing Work in Sughd Region.](#)

⁹³³ [FAO. \(2024\). Country Profile: Tajikistan.](#)

⁹³⁴ [World Bank. \(2024\). Climate-Smart Agriculture Profile: Tajikistan](#)

⁹³⁵ [IFAD. \(2024\). Tajikistan Country Profile.](#)

⁹³⁶ [UNECE. \(2024\). Tajikistan Economic Overview.](#)

settlements, agricultural land, and infrastructure along valley floors, including the Zeravshan River corridor⁹³⁷. While valley floors remain confined, they widen locally compared to neighbouring high-mountain districts such as Ayni, enabling more intensive irrigated agriculture but also increasing exposure of productive land and irrigation systems to high-energy, sediment-laden flood events.

Flood impacts in Panjakent are frequently mediated through damage to irrigation canals and irrigated farmland in river-valley villages, rather than concentrated impacts on dense district centres. During a mudflow event in 2017, approximately 3.5 km of irrigation channels were damaged and around 40 ha of agricultural land were inundated, directly disrupting irrigated production systems and associated livelihoods⁹³⁸. This pattern reflects a flood risk pathway in which agricultural infrastructure and rural livelihoods are disproportionately affected, even where settlement densities are relatively low.

Regional-scale hazard and risk assessments for mountainous and foothill areas of Tajikistan identify moderate to high susceptibility to flash floods and mudflows in terrain settings comparable to Panjakent, particularly where narrow valleys and degraded slopes coincide with human settlements. Observational and remote-sensing-based studies further confirm that mudflow activity is widespread across mountain and foothill districts, including in Sughd Region, indicating that such events are recurrent rather than exceptional⁹³⁹.

Climate change is expected to exacerbate flood and mudflow risks. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events⁹⁴⁰. Hydrological modelling for major snow- and glacier-fed river basins in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation. While these projections are basin-specific, they provide evidence of climate processes that are relevant for mountainous catchments more broadly, including those in the Sughd Region, where steeper terrain and confined valleys amplify runoff responses and associated flash flood and mudflow risk.

Vulnerability and Adaptive Capacity

National poverty diagnostics show that rural households dependent on agriculture experience higher poverty rates, greater income volatility, and increased sensitivity to climate and disaster shocks compared to urban households⁹⁴¹. Socio-economic vulnerability in Panjakent is driven by reliance on climate-sensitive agricultural livelihoods, limited livelihood diversification, and pockets of poverty and food insecurity in rural communities. Agricultural production systems

⁹³⁷ *Ibid*

⁹³⁸ IFRC. "Tajikistan." *IFRC Disaster Response and Preparedness*, 2026, <https://go.ifrc.org/countries/167/ongoing-activities/emergencies>. Accessed 27 01 2026.

⁹³⁹ Safarov, Mustafo, et al. "Mapping the territories of the mountain-foothill zone of Tajikistan exposed to mudflows." *J. Mt. Sci.*, vol. 22, 2025, pp. 16–30, <https://doi.org/10.1007/s11629-024-9020-2>.

⁹⁴⁰ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁴¹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

are sensitive to both flood-related damage to irrigation infrastructure and climate variability affecting water availability, increasing sensitivity to climate shocks⁹⁴².

Adaptive capacity is constrained by limited access to timely early warning information, variable quality and resilience of rural infrastructure, and limited local institutional capacity for disaster preparedness and climate risk management, particularly in more remote valley settlements⁹⁴³. These constraints reduce the ability of households and local institutions to anticipate, absorb, and recover from flood- and mudflow-related shocks, with disproportionate impacts on poorer households and vulnerable groups⁹⁴⁴.

Key Climate Risk Drivers

Climate risk in Panjakent arises from the interaction of terrain-driven hazard exposure and socio-economic vulnerability. Steep catchments and narrow valleys create high exposure to flash floods and mudflows, while settlement and irrigation patterns along river corridors amplify potential impacts on agricultural livelihoods, as illustrated by regional susceptibility patterns for mountainous areas (Figure 3). This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to flood-related damage and climate variability^{945, 946}.

Khatlon region

Khatlon Region occupies the southwestern portion of the Republic of Tajikistan, spanning fertile plains of the Vakhsh and Panj river valleys in the west and transitioning to foothills and more rugged terrain in the east. Covering an area of approximately 24,700 km², it is one of Tajikistan's four first-level administrative regions and shares international borders with Uzbekistan to the west and Afghanistan to the south. The regional capital is Bokhtar (formerly Qurghonteppa), a central hub of administration and commerce. Khatlon is the country's most populous region, with an estimated population of over 3.3 million in 2020, reflecting significant demographic growth driven by high fertility and a predominantly rural agrarian economy. Administratively, Khatlon consists of 21 districts and four district-level cities (Kulob, Levakant, Norak, and Bokhtar), which together encompass urban centres and surrounding rural localities⁹⁴⁷.

Agriculture forms the economic backbone of Khatlon, with the region producing the bulk of the country's cotton, cereals, fruits, and vegetables. Cotton cultivation remains especially significant as both a staple and export crop, while cereal and horticultural production support local food security and livelihoods. Due to its extensive irrigated farmland and fertile alluvial soils, Khatlon accounts for a significant share of national agricultural output, with agriculture contributing roughly 80% to the regional GDP and over 40% of Tajikistan's exports. However,

⁹⁴² United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁴³ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁴⁴ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁴⁵ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁴⁶ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁴⁷ https://en.wikipedia.org/wiki/Khatlon_Region

poverty, seasonal water shortages, and reliance on irrigation infrastructure make yields sensitive to climatic variability and water governance constraints⁹⁴⁸. Analysis of survey data from 2,000 households across 12 districts in Khatlon Province documents significant structural changes in the agriculture sector between 2015 and 2023. While household participation in agriculture remained stable at 85%, the average cultivated area declined markedly, reflecting population growth within the study area and continued subdivision of dehkan farms. Cropping patterns shifted over the period, with a substantial increase in maize cultivation, while cotton maintained similar participation levels but on significantly smaller plot sizes, alongside an overall increase in the diversity of semi-annual and annual crops. Mechanisation for land preparation is now used for nearly all major crops, representing a significant increase since 2015. Meanwhile, mechanised harvesting has also expanded for fodder crops, from 6% to 15%, and maize, from 2% to 8%, mainly through rental services due to low ownership of machinery. Access to productive assets improved, with more households reporting ownership of water pumps, greenhouses, and cold storage, and a higher proportion of household and presidential plots having irrigation in 2023 compared to 2015. However, the uptake of advanced innovations, such as drip irrigation and solar panels, remains very limited, at below 1%. Livestock trends show a decline in cattle ownership and a corresponding reduction in households with milk-producing cows from 40% to 33%, which may partly explain lower dairy consumption among female respondents in 2023, while poultry ownership increased sharply from 7% to 25%, including among more vulnerable households, contributing to higher household-level egg consumption⁹⁴⁹.

The region's continental climate is characterised by hot, dry summers and cold winters, with the longest warm seasons supporting crop growth but also heightening exposure to droughts and water stress. Irrigation from the Vakhsh and Panj rivers is central to maintaining year-round agriculture; however, land degradation, including salinisation, soil erosion, and waterlogged or parched soils, poses mounting challenges to long-term productivity. Recent decades have seen increasing impacts from variable precipitation and rising temperatures, exacerbating constraints on farm productivity and the sustainability of natural resources⁹⁵⁰.

Khatlon also faces multiple natural hazards, including droughts, floods, mudflows, and soil erosion, which affect infrastructure, agricultural productivity, and rural livelihoods. Landscape degradation and water scarcity have been specifically noted as pressing environmental issues in the southern districts, where agricultural land has fallen out of productive rotation. These climatic and environmental pressures underscore the importance of integrated risk management, improved water resource governance, and climate-resilient agricultural practices for the region's sustainable development⁹⁵¹. Within the Khatlon region, the districts of Vose, Dangara, Temurmalik, Khuroson and Qabodiyon have been selected for project interventions.

District Profile of Vose

Geography

Vose is a district within the Khatlon Province, located in south-west Tajikistan. It is bordered by the Temurmalik Khovaling district to the North, the Kulyab district to the East, Dangharat to the West, and the Hamadani Farkhor district to the South (Figure 108). It is 3631 km² in

⁹⁴⁸ https://embed-rech-01.dialog.cm/zoienvironment/docs/af-ca-osce_en/s/27796649

⁹⁴⁹ <https://cgspace.cgiar.org/server/api/core/bitstreams/d93ae4cb-4542-47e2-bada-5e3506873466/content>

⁹⁵⁰ Rural Economy Development Project (REDP). 2021. Environmental and Social Impact Assessment (ESIA) for natural, cultural and historical sites (Khulbuk fortress, Khoja Mashhad and Chiluchor Chashma madrasah) in the Khotlon region of the Republic of Tajikistan. [Available online.](#)

⁹⁵¹ <https://cabar.asia/en/land-degradation-in-khatlon-region-poses-threats-to-the-environment>

size, and its capital is Hulbuk⁹⁵². Important rivers in this district include Yakhsu, Kizilsu and Surkhob. With fertile soils and mountainous terrain, the region boasts a rich biodiversity. Sari Khosi Park is nestled amidst the Pamir Mountains, and is known for its diverse flora and fauna⁹⁵³.

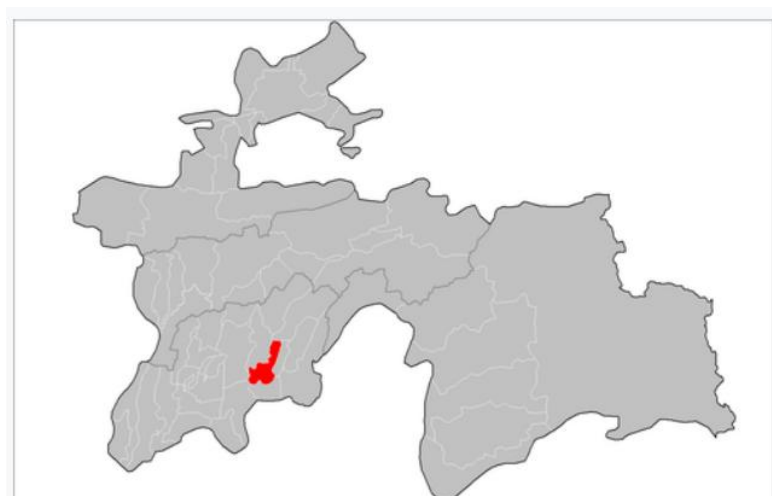


Figure 108. Map of Tajikistan according to districts⁹⁵⁴. The red-highlighted region indicates the Vose district⁹⁵⁵.

Socioeconomic profile

As is notable across Tajikistan, socioeconomic development in the Vose district is also hindered by unemployment, poverty, inadequate governance capacity, and inequality. There is a lack of skills development and employment diversification. Furthermore, policies that encourage entrepreneurship and reduce corruption are necessary to foster socioeconomic growth and promote the development of free economic zones, thereby enabling the growth of value chains. A clear commitment from local and national authorities to design a comprehensive reform package that promotes support for the private sector in the region is also needed⁹⁵⁶. The sparseness of the current population, approximately 237,000, and the lack of economic activity have also limited socio-economic development across this district⁹⁵⁷. At least 80% of the population resides in rural areas of Vose and engages in agricultural activities as a primary source of income. Poverty remains persistent, with a greater share of its population living below the poverty line than the national average, despite a somewhat higher per capita income, suggesting more significant income inequality than in other provinces. Thus, the HDI of the region remains below the national HDI⁹⁵⁸.

A lack of free and formal trade also exacerbates such persistent poverty and income inequality. Economic free zones across this district are lacking, and their development could stimulate economic growth through supply chain linkages with the rest of Khatlon's economy. There is also room to seek to expand the transport links with Dushanbe and beyond the province. Considering that this region has a population growth rate which exceeds the national average, the potential for job creation and socio-economic development is notable. Yet, a lack

⁹⁵² Khatlon region: Vose district. Available from: [Site Tajikistan](#)

⁹⁵³ Khatlon region: Vose district. Available from: [Site Tajikistan](#)

⁹⁵⁴ https://www.researchgate.net/figure/Map-of-Tajikistan-showing-the-District-administrative-boundaries-for-the-five-Oblasts_fig1_239785685

⁹⁵⁵ [Vose District - Wikipedia](#)

⁹⁵⁶ Reinventing Growth in the Khatlon Oblast Tajikistan. 2013. Available from: [World Bank Document](#)

⁹⁵⁷ [Chatlon \(Province, Tajikistan\) - Population Statistics, Charts, Map and Location](#)

⁹⁵⁸ [Subnational HDI - Table - Subnational HDI - Global Data Lab](#)

of private investment, large-scale informal employment opportunities and reduced infrastructure development exacerbate labour migration to other districts. Poor socio-economic growth is also attributed to a large share of youth who are unemployed or self-employed in agriculture or informal trade. In addition to persistent poverty and inadequate regulatory reforms, entrepreneurship across the Vose district is constrained by the rise of informal trade⁹⁵⁹.

The region's agriculture-based economy is highly dependent on the export of labour to Russia and is reliant on remittances from migrant workers. Severe winter energy constraints also hinder the district's economic growth, despite its considerable potential for energy generation. Research indicates that private sector investments in energy generation within the region hold promise for growth if supported by public sector reforms. An economy largely reliant on agriculture, poor regulatory reforms, and immigration to other parts of the country have contributed to reduced urban development. Urban economic opportunities are thus limited, and infrastructure development in villages such as Tugarak and Aral remains inadequate. For those participating in the local labour market, gender inequality is evident, with female labour force participation being significantly lower than that of males. Female earnings overall are one-quarter of male earnings, with a significant gap in the services sector. The share of female-headed households is at least 13%, but in the lowest income quintile of the population, this share rises to at least 20%. Primary education enrolment is close to 100%, but female enrolment in secondary education is significantly higher⁹⁶⁰.

Agricultural profile

Since Khatlon accounts for half of the country's agricultural land and pastures, the district of Vose is mainly reliant on the agriculture sector for economic growth and food security. At least 60% of the population is employed in this sector, which is comprised primarily of cotton fibre, potato, milk, mutton, beef, poultry, vegetable, and fruit production. Dehkan farms and household farms engage in production, focusing on growing products for self-consumption and selling surpluses to small wholesale intermediaries. At the same time, a gradual process of land concentration is occurring among larger tenants; however, a high level of landholding fragmentation persists among small-scale tenants. Since the state owns agricultural land and is not subject to sale or purchase, market participants lease it with the possibility of transferring rights or subleasing.

Primary tenants in the region who control significant consolidated areas of agricultural land, amounting to thousands of hectares. However, in most cases, these lands are subleased to smaller tenants. Furthermore, the independence of dehkan farms in determining production directions is limited by directives from local administrations. Farms receive instructions from the Ministry of Agriculture. This has contributed to the forced cultivation of cotton, which is not always profitable for farmers, especially if there is no nearby processing plant, or if risk mitigation measures, banking, credit and market access are lacking. Additionally, irrigation canals throughout the region are prone to siltation, necessitating regular maintenance and cleaning work. Yet, specialised services for cleaning canals are underdeveloped, and there is a shortage of reclamation equipment, including excavators. Skills development and diversified agricultural output are limited across the district due to underinvestment and poor adoption of improved agricultural practices⁹⁶¹. The fragmentation of agricultural production further complicates the sustainable development of the sector. This limits the aggregation of large homogeneous batches of raw materials for production and export, and worsens the utilisation

⁹⁵⁹ Reinventing Growth in the Khatlon Oblast Tajikistan. 2013. Available from: [World Bank Document](#)

⁹⁶⁰ Reinventing Growth in the Khatlon Oblast Tajikistan. 2013. Available from: [World Bank Document](#)

⁹⁶¹ UNDP. Tajikistan. 2024. Available from: [final report development of production chains in khatlon region eng.pdf](#)

of processing capacities. Thus, the level of industrial processing of agricultural products in the region remains low⁹⁶².

The favourable climatic conditions of this region allow for the use of land more efficiently compared to other provinces. This is the main driving force behind the government's decision to diversify crop production in the region. Due to limited public spending on the agricultural sector and competition for scarce public resources among economic sectors, the government aims to create new jobs and reduce poverty through agricultural and value chain development. The government also aims to address growing domestic demand resulting from income and population growth by promoting agriculture-led growth and enhancing food security. Thus, the Vose district plays a vital role in facilitating sustainable and long-term agriculture-led growth⁹⁶³.

Hazard profile

Observed climate change impacts

The Vose district has been impacted by drought and flooding in the past. This has caused extensive damage to homes, infrastructure and agricultural productivity. In 1992, a village at the confluence of the Yakhsu and Surkhob rivers suffered extensive losses due to landslides caused by the flooding of these rivers⁹⁶⁴. The Vakhsh Valley has experienced extensive degradation over the last 20 years, primarily due to flooding and landslides. Damage due to flooding and landslides has been exacerbated by poor land management and unsustainable agricultural practices. Degradation of this valley has led to poor soil fertility, soil erosion and reduced crop and pasture productivity, thus contributing to food insecurity.⁹⁶⁵ The increased occurrence of intensified flooding and landslides also poses a risk to water security. These hazards have contributed to the damage of water infrastructure and led to decreased water quality⁹⁶⁶. The health and welfare of rural communities have been adversely impacted by reduced access to potable water⁹⁶⁷.

Projected climate change impacts

Flooding, landslides, wildfires, and extreme heat are likely to intensify in the future. This district is at high and medium risk of river flooding and landslides, respectively (Figure 109)⁹⁶⁸. The Mehrobod village, located near the confluence of the Yakhsu and Kizilsu rivers, has been identified as at risk of flooding. This is an example of a town in the Vose district, which has benefited from World Bank-financed riverbank reinforcement works under the Strengthening Critical Infrastructure against Natural Hazards Project⁹⁶⁹. Flooding and landslides are likely to exacerbate siltation in water catchment areas and irrigation systems. Agriculture losses will also be exacerbated due to the loss of soil fertility and damage to crucial infrastructure. Extreme heat is likely to contribute to rapid glacier melting and river flooding. Increased temperatures will also contribute to changes in planting and harvesting seasons, as well as an increase in the prevalence of diseases and pests. In the long term, this will contribute to water and food insecurity (Figure 110)⁹⁷⁰.

⁹⁶² UNDP. Tajikistan. 2024. Available from: [final_report_development_of_production_chains_in_khatlon_region_eng.pdf](#)

⁹⁶³ IFPRI. Khatlon region's agriculture sector development trends. 2025. Available from: [Template_WorkingPaper](#)

⁹⁶⁴ [Protecting Lives and Livelihoods from Natural Disasters in Tajikistan](#)

⁹⁶⁵ [Land degradation in Khatlon region poses threats to the environment - CABAR.asia](#)

⁹⁶⁶ UNDRR. Country Disaster Risk Profile of the Republic of Tajikistan. Available from: [DISCORSO](#)

⁹⁶⁷ [Expanding Access to Safe Water in Rural Tajikistan Translates into More Time for Learning, Better Health and Increased Prosperity](#)

⁹⁶⁸ [Think Hazard - Khatlon](#)

⁹⁶⁹ [World Bank supports improvement of access to water in rural areas of Tajikistan | Tajikistan News ASIA-Plus](#)

⁹⁷⁰ [Think Hazard - Khatlon](#)

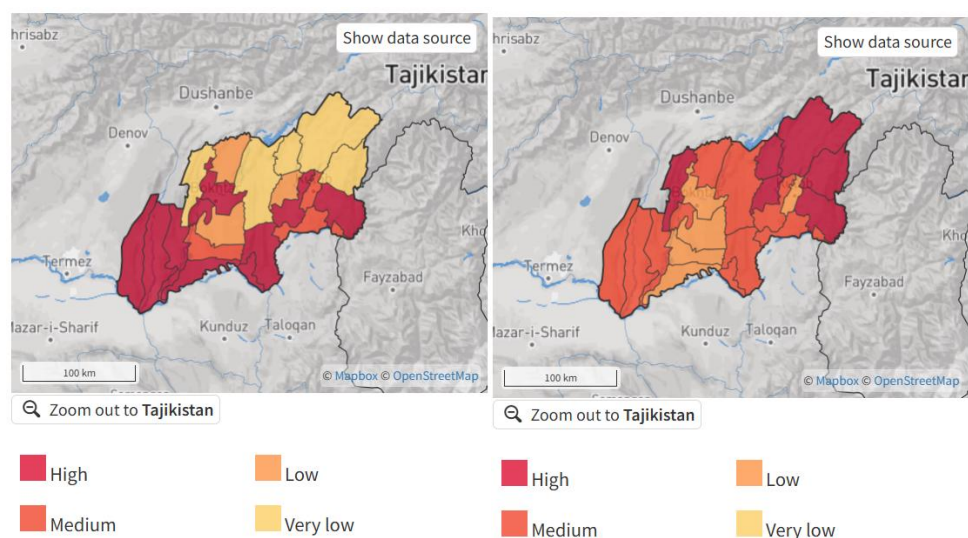


Figure 109. Flooding (left) and landslide hazard risk, according to the Khatlon districts⁹⁷¹.

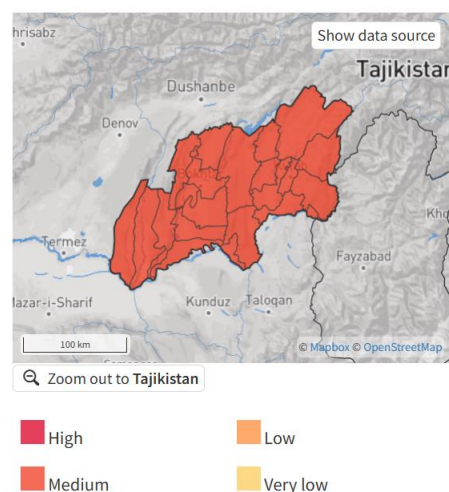


Figure 110. Water scarcity risk in the Khatlon districts⁹⁷².

Flood and Mudflow Risk

Flood risk in Vose is driven by a combination of lowland floodplain exposure and inflows from tributary and foothill catchments, resulting in recurrent riverine flooding often accompanied by sediment- and mudflow-laden waters⁹⁷³. Seasonal snowmelt and intense rainfall upstream contribute to elevated flows and high sediment loads, increasing channel instability and flood impacts during peak events⁹⁷⁴. Extensive irrigation infrastructure, together with limited drainage capacity and ageing canals, increases exposure to overbank flooding and waterlogging in agricultural areas⁹⁷⁵. Settlements, farmland, and rural infrastructure located

⁹⁷¹ [Think Hazard - Khatlon](#)

⁹⁷² [Think Hazard - Khatlon](#)

⁹⁷³ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

⁹⁷⁴ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

⁹⁷⁵ World Bank. *Implementation Completion and Results Report*. 2022, <https://documents1.worldbank.org/curated/en/501751644260784719/pdf/Tajikistan-Zarafshon-Irrigation-Rehabilitation-and-Management-Improvement-Project.pdf>.

on floodplains and along tributary channels are particularly exposed to prolonged inundation and associated damage⁹⁷⁶.

Disaster reporting consistently identifies Vose as recurrently affected by floods and mudflows, with impacts typically dispersed across rural settlements and agricultural land rather than concentrated in dense district centres. This results in patterns of widespread livelihood disruption and agricultural loss rather than catastrophic asset damage⁹⁷⁷.

Comparative regional hazard assessments indicate that lowland districts in Khatlon experience higher relative exposure to riverine flooding than mountainous districts, where flash floods and mudflows dominate⁹⁷⁸ (Figure 3). While mudflows are less prevalent in Vose than in steeper mountain and foothill districts, sediment transport and localised erosion remain important contributors to flood impacts where upstream catchments deliver high sediment loads into lowland river systems⁹⁷⁹.

Climate change is expected to exacerbate flood risk in Vose. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events⁹⁸⁰. Hydrological modelling for major river basins in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation events⁹⁸¹. The same modelling indicates increases in extreme daily rainfall and higher return-period precipitation (e.g. 50-year daily rainfall) during the second half of the 21st century. These projected changes are associated with higher peak river flows and an increased likelihood of floodplain inundation in downstream lowland districts such as Vose^{982, 983}.

In comparative terms, Vose faces higher riverine flood risk than mountainous districts, but lower exposure to flash floods and mudflows than districts characterised by steep, narrow catchments^{984, 985}.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Vose is driven by a high reliance on climate-sensitive, irrigated agriculture, limited livelihood diversification, and persistent pockets of rural poverty and food

⁹⁷⁶ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

⁹⁷⁷ *Ibid*

⁹⁷⁸ GFDRR. "Tajikistan." *ThinkHazard!*, 26 08 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

⁹⁷⁹ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

⁹⁸⁰ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁸¹ Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

⁹⁸² Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁸³ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

⁹⁸⁴ GFDRR. "Tajikistan." *ThinkHazard!*, 26 08 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

⁹⁸⁵ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

insecurity^{986, 987}. Agricultural production systems are sensitive to both flooding and drought, with crop losses, soil degradation, and damage to irrigation infrastructure directly affecting household incomes and food availability⁹⁸⁸. National poverty and vulnerability assessments consistently show that rural, agriculture-dependent households experience higher income volatility and greater sensitivity to climate and disaster shocks^{989, 990}.

Adaptive capacity in Vose is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely early warning information, and uneven local institutional capacity for disaster preparedness and response^{991, 992}. While lowland districts may benefit from relatively better physical access compared to remote mountain areas, the scale of exposure and concentration of assets on floodplains increase potential impacts⁹⁹³. Poorer households and vulnerable groups are often disproportionately affected due to limited resources for recovery and adaptation following flood events⁹⁹⁴.

Key Climate Risk Drivers

Climate risk in Vose arises from the interaction of floodplain exposure, tributary-driven sediment inflows, and socio-economic vulnerability⁹⁹⁵. Low-lying terrain, proximity to river and tributary systems, and extensive irrigated agriculture create high exposure to riverine flooding and waterlogging, as illustrated by the contrast between lowland and mountainous hazard patterns in regional susceptibility assessments⁹⁹⁶. This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to both flood-related damage and climate variability affecting water availability⁹⁹⁷.

Indicative Adaptation Priorities

Addressing climate risk in Vose will require a combination of flood risk reduction, agricultural resilience, and institutional strengthening measures. Priority needs include improving flood forecasting and early warning systems, strengthening and maintaining irrigation and drainage

⁹⁸⁶ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

⁹⁸⁷ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁸⁸ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

⁹⁸⁹ *Ibid*

⁹⁹⁰ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁹¹ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

⁹⁹² World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

⁹⁹³ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

⁹⁹⁴ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

⁹⁹⁵ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

⁹⁹⁶ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

⁹⁹⁷ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

infrastructure, and promoting climate-resilient agricultural practices to reduce sensitivity to both flooding and drought⁹⁹⁸. Strengthening local institutional capacity for disaster preparedness, flood management, and risk-informed land-use planning will be important to support sustained adaptation outcomes⁹⁹⁹.

District Profile of Danghara

Geography

Danghara is a district within the Khatlon Province, located in southwestern Tajikistan (Figure 111). It is bordered by the Norak district to the north, the Vose and Sovet districts to the east, the Ghozimalik, Vakhsh, Sarband, and Yovon districts to the west, and the Farkhor district to the south. Danghara is 2,000 km² in size and is divided into eight jamoats, with Daghara town serving as the district capital. The jamoats, namely Korez, Lohur, Lolazor, Oqsu, Pushing, Sangtuda, Sebiston, and Sharipov, are responsible for local governance and serve as the primary point of contact for residents dealing with administrative matters. The district is characteristically mountainous, with elevations ranging from 600 to 1,990 m. Important geographical features include the Vakhsh valley and river. The area is rich in natural resources, including water, oil and gas reserves¹⁰⁰⁰.

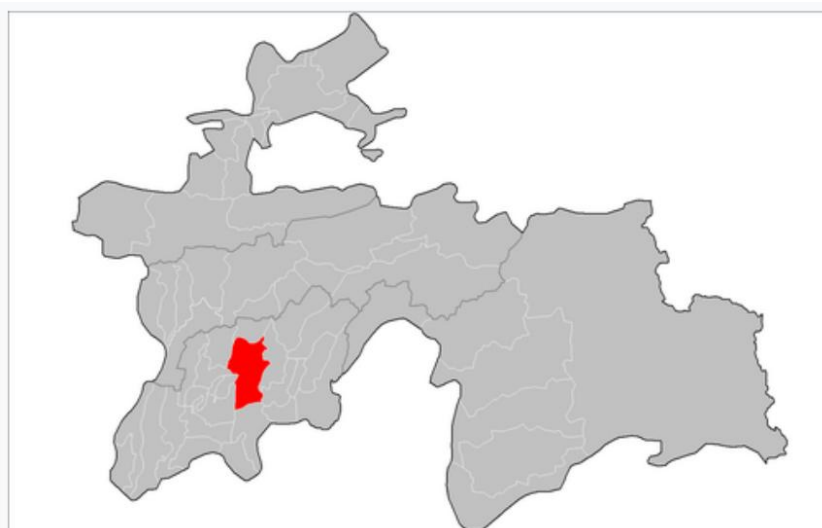


Figure 111. Map of Tajikistan according to districts. Danghara district is highlighted in red¹⁰⁰¹.

Socioeconomic profile

The district has experienced substantial population growth, with at least 161,000 people residing within its boundaries. This has been especially evident across the urban regions. In 2020, Danghara town's population was 31,000, indicating an increase from 2015, when the population was estimated at 25,000. Daghara town has the highest population in the district, followed by Oqsu and Sharipov. The town of Danghara, the district capital, was considered in 2012 as a possible new location for Tajikistan's capital due to its infrastructure developments and its central role in manufacturing, industry, processing, and transport infrastructure in the

⁹⁹⁸ *Ibid*

⁹⁹⁹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰⁰⁰ Danghara district overview. Available from: [Danghara District -](#)

¹⁰⁰¹ [Danghara District - Wikipedia](#)

Khatlon province. These sectors are crucial to the district's economic growth. Despite increasing urbanisation, agriculture, especially the cotton value chain, remains a vital sector for sustainable livelihoods across the region, with non-agricultural employment of lesser importance¹⁰⁰².

Research, however, showed that several households whose heads moved from low-skilled to medium- or high-skilled occupations were significantly more likely to achieve middle-class status. This meant that middle-class membership in the region had increased by at least 13% points between 2021 and 2022. Such development had also been promoted by greater urbanisation and infrastructure development across the region. The development of the Danghara-Guliston road is vital for establishing economic trade routes in southern Tajikistan. This proves essential for the economic growth of the southern areas of the country via intraregional trade and also promotes access to export routes¹⁰⁰³.

Yet, the region is characterised by persistent poverty, which is partly due to reliance on climate-dependent agriculture and remittance-dependent incomes. The province is home to at least 50% of the nation's poor population. Low education levels are a key factor, with at least 80% of the people experiencing poverty having only a general secondary education or less. Despite improvement in economic development, a significant percentage of children were not attending or enrolled in school in 2023. For poor households in the region, schools are often located far away and are expensive. Furthermore, limited investment in human capital has constrained economic growth, restricted equal opportunities, and hampers efforts to expand income opportunities¹⁰⁰⁴.

Agricultural profile

Agriculture plays a crucial role in driving economic growth and ensuring food security across the region. This includes value chain development, such as the processing of cotton, cocoon, meat, fur, leather, dried fruits, and other types of grain crops. Danghara lies in the Vakhsh River valley, which has a favourable climate and water conditions ideal for cultivating cotton. Thus, it is a well-known region for cotton production. Most farms are Dehkan farms that engage in the production of crops and livestock for self-consumption and selling surpluses to small wholesale intermediaries. At the same time, a gradual process of land concentration is occurring among larger tenants; however, a high level of landholding fragmentation persists among small-scale tenants¹⁰⁰⁵. Since the state owns agricultural land and is not subject to sale or purchase, market participants lease it with the possibility of transferring rights or subleasing. Primary tenants in the region who control significant consolidated areas of agricultural land, amounting to thousands of hectares. However, in most cases, these lands are subleased to smaller tenants. Furthermore, the independence of dehkan farms in determining production directions is limited by directives from local administrations. Farms receive instructions from the Ministry of Agriculture¹⁰⁰⁶.

The region is known for its exceptional agricultural potential. By the 1970s, the Vakhsh had become a landscape of canals, collectors, and pumping stations, feeding some of the highest per-hectare yields in Central Asia. Extensive irrigation infrastructure had enabled the increase and maintenance of cotton and wheat yields. Yet, infrastructure has become silted up, and soils have, over the last 30 years, become increasingly degraded, eroded, and waterlogged.

¹⁰⁰² World Bank. 2025. Available from: [Tajikistan Poverty and Equity Assessment](#)

¹⁰⁰³ World Bank. 2025. Available from: [Tajikistan Poverty and Equity Assessment](#)

¹⁰⁰⁴ World Bank. 2025. Available from: [Tajikistan Poverty and Equity Assessment](#)

¹⁰⁰⁵ UNDP. Tajikistan. 2024. Available from: [final report development of production chains in khatlon region eng.pdf](#)

¹⁰⁰⁶ UNDP. Tajikistan. 2024. Available from: [final report development of production chains in khatlon region eng.pdf](#)

Such challenges have been exacerbated by the mountainous terrain, the expansion of agricultural land, poor land management practices, and the impacts of climate change¹⁰⁰⁷.

Hazard profile

Observed climate change impacts

Due to its topography and location in the vicinity of the Vakhsh Valley, this district has been exposed to the impacts of climate change, including floods, droughts, and landslides. Warmer winters have adversely impacted snowmelt, thereby reducing the availability of reliable surface water for irrigation systems and water catchment areas. It has been noted that by July, when irrigation demand is highest, flow rates in irrigation systems are declining. In dry years, such as 2018 and 2021, reservoir levels decreased below critical thresholds, forcing rationed water deliveries downstream. This has forced farmers to overdraw from canals and wells, leading to increased soil salinity. Variability in upstream water storage and glacier melting has also adversely impacted power generation capacity for agricultural value chains¹⁰⁰⁸. Soil erosion due to erratic rainfall and flooding has exacerbated sedimentation of canals downstream. This has reduced the amount of water available for irrigation and has forced repeated dredging of canals. In 2019, a single summer storm resulted in over 150,000 m³ of silt sediment accumulating in the lower Vakhsh Valley. The valley's productivity has now become dependent on the constant maintenance of canals and other irrigation infrastructure as a result. Soil degradation has led to the cultivation of salt-tolerant wheat and sunflower varieties¹⁰⁰⁹.

Projected climate change impacts

It is projected that intensified heat, flooding and drought will adversely impact Danghara in the future. Research indicates that the district is at medium risk of such hazards¹⁰¹⁰. Extreme heat is likely to exacerbate water scarcity and reduce agricultural productivity. Such losses will result from unreliable surface water flows, reduced water quality, and changes in planting and harvesting seasons. Also, pests and diseases are likely to increase in prevalence, contributing to pre-harvest losses of grain and cotton crops. The melting of glaciers will also exacerbate variable surface water flows. In addition to contributing to water scarcity, glacier melting will also increase the risk of flood events¹⁰¹¹. It is likely that intensified flooding and resultant landslides will cause further damage to crops, pastures, irrigation and transport infrastructure. A higher average temperature is expected to cause the Vakhsh river basins to shrink by 53%, significantly impacting freshwater supplies¹⁰¹². Farmers in the region are thus expected to rely more extensively on irrigation and the maintenance of such infrastructure. In addition, cotton and grain producers will need to rely on fertilisers and climate-resilient crop varieties to maintain increased productivity¹⁰¹³.

Flood and Mudflow Risk

Flood risk in Dangara is dominated by riverine flooding associated with the district's lowland setting and proximity to river systems, but impacts are strongly mediated through dense and ageing irrigation and drainage infrastructure¹⁰¹⁴. Seasonal snowmelt and rainfall upstream contribute to elevated river flows, while canal overtopping, embankment failure, and blocked

¹⁰⁰⁷ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹⁰⁰⁸ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹⁰⁰⁹ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹⁰¹⁰ [Think Hazard - Dangara](#)

¹⁰¹¹ [Climate Change Profile: Tajikistan | PDF | Climate | Earth Sciences](#)

¹⁰¹² [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

¹⁰¹³ [Climate Change Danghara - meteoblue](#)

¹⁰¹⁴ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

drainage during high-flow periods allow relatively moderate flood events to cascade across agricultural land, settlements, and transport infrastructure¹⁰¹⁵. As a result, Dangara has been repeatedly identified in disaster reporting as one of the more severely affected districts in Khatlon, with widespread damage to housing, farmland, and local infrastructure driven by systemic infrastructure vulnerability rather than extreme hazard alone¹⁰¹⁶.

Settlements, farmland, and rural infrastructure located along river corridors and irrigation networks are particularly exposed to prolonged inundation and waterlogging, increasing both direct flood damage and post-flood disruption to agricultural production¹⁰¹⁷.

Comparative regional assessments indicate that lowland districts in Khatlon experience higher relative exposure to riverine flooding than mountainous districts, where flash floods and mudflows dominate^{1018, 1019}. While mudflows are less prevalent in Dangara than in foothill or mountain districts, sediment transport and localised erosion can still occur during high-flow events, affecting agricultural land and irrigation infrastructure¹⁰²⁰.

Climate change is expected to exacerbate flood risk in Dangara. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events¹⁰²¹. Hydrological modelling for major snow- and glacier-fed river basins elsewhere in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation events¹⁰²². While basin-specific, these projections illustrate climate processes that are relevant for downstream lowland districts such as Dangara, where higher peak river flows increase the likelihood of floodplain inundation^{1023, 1024}.

In comparative terms, Dangara faces higher riverine flood risk than mountainous districts in Sughd and DRS, but lower exposure to flash floods and mudflows than districts characterised by steep, narrow catchments.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Dangara is driven by reliance on climate-sensitive irrigated agriculture, limited livelihood diversification, and persistent pockets of rural poverty and food

¹⁰¹⁵ *Ibid*

¹⁰¹⁶ *Ibid*

¹⁰¹⁷ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰¹⁸ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

¹⁰¹⁹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰²⁰ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹⁰²¹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰²² Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

¹⁰²³ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰²⁴ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

insecurity^{1025, 1026}. Agricultural production systems are sensitive to both flooding and drought, with crop losses, soil degradation, and damage to irrigation infrastructure directly affecting household incomes and food availability¹⁰²⁷.

Adaptive capacity is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely early warning information, and uneven local institutional capacity for disaster preparedness and response^{1028, 1029}. While Dangara benefits from relatively good physical access compared to remote mountain districts, the concentration of productive land, housing, and infrastructure on flood-prone land increases potential impacts¹⁰³⁰. Poorer households and vulnerable groups are often disproportionately affected due to limited resources for recovery and adaptation following flood events¹⁰³¹.

Key Climate Risk Drivers

Climate risk in Dangara arises from the interaction of floodplain exposure, infrastructure-mediated flood amplification, and socio-economic vulnerability¹⁰³². Low-lying terrain, proximity to river systems, and extensive irrigated agriculture create high exposure to riverine flooding, as illustrated by regional contrasts between lowland and mountainous hazard processes¹⁰³³. This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to both flood-related damage and climate variability affecting water availability^{1034, 1035}.

Indicative Adaptation Priorities

Addressing climate risk in Dangara will require a combination of flood risk reduction, agricultural resilience, and institutional strengthening measures. Priority needs include improving flood forecasting and early warning systems, strengthening and maintaining irrigation and drainage infrastructure, and promoting climate-resilient agricultural practices to

¹⁰²⁵ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹⁰²⁶ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰²⁷ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹⁰²⁸ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰²⁹ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹⁰³⁰ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰³¹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰³² GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

¹⁰³³ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

¹⁰³⁴ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰³⁵ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

reduce sensitivity to both flooding and drought¹⁰³⁶. Strengthening local institutional capacity for disaster preparedness, flood management, and risk-informed land-use planning will be important to support sustained adaptation outcomes¹⁰³⁷.

District Profile of Temurmalik

Geography

The Temurmalik district is situated in the Khatlon province, south of the Vakhsh Range, along the middle course of the Kyzylsu River. It is located between the mountain chains of Ilontog, Khujai Nur, Kuhi Khuja Sartezi. Surrounding districts include Baljuvon, Khovaling, Danghara, Norak and Vose (Figure 112). Temurmalik has an area of about 1,000 km² and is divided administratively into one town, Bahmanrud, and six jamoats¹⁰³⁸.

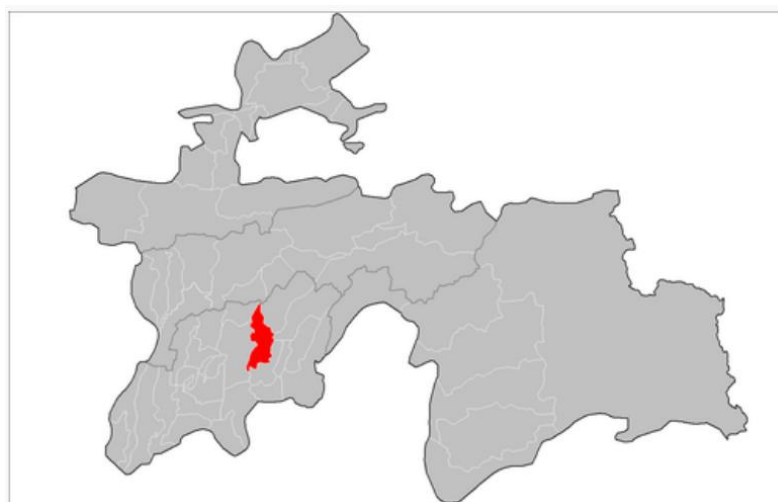


Figure 112. Tajikistan districts map. Temurmalik is highlighted in red¹⁰³⁹.

Socioeconomic profile

This district is characterised by limited urban development and mostly rural towns that partake in subsistence agriculture. Persistent poverty, restricted access to sustainable livelihoods, education, healthcare, markets and financing hamper socio-economic growth. A commitment from local and national authorities to design a comprehensive reform package that promotes support for the private sector in the region is also needed¹⁰⁴⁰. The sparseness of the current population, approximately 69,800, and the lack of economic activity have also limited socio-economic development across this district¹⁰⁴¹. At least 80% of the population resides in rural areas of Vose and engages in agricultural activities as a primary source of income. Variability in households entering and exiting poverty between 2015 and 2023, as well as fluctuations in

¹⁰³⁶ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰³⁷ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰³⁸ [Temurmalik District - Wikipedia](#)

¹⁰³⁹ [Temurmalik District - Wikipedia](#)

¹⁰⁴⁰ Reinventing Growth in the Khatlon Oblast Tajikistan. 2013. Available from: [World Bank Document](#)

¹⁰⁴¹ [Temurmalik District - Wikipedia](#)

household food security, suggests that households remain at risk of poverty's impacts¹⁰⁴². Poverty remains persistent, with a greater share of its population living below the poverty line than the national average, despite a somewhat higher per capita income, suggesting more significant income inequality than in other provinces. Thus, the HDI of the region remains below the national HDI¹⁰⁴³. For those participating in the local labour market, gender inequality is evident, with female labour force participation being significantly lower than that of males. Female earnings overall are one-quarter of male earnings, with a significant gap in the services sector¹⁰⁴⁴.

Despite average incomes needing to increase and reach sustainable levels, improvements in socio-economic development have been made. At least half of households had access to improved sanitation in early 2023, which is an improvement from 2015. A greater number of rural communities are connected to transport and water infrastructure, and improvements in food security have also been evident since 2015. Households' average consumption expenditures increased by at most 10% between 2016 and 2022. Inequality in income, however, has remained a concern. Across the region, households with a greater number of household members, fewer livelihood sources, and living in remote locations also have a higher risk of remaining in poverty. Furthermore, policies that encourage entrepreneurship and reduce corruption are necessary to foster socioeconomic growth and promote the development of free economic zones, thereby enabling the growth of value chains. A lack of free and formal trade also exacerbates such persistent poverty and income inequality.

There is also room to expand the transport links with Dushanbe and beyond the province. Considering that this region has a population growth rate which exceeds the national average, the potential for job creation and socio-economic development is notable. Yet, a lack of private investment, large-scale informal employment opportunities and reduced infrastructure development exacerbate labour migration to other districts. Poor socio-economic growth is also attributed to a large share of youth who are unemployed or self-employed in agriculture or informal trade. In addition to persistent poverty and inadequate regulatory reforms, entrepreneurship across the district is constrained by the rise of informal trade¹⁰⁴⁵. The region's agriculture-based economy is highly dependent on the export of labour to Russia and is reliant on remittances from migrant workers. An economy largely dependent upon agriculture, poor regulatory reforms, and immigration to other parts of the country have contributed to reduced urban development. Urban economic opportunities are thus limited, and infrastructure development in villages remains inadequate¹⁰⁴⁶.

Agricultural profile

This district falls within the mixed-agriculture zone of the Khatlon province. It is interspersed between the Southern Khatlon Cotton, Vegetable and Wheat Zones. The zone receives adequate precipitation annually, providing wheat, beans, lentils, sesame and sunflower crops with enough moisture to mature¹⁰⁴⁷. A limited number of farmers also produce fruits and pistachios. Land is prepared mainly by animal traction; however, those who can afford the expense rent tractors to plough their fields. Animals raised in the zone are cattle, sheep, goats and poultry. Cattle are used for ploughing, milk and meat production. Subsistence production

¹⁰⁴² CGIAR: Welfare and vulnerability in Tajikistan: Evidence from twelve districts in Khatlon Province, 2015 – 2023. Available from: <https://hdl.handle.net/10568/140371>

¹⁰⁴³ [Subnational HDI - Table - Subnational HDI - Global Data Lab](#)

¹⁰⁴⁴ CGIAR: Welfare and vulnerability in Tajikistan: Evidence from twelve districts in Khatlon Province, 2015 – 2023. Available from: <https://hdl.handle.net/10568/140371>

¹⁰⁴⁵ Reinvigorating Growth in the Khatlon Oblast Tajikistan. 2013. Available from: [World Bank Document](#)

¹⁰⁴⁶ CGIAR: Welfare and vulnerability in Tajikistan: Evidence from twelve districts in Khatlon Province, 2015 – 2023. Available from: <https://hdl.handle.net/10568/140371>

¹⁰⁴⁷ Tajikistan Livelihood Zones. Available from: [TJ Livelihood Zone Descriptions English.pdf](#)

is a significant source of food security; however, many rural farmers are dependent on the market for a substantial portion of their food needs. Market access across the region has improved since 2015, connecting various village clusters with larger main markets. This enables year-round market access and the flow of commodities into and out of the region¹⁰⁴⁸. Wheat flour, rice, lentils and peas are often imported from Qurghonteppa and Dushanbe and sold to local residents to ensure that nutritional needs are met. Small-scale producers also utilise local markets to sell their produce, which is then transported to Dushanbe for resale. Crop sales of wheat and some vegetables are another source of income for those farmers operating small-scale businesses. Crops are frequently sold immediately after harvest to limit spoilage, cover urgent food and non-food needs and repay creditors¹⁰⁴⁹. With minimal access to assets, rural farming communities rely on local labour opportunities, remittances from household members in Russia and Dushanbe, informal trading and crop sales. Crop sales are often unreliable, depending on the season, climate change and harvest losses. Insufficient rainfall, crop pests and diseases, livestock diseases, and market volatility have also hampered reliable agricultural production across this region¹⁰⁵⁰.

Hazard profile

Observed climate change impacts

Temurmalik has experienced an increase in extreme heat events, flooding and variable rainfall since 1960¹⁰⁵¹. This is partly attributed to the districts' mountainous terrain and the proximity of the Kyzylsu River. Additionally, the extensive misuse of rangelands and agricultural practices has contributed to this region's vulnerability to climate impacts. In 2012, this region experienced the harshest winters in 50 years. This resulted in significant flooding once the snow melted, causing extensive damage to infrastructure and crop production across Temurmalik, further downstream¹⁰⁵².

Again in 2024, extensive flooding resulted due to a sudden outburst from a supraglacial lake on the Kyzylsu glacier. Warmer winters have adversely impacted snowmelt, thereby reducing the availability of reliable surface water for irrigation systems and water catchment areas. Such climate change impacts have resulted in reservoir levels decreasing below critical thresholds, forcing the rationing of water deliveries downstream. Considering the districts' proximity to the Vakhsh Valley, farmers are dependent on reliable surface water flow. This has been impacted by snow melting and extreme heat. Farmers are thus forced to overdraw from canals and wells, leading to increased soil salinity¹⁰⁵³. Soil erosion due to erratic rainfall and flooding has exacerbated sedimentation of canals downstream. This has reduced the amount of water available for irrigation and has forced repeated dredging of canals. Thus, the constant maintenance of canals and other irrigation infrastructure is becoming increasingly important. Farmers are also compelled to shift to cultivating crops that are tolerant to flooding and extreme heat¹⁰⁵⁴.

Projected climate change impacts

It is projected that intensified heat and flooding will have an adverse impact on Temurmalik. Research indicates that the district is at medium risk of such hazards¹⁰⁵⁵. Extreme heat is likely to exacerbate water scarcity and reduce agricultural productivity. Such losses will result from unreliable surface water flows, reduced water quality, and changes in planting and harvesting

¹⁰⁴⁸ Tajikistan Livelihood Zones. Available from: [TJ Livelihood Zone Descriptions English.pdf](#)

¹⁰⁴⁹ Tajikistan Livelihood Zones. Available from: [TJ Livelihood Zone Descriptions English.pdf](#)

¹⁰⁵⁰ Tajikistan Livelihood Zones. Available from: [TJ Livelihood Zone Descriptions English.pdf](#)

¹⁰⁵¹ [Tajikistan - Country Overview | Climate Change Knowledge Portal](#)

¹⁰⁵² [Tajikistan: Floods and Avalanches - Feb 2012 | ReliefWeb](#)

¹⁰⁵³ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹⁰⁵⁴ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹⁰⁵⁵ [Temurmalik District - Wikipedia](#)

seasons. Additionally, pests and diseases are likely to increase in prevalence, leading to pre-harvest crop losses. The melting of glaciers will also exacerbate variable surface water flows. In addition to contributing to water scarcity, glacier melting will also increase the risk of flood events¹⁰⁵⁶. A higher average temperature is expected to cause variability in flow along the River Kyzylsu, with a greater potential for flooding¹⁰⁵⁷. It is likely that intensified flooding and resultant landslides will cause further damage to crops, pastures, irrigation and transport infrastructure. Farmers in the region are thus expected to rely more extensively on irrigation and the maintenance of such infrastructure. In addition, agricultural producers will need to rely on fertilisers and climate-resilient crop varieties for increased productivity¹⁰⁵⁸.

Flood and Mudflow Risk

Flood risk in Temurmalik is dominated by riverine flooding affecting low-lying agricultural areas adjacent to river channels, reflecting the district's floodplain setting and proximity of productive land and settlements to active river systems¹⁰⁵⁹. Seasonal snowmelt and rainfall upstream contribute to elevated river flows, while limited drainage capacity and irrigation canal networks increase exposure to overbank flooding and waterlogging in agricultural areas¹⁰⁶⁰. As settlements, farmland, and local infrastructure are closely situated on flood-prone land, flood impacts can be substantial even during non-extreme events, resulting in recurrent disruption to agricultural production and rural livelihoods¹⁰⁶¹.

Comparative regional assessments indicate that lowland districts in Khatlon experience higher relative exposure to riverine flooding than mountainous districts, where flash floods and mudflows dominate^{1062, 1063}. While mudflows are less prevalent in Temurmalik than in foothill or mountain districts, sediment transport and localised erosion can still occur during high-flow events, affecting agricultural land and irrigation infrastructure¹⁰⁶⁴.

Climate change is expected to exacerbate flood risk in Temurmalik. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events¹⁰⁶⁵. Hydrological modelling for major snow- and glacier-fed river basins elsewhere in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation events¹⁰⁶⁶. While basin-specific, these projections illustrate climate processes

¹⁰⁵⁶ [Climate Change Profile: Tajikistan | PDF | Climate | Earth Sciences](#)

¹⁰⁵⁷ [Tajikistan's melting glaciers put water resources under stress, UNEP Atlas reveals](#)

¹⁰⁵⁸ [Climate Change Danghara - meteoblue](#)

¹⁰⁵⁹ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹⁰⁶⁰ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰⁶¹ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹⁰⁶² GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

¹⁰⁶³ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰⁶⁴ *Ibid*

¹⁰⁶⁵ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰⁶⁶ Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

that are relevant for downstream lowland districts such as Temurmalik, where higher peak river flows increase the likelihood of floodplain inundation^{1067, 1068}.

In comparative terms, Temurmalik faces higher riverine flood risk than mountainous districts in Sughd and DRS, but lower exposure to flash floods and mudflows than districts characterised by steep, narrow catchments.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Temurmalik is driven by reliance on climate-sensitive irrigated agriculture, limited livelihood diversification, and persistent pockets of rural poverty and food insecurity^{1069, 1070}. Agricultural production systems are sensitive to both flooding and drought, with crop losses, soil degradation, and damage to irrigation infrastructure directly affecting household incomes and food availability¹⁰⁷¹.

Adaptive capacity is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely early warning information, and uneven local institutional capacity for disaster preparedness and response^{1072, 1073}. While Temurmalik benefits from relatively good physical access compared to remote mountain districts, the close proximity of settlements and productive assets to flood-prone land increases potential impacts and recovery burdens for affected households. Poorer households and vulnerable groups are often disproportionately affected due to limited resources for recovery and adaptation following flood events¹⁰⁷⁴.

Key Climate Risk Drivers

Climate risk in Temurmalik arises from the interaction of floodplain exposure, settlement and asset concentration on flood-prone land, and socio-economic vulnerability¹⁰⁷⁵. Low-lying terrain, proximity to river systems, and extensive irrigated agriculture create high exposure to riverine flooding, as illustrated by regional contrasts between lowland and mountainous hazard processes¹⁰⁷⁶. This physical exposure is compounded by dependence on climate-sensitive

¹⁰⁶⁷ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹⁰⁶⁸ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰⁶⁹ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹⁰⁷⁰ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹⁰⁷¹ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹⁰⁷² World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰⁷³ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰⁷⁴ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹⁰⁷⁵ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹⁰⁷⁶ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

livelihoods and constrained adaptive capacity, increasing sensitivity to both flood-related damage and climate variability affecting water availability^{1077, 1078}.

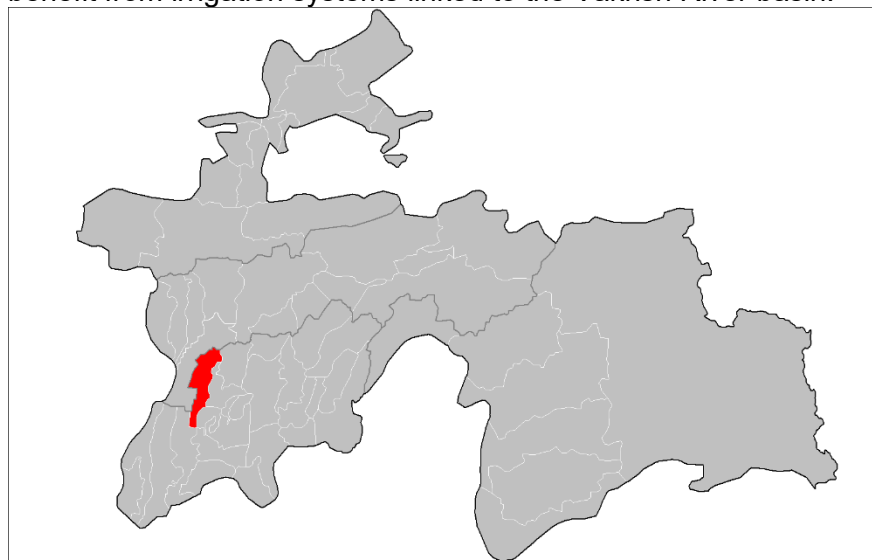
Indicative Adaptation Priorities

Addressing climate risk in Temurmalik will require a combination of flood risk reduction, agricultural resilience, and institutional strengthening measures. Priority needs include improving flood forecasting and early warning systems, strengthening and maintaining irrigation and drainage infrastructure, and promoting climate-resilient agricultural practices to reduce sensitivity to both flooding and drought¹⁰⁷⁹. Strengthening local institutional capacity for disaster preparedness, flood management, and risk-informed land-use planning will be important to support sustained adaptation outcomes.

District Profile of Khuroson

Geography

Khuroson District is situated in the Khatlon Region of Tajikistan, extending southward from the national capital, Dushanbe, toward the regional capital, Bokhtar (Figure 113). The district covers an area of approximately 900 km² and has a population of about 116,500 people (2020 estimate). Its administrative centre is the town of Obikiik, formerly known as Pravda¹⁰⁸⁰. Geographically, Khuroson is situated in the central-western part of Khatlon, at an elevation of approximately 503 m above sea level, and is located at coordinates 38°05'N, 68°40'E¹⁰⁸¹. The district's landscape is characterised by river valleys, foothills, and agricultural plains, which benefit from irrigation systems linked to the Vakhsh River basin.



¹⁰⁷⁷ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰⁷⁸ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹⁰⁷⁹ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰⁸⁰ [Khuroson District](#).

¹⁰⁸¹ [Khuroson District – Mapcarta](#).

Figure 113. Map of the geographical location of the Khuroson District, Tajikistan (highlighted in red).

Socioeconomic profile

Khuroson District, located in Tajikistan's Khatlon Region, along the Dushanbe-Bokhtar corridor, holds strategic importance for trade and mobility. Its economy is primarily agriculture-based, with cotton, grains, and horticulture as key crops, supported by irrigation from the Vakhsh River basin, though water scarcity and infrastructure challenges persist. In 2025, Khuroson was among the first districts in Khatlon to fully meet its cotton harvest plan, underscoring its agricultural productivity¹⁰⁸². Employment is concentrated in farming, small-scale trade, and public services, while remittances from labour migration abroad — mainly to Russia — remain a critical source of income^{1083,1084}. Demographically, the population is predominantly Tajik-speaking and relatively young, creating pressure on education, healthcare, and job creation¹⁰⁸⁵. Poverty rates remain high compared to urban centres, with households vulnerable to climate risks such as floods, mudflows, and landslides. In 2024, landslides displaced families in Khuroson, highlighting its fragility to climate change impacts^{1086,1087}. Despite its proximity to major transport routes, rural infrastructure and social services remain underdeveloped, requiring investment to strengthen resilience and improve living standards¹⁰⁸⁸.

Agricultural profile

Khuroson District, situated in Tajikistan's Khatlon Region, is predominantly agricultural, with the majority of households engaged in farming. Cotton remains the flagship crop, and in 2025, the district was among the first in Khatlon to fully meet its cotton harvest plan, reflecting strong organisational capacity and farmer commitment¹⁰⁸². Cotton is processed locally at facilities such as the Vodii Zarrin LLC plant, which adds value and supports employment. Beyond cotton, grains such as wheat, barley, and maize, as well as horticulture including fruits and vegetables, are widely cultivated.

Survey data from 2015 to 2023 across Khatlon Province show that while cotton remains essential, its average plot size has decreased, with maize cultivation increasing significantly as households diversify their cropping patterns¹⁰⁸⁹. This shift reflects both market adaptation and household strategies aimed at improving food security. Agriculture in Khuroson relies heavily on irrigation infrastructure linked to the Vakhsh River basin, but water scarcity, ageing canals, and climate variability pose risks to productivity. Land fragmentation, resulting from the subdivision of dehkan farms, has reduced average cultivated area per household, limiting economies of scale¹⁰⁸⁹. Livestock rearing (cattle, sheep, goats) complements crop farming, providing food and income diversification.

The district's agricultural economy is also shaped by labour migration, as remittances finance farm inputs and household consumption¹⁰⁸⁰. However, dependence on external income sources makes farming households vulnerable to external shocks. Climate hazards such as floods, mudflows, and droughts further threaten agricultural stability, underscoring the need for resilient practices and investment in irrigation modernisation.

¹⁰⁸² [Cotton Harvest Plan in Khuroson - Avesta.](#)

¹⁰⁸³ [IOM Migration Report.](#)

¹⁰⁸⁴ [Migration and employment in Tajikistan: Evidence from twelve districts in Khatlon Province, 2015 – 2023.](#)

¹⁰⁸⁵ [Results of Population Census and Housing 2020.](#)

¹⁰⁸⁶ [RFI – Climate Migrants in Tajikistan.](#)

¹⁰⁸⁷ [Tajikistan: A Unified Approach to Tackling Climate Risks.](#)

¹⁰⁸⁸ [UNDP: Tajikistan](#)

¹⁰⁸⁹ [CGIAR Policy Brief.](#)

Hazard profile

Khuroson District, located in Tajikistan's Khatlon Region, faces recurring climatic hazards due to its mountainous terrain and proximity to river basins. Floods and mudflows are frequent, particularly during spring and early summer when snowmelt and heavy rains coincide. In 2020, severe mudflows and floods affected thousands of households across Tajikistan, including Khuroson, highlighting the district's exposure to seasonal hydrological extremes¹⁰⁹⁰. Landslides are another major hazard, often triggered by heavy precipitation and unstable slopes. In 2024, families in Khuroson were displaced after landslides destroyed homes, underscoring the growing risk of slope failure linked to climate variability¹⁰⁸⁶. Recent scientific studies have confirmed that mudflows and landslides are increasing in frequency and severity across Tajikistan's mountain-foothill zones, posing a significant threat to infrastructure and livelihoods¹⁰⁹¹. Droughts also pose a significant hazard, particularly in the agricultural sector. Water scarcity, exacerbated by ageing irrigation systems and climate change, reduces crop yields and heightens food insecurity¹⁰⁸⁷. This is especially critical in Khuroson, where cotton and grain production depend on reliable irrigation from the Vakhsh River basin.

On the non-climatic side, Khuroson faces hazards linked to infrastructure fragility, poverty, and dependence on migration. Poorly maintained rural roads, housing, and irrigation canals increase vulnerability to disasters. Poverty rates remain high compared to urban centres, limiting households' ability to recover from shocks. Additionally, reliance on remittances from labour migration abroad creates socioeconomic fragility, as external economic downturns can directly impact household resilience.

Flood and Mudflow Risk

Flood risk in Khuroson is characterised by riverine flooding combined with flash mudflows originating from adjacent foothill catchments, reflecting the district's lowland floodplain setting and proximity to both river systems and upland sediment sources¹⁰⁹². Seasonal snowmelt and rainfall upstream contribute to elevated river flows, while runoff from foothill areas delivers sediment-laden waters that inundate agricultural land and settlements during high-flow periods¹⁰⁹³. Extensive irrigation infrastructure, together with limited and poorly functioning drainage systems, increases exposure to overbank flooding and contributes to prolonged waterlogging in agricultural areas¹⁰⁹⁴.

As a result, flood impacts in Khuroson often persist beyond peak river flows, delaying drainage and recovery of cropping systems and extending livelihood disruption even following moderate flood events¹⁰⁹⁵. Settlements, farmland, and rural infrastructure located on flat floodplain terrain are particularly exposed to prolonged inundation and post-flood impacts, increasing economic losses and recovery times¹⁰⁹⁶.

¹⁰⁹⁰ [IFRC Flood Report](#).

¹⁰⁹¹ [Journal of Mountain Science](#).

¹⁰⁹² UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹⁰⁹³ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/0999912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰⁹⁴ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹⁰⁹⁵ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹⁰⁹⁶ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

Comparative regional assessments indicate that lowland districts in Khatlon experience higher relative exposure to riverine flooding than mountainous districts, where flash floods and mudflows dominate¹⁰⁹⁷. While mudflows are less dominant in Khuroson than in steeper mountain districts, their interaction with riverine flooding and poor drainage conditions represents a key differentiating risk pathway¹⁰⁹⁸.

Climate change is expected to exacerbate flood risk in Khuroson. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of heavy rainfall events¹⁰⁹⁹. Hydrological modelling for major snow- and glacier-fed river basins elsewhere in Tajikistan projects mean air temperature increases of approximately 1.5–2.5°C over the period 2036–2065, accompanied by a shift from snowfall to rainfall and increasing frequencies of heavy precipitation events¹¹⁰⁰. While basin-specific, these projections illustrate climate processes that are relevant for downstream lowland districts such as Khuroson, where higher peak river flows and increased runoff can intensify floodplain inundation and post-flood waterlogging^{1101, 1102}.

In comparative terms, Khuroson faces higher riverine flood risk than mountainous districts in Sughd and DRS, but lower exposure to rapid-onset flash floods and mudflows than districts characterised by steep, narrow catchments.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Khuroson is driven by reliance on climate-sensitive irrigated agriculture, limited livelihood diversification, and persistent pockets of rural poverty and food insecurity^{1103, 1104}. Agricultural production systems are particularly sensitive to prolonged inundation and saturated soils, with delayed planting, crop losses, and soil degradation directly affecting household incomes and food availability¹¹⁰⁵.

Adaptive capacity is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely early warning information, and uneven local institutional capacity for disaster preparedness and response¹¹⁰⁶. Although Khuroson benefits from

¹⁰⁹⁷ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹⁰⁹⁸ *Ibid*

¹⁰⁹⁹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁰⁰ Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

¹¹⁰¹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁰² World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹¹⁰³ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹¹⁰⁴ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹¹⁰⁵ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹¹⁰⁶ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

relatively good physical access compared to remote mountain districts, prolonged post-flood impacts increase recovery burdens for affected households and agricultural producers¹¹⁰⁷. Poorer households and vulnerable groups are often disproportionately affected due to limited resources for recovery and adaptation following flood events¹¹⁰⁸.

Key Climate Risk Drivers

Climate risk in Khuroson arises from the interaction of floodplain exposure, foothill-derived sediment inflows, poor drainage capacity, and socio-economic vulnerability¹¹⁰⁹. Low-lying terrain, proximity to river systems, and extensive irrigated agriculture create high exposure to riverine flooding, as illustrated by regional contrasts between lowland and mountainous hazard processes. This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to both flood-related damage and climate variability affecting water availability^{1110, 1111}.

Indicative Adaptation Priorities

Addressing climate risk in Khuroson will require a combination of flood risk reduction, agricultural resilience, and institutional strengthening measures. Priority needs include improving flood forecasting and early warning systems, strengthening and maintaining irrigation and drainage infrastructure to reduce prolonged waterlogging, and promoting climate-resilient agricultural practices suited to saturated soil conditions¹¹¹². Strengthening local institutional capacity for disaster preparedness, flood management, and risk-informed land-use planning will be important to support sustained adaptation outcomes¹¹¹³.

District Profile of Qabodiyon

Geography

Qabodiyon District (also spelt Qubodiyon) covers an area of about 1,800 km² and has a population of approximately 188,100 (2020 estimate). Its administrative centre is the town of Qabodiyon. The district lies at coordinates 37°26'N, 68°13'E, with an average elevation of 513 m (1,683 feet) above sea level^{1114,1115}. Geographically, Qabodiyon is part of the southern plains of Tajikistan, characterised by fertile soils and semi-arid climate conditions (Figure 114). Its proximity to the Amu Darya River provides irrigation opportunities that support cotton,

¹¹⁰⁷ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

¹¹⁰⁸ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹¹⁰⁹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹¹¹⁰ World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹¹¹¹ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹¹¹² World Bank. *Central Asia Hydrometeorology Modernization Project (P120788), Implementation Status & Results Report*. 2014, <https://documents1.worldbank.org/curated/en/995851482427521255/pdf/1482427519273-0000A8056-ISR-Disclosable-P120788-12-22-2016-1482427500244.pdf>.

¹¹¹³ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

¹¹¹⁴ [Qubodiyon District](#).

¹¹¹⁵ [Qabodiyon District – Mapcarta](#).

wheat, and horticulture; however, water scarcity and climate variability remain significant challenges. The district is divided administratively into one town and seven jamoats, reflecting a mix of urban and rural settlement patterns¹¹¹⁶. Qabodiyon's location along the border with Uzbekistan makes it strategically important for cross-border trade and cultural exchange¹¹¹⁷. The terrain is mainly flat with agricultural fields, but the district is vulnerable to climatic hazards such as droughts and floods due to its riverine setting.

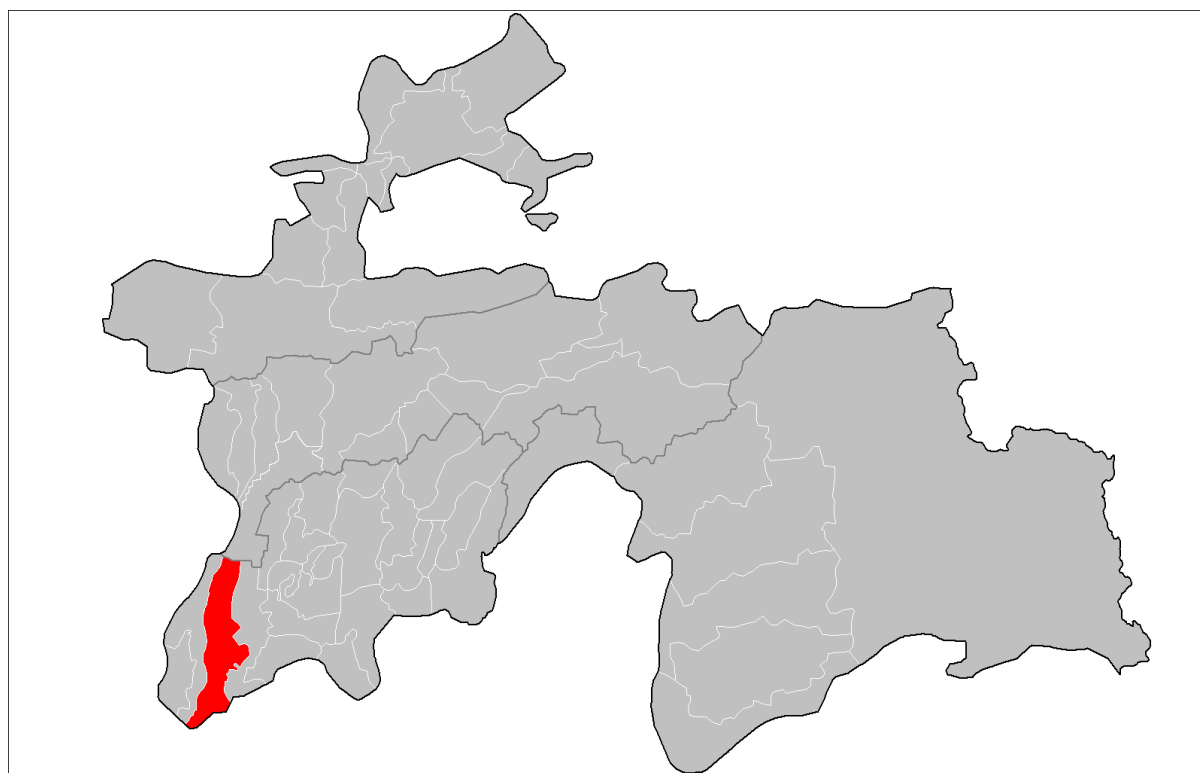


Figure 114. Map of the geographical location of the Qabodiyon District, Tajikistan (highlighted in red).

Socioeconomic profile

The district is situated near the Amu Darya River and the border with Uzbekistan, making it strategically important for agriculture and cross-border trade. Its economy is primarily agriculture-based, with cotton, wheat, and horticulture as the dominant crops, supported by irrigation from the Amu Darya basin. Cotton remains a key cash crop, though diversification into grains and vegetables is increasing to strengthen food security¹¹¹⁸. Employment is concentrated in farming, small-scale trade, and public services, while labour migration abroad, mainly to Russia, plays a critical role in household income, with remittances financing farm inputs and consumption^{1119,1120}. Demographically, the population is predominantly Tajik-speaking and relatively young, creating pressure on education, healthcare, and job creation¹¹²¹. Despite national poverty reduction (from 56% in 2010 to just over 20% in 2023), rural districts like Qabodiyon remain more vulnerable due to limited job opportunities, dependence on agriculture, and climate risks¹¹²². Infrastructure challenges persist, with rural

¹¹¹⁶ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹¹¹⁷ [The Vakhsh Valley: Agriculture and Risk – GEOGRAPHICAL SOCIETY OF TAJIKISTAN](#)

¹¹¹⁸ [FAO – Tajikistan Agriculture.](#)

¹¹¹⁹ [IFPRI – Migration and Employment in Tajikistan.](#)

¹¹²⁰ [IFPRI – Migration and Employment in Tajikistan.](#)

¹¹²¹ [Agency on Statistics of Tajikistan – Census.](#)

¹¹²² [World Bank – Poverty and Equity Assessment.](#)

roads, irrigation canals, and service delivery systems requiring investment. Healthcare and educational facilities exist, but they are unevenly distributed, leaving rural households at a disadvantage. Qabodiyon is also vulnerable to climatic hazards, including droughts and floods, which directly impact agricultural productivity and food security. Non-climatic vulnerabilities include poverty, migration dependence, and fragile infrastructure, which reduce household resilience¹¹²³.

Agricultural profile

Agriculture remains a cornerstone of Tajikistan's economy, employing nearly half of the labour force and contributing significantly to rural livelihoods. The sector is shaped by the country's diverse geography, ranging from fertile river valleys to semi-arid plains and mountainous terrain. Cotton is the leading cash crop, historically a central component of Tajikistan's agricultural economy. Wheat is the staple food crop, supplemented by barley, maize, and rice. Horticulture, including fruits such as apricots, grapes, and apples, as well as vegetables, has expanded in recent years, providing both domestic food security and export potential¹¹²⁴. Sheep, goats, and cattle are widely raised, contributing to household food security and income. Livestock also plays a role in mixed farming systems, with manure used to maintain soil fertility. Agriculture depends heavily on irrigation, particularly from the Amu Darya and Vakhsh River basins. However, ageing infrastructure, inefficient water use, and climate variability pose risks to productivity. Droughts and floods are recurring hazards that directly affect yields^{1125,1126}. Rising temperatures, glacier retreat, and erratic rainfall patterns are intensifying water scarcity and increasing vulnerability to hazards such as mudflows and landslides. Climate-smart agriculture practices are being promoted to improve resilience. Land fragmentation following dehkan farm reforms has reduced average farm size, limiting economies of scale. Rural households often rely on remittances from labour migration to finance farm inputs, underscoring socioeconomic fragility¹¹²⁷.

Hazard profile

Qabodiyon District is exposed to a range of climatic and non-climatic hazards that directly affect its rural livelihoods and infrastructure. Climatic hazards include droughts, floods, and mudflows, which are driven by the semi-arid climate and reliance on irrigation from the Amu Darya River basin. Droughts are recurrent and pose serious risks to cotton and wheat production, while floods and mudflows occur seasonally due to heavy rainfall and river overflow, damaging farmland and settlements^{1124,1123}. The district is also vulnerable to landslides, particularly in areas with unstable soils and slopes, which have displaced households in recent years^{1126,1127}. Non-climatic hazards are equally significant. Infrastructure fragility, including poorly maintained irrigation canals, rural roads, and housing, exacerbates vulnerability to disasters. Poverty and migration dependence are major socioeconomic hazards, as households rely heavily on remittances from abroad, leaving them vulnerable to external economic shocks¹¹²⁴. Limited access to healthcare and education services further reduces resilience, especially in rural jamoats.

Flood and Mudflow Risk

Flood risk in Qubodiyon is dominated by riverine flooding associated with its lowland floodplain setting, proximity to major river systems, and extensive irrigation infrastructure. Seasonal

¹¹²³ [UN DCO – Tackling Climate Risks in Tajikistan.](#)

¹¹²⁴ [FAO Country Profile: Tajikistan.](#)

¹¹²⁵ [Tajikistan Agrifood Security Policies Advice and Analytics.](#)

¹¹²⁶ [Tajikistan Agrifood Security Policies Advice and Analytics.](#)

¹¹²⁷ [CGIAR – Tajikistan's Agrifood System Country Brief \(2023\).](#)

snowmelt and rainfall upstream contribute to elevated river flows, while limited drainage capacity and ageing irrigation canals increase exposure to overbank flooding and prolonged waterlogging in agricultural areas¹¹²⁸.

Flood impacts are frequently mediated through irrigation and drainage systems. Canal overtopping, embankment weakness, and blocked drainage during high-flow periods can result in widespread inundation of irrigated fields and disruption to agricultural production, even during moderate flood events¹¹²⁹. Settlements and rural infrastructure located along river corridors and irrigation networks are therefore particularly exposed to flood-related damage and post-flood disruption.

Comparative regional assessments indicate that lowland districts in Khatlon, including Qubodiyon, experience higher relative exposure to riverine flooding than mountainous districts, where flash floods and mudflows dominate^{1130, 1131}. While mudflows are less prevalent than in foothill or mountain districts, sediment transport and localised erosion can still occur during high-flow events, affecting agricultural land and irrigation infrastructure¹¹³².

Climate change is expected to exacerbate flood risk in Qubodiyon. National climate assessments indicate a warming trend and increasing precipitation variability across Tajikistan, including an increasing likelihood of intense rainfall events¹¹³³. Hydrological modelling for major snow- and glacier-fed river basins projects increasing peak river flows and higher return-period precipitation under future climate conditions, increasing the likelihood of floodplain inundation and drainage exceedance in downstream lowland districts such as Qubodiyon¹¹³⁴.

In comparative terms, Qubodiyon faces higher riverine flood and waterlogging risk than mountainous districts in Sughd, Districts of Republican Subordination (DRS), and Gorno-Badakhshan Autonomous Oblast (GBAO), but lower exposure to flash floods and mudflows than districts characterised by steep, narrow catchments.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Qubodiyon is driven by high dependence on climate-sensitive irrigated agriculture, limited livelihood diversification, and persistent pockets of rural poverty and food insecurity. Agricultural production systems are sensitive to both flooding and drought,

¹¹²⁸ *Ibid*

¹¹²⁹ *Ibid*

¹¹³⁰ GFDRR. "Tajikistan." *ThinkHazard!*, 2020, <https://thinkhazard.org/en/report/239-tajikistan>.

¹¹³¹ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/0999912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹¹³² *Ibid*

¹¹³³ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹³⁴ Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

with crop losses, soil degradation, and damage to irrigation infrastructure directly affecting household incomes and food availability^{1135, 1136}.

Adaptive capacity is constrained by variable quality and resilience of irrigation and drainage infrastructure, limited access to timely flood early warning information, and uneven local institutional capacity for disaster preparedness and response¹¹³⁷. While Qubodiyon benefits from relatively good physical access compared to remote mountain districts, the concentration of productive land and assets on floodplains increases potential impacts and recovery burdens for affected households¹¹³⁸. Poorer households and vulnerable groups are often disproportionately affected due to limited resources for recovery and adaptation following flood events¹¹³⁹.

Key Climate Risk Drivers

Climate risk in Qubodiyon arises from the interaction of floodplain exposure, irrigation and drainage system performance, and socio-economic vulnerability. Low-lying terrain, proximity to major river systems, and extensive irrigated agriculture create high exposure to riverine flooding and waterlogging, while ageing canal networks and drainage bottlenecks amplify the impacts of elevated river flows¹¹⁴⁰. This physical exposure is compounded by dependence on climate-sensitive livelihoods and constrained adaptive capacity, increasing sensitivity to flood-related damage and climate variability affecting water availability¹¹⁴¹.

Indicative Adaptation Priorities

Addressing climate risk in Qubodiyon will require a combination of riverine flood risk reduction, irrigation and drainage system rehabilitation, and institutional strengthening measures. Priority needs include improving the capacity and maintenance of irrigation and drainage infrastructure, strengthening flood forecasting and early warning systems for riverine flooding, and promoting climate-resilient agricultural practices to reduce sensitivity to both flooding and drought¹¹⁴². Strengthening local institutional capacity for disaster preparedness, flood management, and risk-informed land-use planning will be important to support sustained adaptation outcomes¹¹⁴³.

Districts of Republican Subordination (DRS)

¹¹³⁵ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹¹³⁶ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹¹³⁷ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹³⁸ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹¹³⁹ United Nations Tajikistan. *Tajikistan Common Country Analysis Annual Update 2023*. 2023, <https://tajikistan.un.org/en/238828-tajikistan-common-country-analysis-annual-update-2023>.

¹¹⁴⁰ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹¹⁴¹ Azevedo, Joao Pedro, et al. "Poverty Reduction and Shared Prosperity in Tajikistan A Diagnostic." Edited by World Bank. *Policy Research Working Paper*, vol. 6923, 2014, <https://openknowledge.worldbank.org/entities/publication/96d75552-259a-5d18-9442-7d28e1b47806>.

¹¹⁴² The World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹¹⁴³ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

The Districts of Republican Subordination (DRS) form a key administrative-territorial unit of Tajikistan and covers a territory of around 28,600 km² in the central and eastern part of Tajikistan, and the second largest region of Tajikistan, stretching over a variety of landscapes — from the foothills of the Gissar Range and Zeravshan Mountains in the north, to river plateaus, and then rising into the high-mountain zones of the Darvaz Range and Pamir-Alay in the south and east. The DRS borders the Sughd Region and the Kyrgyz Republic to the north, the Gorno-Badakhshan Autonomous Region to the east and southeast, the Khatlon Region to the south, and the Republic of Uzbekistan to the west¹¹⁴⁴. The climate and ecology across the DRS are highly diverse: lower valleys and plateaus experience continental climates with relatively hot summers and cold winters, whereas high-mountain districts are characterised by long, cold winters with heavy snowfall and short, mild summers. Snow typically begins in October and may persist until May at higher elevations. The territory comprises 13 districts, with a population of ~1,971,600 people. The administrative centre of the DRS is the city of Dushanbe¹¹⁴⁵.

The DRS encompasses a diverse range of livelihood systems, including valley agriculture, irrigated horticulture, high-altitude pastoralism, and transhumance. In many of the mountainous districts, small-scale agriculture, livestock husbandry, migration/remittances, and subsistence livelihoods dominate¹¹⁴⁶. At the same time, the DRS are among the most hazard-prone regions in Tajikistan: steep slopes, glacial zones, seismic fault lines, and heavy seasonal precipitation combine to create risks of landslides, mudflows, avalanches, floods, and, in some zones, glacial lake outburst floods (GLOFs)¹¹⁴⁷. Within the DRS region, the districts of Lakhsh, Sangvor and Tojikobod have been selected for project interventions.

District Profile of Lakhsh

Geography

Lakhsh District, located in the extreme northeastern corner of the Districts of Republican Subordination (DRS) in Tajikistan, lies at an elevation of roughly 1,795 m above sea level in the upper Surkhob River valley, one of the key headwater branches of the Vakhsh River basin. As shown in Figure 115, Lakhsh is situated along Tajikistan's northeastern border, adjacent to the Kyrgyz Republic to the north and northeast, and neighbouring Sangvor, Tojikobod, and Rasht districts to the south and west. The administrative centre is the town of Vahdat (formerly Jirgatal)^{1148,1149}. The district is dominated by rugged mountain systems, including the Oloy Range (reaching up to 2,646 m at Peak Shumkor), the towering Pasi Oloy/Trans-Alai Range (rising to about 5,900 m), and the western extensions of the Academy of Sciences and Peter the First ranges, home to some of Central Asia's highest peaks such as Somoni (7,495 m) and Moscow Peak (6,785 m)¹¹⁵⁰.

Steep valleys characterise Lakhsh's landscape, with extensive glacial formations and alpine terrain that support a network of rivers sustaining its settlements, agriculture, and pastoral livelihoods. Hydrologically, Lakhsh is sustained by the Surkhob–Vakhsh river system, fed by snowmelt, glacier melt, and seasonal precipitation. In addition to the Surkhob, the district hosts many smaller but crucial mountain streams, including the Kyzyl-Suu River, that flow from high-

¹¹⁴⁴ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁴⁵ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁴⁶ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁴⁷ <https://asiaplustj.info/en/news/tajikistan/incidents/20241111/28-households-affected-by-glacier-lake-outburst-in-tojikobod-district>

¹¹⁴⁸ <https://en.wikipedia.org/wiki/Lakhsh>

¹¹⁴⁹ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁵⁰ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

altitude glaciers through interior valleys. These tributaries, though short, are essential for localised irrigation, drinking water supply, and determining where communities can settle within the steep terrain^{1151,1152}.

The district's climate is highly continental, with hot summers reaching average temperatures of +36.8°C and cold winters dropping to −27.5°C. Precipitation varies by elevation: 200–700 mm on the slopes of the Oloy and Pasi Oloy (Trans-Alai) ranges, and 700–900 mm on the Academy of Sciences and Peter the First ranges. This combination of high-mountain climate, hydrology, and topography makes Lakhsh one of Tajikistan's most environmentally dynamic and hydrologically significant districts¹¹⁵³.



Figure 115. Map of Lakhsh District, Tajikistan¹¹⁵⁴.

Socioeconomic profile

As of 2024, Lakhsh District has a population of approximately 56,800 residents, including 27,042 males and 25,896 females, spread across an area of 4,631 km². The population has grown at an average annual rate of 2.2% between 2020 and 2024¹¹⁵⁵. Administratively, the district comprises one town, nine rural jamoats¹¹⁵⁶, and 54 villages, with over 56% of residents living in rural areas¹¹⁵⁷. Lakhsh's economy is predominantly rural and centred on agriculture, which forms the backbone of household livelihoods. Key activities include horticulture, livestock rearing (sheep, goats, and cattle), beekeeping, potato and vegetable cultivation, and pisciculture. Most agricultural production is small-scale and subsistence-oriented, concentrated in narrow valley bottoms where arable land is available. Livelihoods in the district are shaped by its high-mountain geography, which limits market access, infrastructure development, and economic diversification. Many households supplement their income through remittances and small local trade, reflecting patterns typical of mountain districts in the broader Rasht zone, where farm sizes are small and access to services remains constrained¹¹⁵⁸.

¹¹⁵¹ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁵² https://en.wikipedia.org/wiki/Mehrobod%2C_Lakhsh_district

¹¹⁵³ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁵⁴ [Lakhsh District - Wikipedia](https://www.citypopulation.de/en/tajikistan/admin/noh%CC%A6ijah%CC%A6oi_tobei_%C3%A7umh/552_lach%C5%A1/)

¹¹⁵⁵ https://www.citypopulation.de/en/tajikistan/admin/noh%CC%A6ijah%CC%A6oi_tobei_%C3%A7umh/552_lach%C5%A1/

¹¹⁵⁶ Administrative unit in between the district and the village in Tajikistan

¹¹⁵⁷ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁵⁸ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

Given these constraints — limited opportunities beyond farming, narrow arable land, remoteness, and weak infrastructure — many families remain vulnerable to poverty and under-employment. Significant unemployment has led to large-scale migration, especially among men who leave their families to support them, taking on additional household responsibilities and caring for children. In rural areas, such as Lakhsh and its surrounding districts in the national governance area (NGA), a large share of employed people still live below or near the poverty line, and many work in informal or seasonal jobs with low incomes¹¹⁵⁹.

Agricultural profile

Agriculture in Lakhsh is concentrated in the narrow valley floors where irrigation is possible, supporting potatoes, vegetables, small cereal plots, fruit trees in sheltered areas, and extensive livestock grazing on surrounding alpine pastures. Farming is dependent on snowmelt and summer water availability, resulting in small crop plots and modest herd sizes, which are primarily oriented toward household consumption, with only limited surplus reaching local markets. Agriculture remains the dominant economic sector, employing more than 56% of the population¹¹⁶⁰. The Vakhsh River is the primary source of water for these activities. Table 17 indicates Land-use data for 2021, further reflecting the rural agrarian profile: Lakhsh has 136,631 ha of agricultural land, including 129,012 ha of pastures, alongside 6,277 ha of total arable land (of which 4,475 ha are irrigated), 477 ha of perennial crops, 400 ha of abandoned lands, and 3,143 ha of household plots. This distribution indicates the district's reliance on pasture-based livestock and small-scale irrigated farming within the limited arable zones of its mountain valleys¹¹⁶¹.

Table 17. Land area (ha) by type of land cover as of 2021¹¹⁶².

Land category	Lakhsh
Total land area including irrigated lands	458,011
	8,623
Total arable land, including irrigated areas	6,277
	4,475
Perennials, including irrigated perennials	477
	471
Abandoned lands, including irrigated lands	400
	331
Pastures, including irrigated lands	129,012
Grasslands, included irrigated grasslands	465
	28
Total agricultural lands, including irrigated lands	136,631
	5,305
Total household plots, including irrigated lands	3,143
	2,991
Privately owned lands, including irrigated lands	1,243
	1,027

Hazard profile

The district faces a complex mix of climate-induced and non-climatic hazards, dominated by mountain-related processes such as earthquakes, landslides, rockfalls, avalanches,

¹¹⁵⁹ <https://aedpmu.tj/wp-content/uploads/2023/07/esmf.pdf>

¹¹⁶⁰ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁶¹ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁶² <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

mudflows, debris flows, and flash floods. Seasonal snowmelt and episodes of intense summer precipitation frequently trigger floods and slope failures, damaging roads, bridges, farmland, and irrigation networks. As glaciers retreat and temperature variability increases, hydrometeorological risks have intensified across the highlands of Tajikistan, and Lakhsh has emerged as one of the most hazard-exposed districts. A particularly critical hazard is the increasing frequency of glacier lake outburst floods (GLOFs). In August 2025, a powerful mudflow descended from a glacier lake on the Said Nafisi Glacier (formerly Baralmos) into the Archakapa area of Lakhsh. The event blocked the Surkhob River for more than two hours, destroyed over 400 m of the Vahdat–Rasht–Lakhsh–Saritash highway, and deposited large volumes of rock, mud, and debris. Over the past five years, similar GLOFs have occurred 23 times, with three major events recorded in just one summer (July 14, July 22, and August 10). Each outburst causes river blockage, debris-laden mudflows, and prolonged road closures, with repairs delayed 10–15 days while sediment remains waterlogged and unstable¹¹⁶³. The broader glacial catchment is complex: accumulation zones contain avalanche-debris cones, and precipitation can exceed 2,000 mm annually on south- and southwest-facing slopes. Most precipitation occurs in winter and spring, while summer—the peak glacier melt season—remains relatively dry. River runoff in Lakhsh is fed by glacier melt, snowmelt, and groundwater, with groundwater contributing around 30% of annual discharge, reinforcing the district’s vulnerability to shifts in cryosphere dynamics, which threaten water security, irrigation reliability, hydropower potential, and the frequency of hazards like glacial lake outburst floods (GLOFs) and debris flows¹¹⁶⁴.

Non-climatic hazards also play a significant role. Lakhsh sits in a tectonically active zone, making earthquakes a recurrent threat that can trigger cascading disasters such as landslides and debris flows¹¹⁶⁵. Road and infrastructure geohazard assessments classify several sections of the international Vahdat-Rasht-Lakhsh Highway, which connects Tajikistan to the Kyrgyz Republic, as high risk, particularly in steep glacial valleys. These hazards frequently disrupt transport, isolate communities, and interrupt regional trade routes. Recent GLOF-linked inundations of the same highway demonstrate how quickly access can be lost and how vulnerable key infrastructure is to both climatic and geological shocks¹¹⁶⁶.

Flood and Mudflow Risk

Flood risk in Lakhsh is driven primarily by tributary-fed rivers and snowmelt from high-altitude catchments in the upper Rasht Valley, rather than by large mainstem river flooding. Intense rainfall events and seasonal snowmelt generate short-duration, high-energy flows that transport sediment and debris from steep upstream slopes into narrow valley channels, producing flash floods and mudflows with limited lead time¹¹⁶⁷.

Exposure in Lakhsh is concentrated in dispersed valley settlements and along linear road corridors rather than in dense urban centres. As a result, flood and mudflow impacts frequently disrupt transport links, local services, and access to markets, even where the spatial extent of inundation is limited¹¹⁶⁸. Agricultural land located on small valley bottoms and alluvial fans is

¹¹⁶³ <https://glofca.org/en/news/series-of-glacier-lake-outburst-floods-in-lakhsh-district-another-call-to-action/>

¹¹⁶⁴ <https://glofca.org/en/pilot-projects/tajikistan/>

¹¹⁶⁵ <https://kun.uz/en/news/2024/03/22/mild-tremors-felt-in-uzbekistan-after-a-magnitude-54-earthquake-hit-tajikistan>

¹¹⁶⁶ <https://www.gfdr.org/en/feature-story/using-high-resolution-data-screen-road-geohazards-tajikistan>

¹¹⁶⁷ *Ibid*

¹¹⁶⁸ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

particularly vulnerable to erosion and sediment deposition during these events, affecting subsistence crop production rather than large-scale market supply¹¹⁶⁹.

Comparative regional assessments for the Rasht Valley indicate that upper-valley districts such as Lakhsh experience higher relative exposure to flash floods and mudflows than lower-valley districts, where wider floodplains and irrigation systems play a greater role in shaping flood impacts¹¹⁷⁰.

Climate change is expected to exacerbate flood and mudflow risk in Lakhsh. National climate assessments indicate a clear warming trend and increasing precipitation variability across Tajikistan, including a higher likelihood of intense rainfall events¹¹⁷¹. Hydrological modelling for snow- and glacier-influenced basins indicates increasing frequencies of heavy precipitation and earlier snowmelt under future climate conditions, processes that are associated with heightened flash flood and debris-flow activity in steep, high-altitude catchments such as those in the upper Rasht Valley¹¹⁷².

In comparative terms, Lakhsh faces lower exposure to prolonged riverine flooding than mid- and lower-valley districts, but higher relative risk from rapid-onset flash floods and mudflows driven by steep terrain and limited natural flood attenuation.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Lakhsh is shaped by subsistence-oriented agricultural livelihoods, limited livelihood diversification, and repeated disruption of access routes and services due to flood and mudflow events. Damage to roads and bridges can isolate communities and delay access to markets, health services, and emergency support, amplifying the impacts of even moderate hazard events¹¹⁷³.

Adaptive capacity is constrained by dispersed settlement patterns, limited engineered flood protection, and variable access to timely early warning information. While community coping mechanisms exist, limited institutional capacity and infrastructure investment increase sensitivity to recurrent, small- to medium-scale flood and mudflow events¹¹⁷⁴.

Key Climate Risk Drivers

Climate risk in Lakhsh arises from the interaction of high-altitude catchment processes, steep valley morphology, and subsistence-oriented livelihoods. Tributary-fed hydrology and confined channels amplify runoff responses during intense rainfall and snowmelt, while settlement and infrastructure patterns aligned along narrow valleys concentrate impacts on

¹¹⁶⁹ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

¹¹⁷⁰ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹¹⁷¹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁷² Kure, S., et al. "Hydrologic impact of regional climate change for the snow-fed and glacier-fed river basins in the Republic of Tajikistan: statistical downscaling of global climate model projections." *Hydrological Processes*, vol. 27, 2013, pp. 4071–4090, <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.9536>.

¹¹⁷³ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁷⁴ Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation. 2026.

transport and local services¹¹⁷⁵. This physical exposure is compounded by livelihood sensitivity and constrained adaptive capacity, resulting in recurrent disruption and food security impacts even from short-duration events¹¹⁷⁶.

Indicative Adaptation Priorities

Addressing climate risk in Lakhsh will require a combination of flash flood risk reduction, infrastructure resilience, and livelihood support measures. Priority needs include strengthening localised flood and mudflow early warning systems for tributary catchments, improving the resilience of roads and bridges to debris-laden flows, and supporting climate-resilient subsistence agriculture and livestock management to reduce food security impacts¹¹⁷⁷. Strengthening district-level preparedness and response capacity will be important to support sustained adaptation outcomes in this upper-valley context¹¹⁷⁸.

District Profile of Sangvor

Geography

Sangvor District is located in the eastern part of the DRS (Figure 116) and was formerly known as Tavildara, but was renamed in 2016. Its administrative centre is Tavildara (a high-altitude valley settlement). The district covers a vast mountainous area (several thousand km²) with long, high valleys, glaciated peaks, and alpine pastures; the Obikhingou (Vakhsh tributary) and its valley (Vakhiyo/Tavildara valley) are prominent geographic features. Settlements are dispersed along valley floors and in small jamoats^{1179,1180}. Due to its high-mountain setting, the district's hydrology is strongly influenced by snow and glacier melt. High-altitude snowfields and glaciers feed streams in the Obikhingou basin, making Sangvor part of the snow- and glacier-dominated headwaters of the larger Vakhsh/Amu Darya basin. This glacio-nival contribution is critical for sustaining flow in the Obikhingou-Vakhsh, especially during the summer dry season¹¹⁸¹. Seasonal runoff, therefore, exhibits a typical glacio-nival (snowmelt) regime, where stream discharge rises during spring and summer as snow and ice melt, and declines during the colder, drier winter months¹¹⁸².

¹¹⁷⁵ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹¹⁷⁶ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁷⁷ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹¹⁷⁸ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹¹⁷⁹ https://en.wikipedia.org/wiki/Sangvor_District

¹¹⁸⁰ <https://en.wikipedia.org/wiki/Tavildara>

¹¹⁸¹ <https://mel.cgiar.org/reporting/download/hash/1f472e1d61c0e0213c80a5afbb9ade03>

¹¹⁸² Kure, S. et al. 2013. Hydrologic Impact of Regional Climate Change for the Snowfed and Glacierfed River Basins in the Republic of Tajikistan: Hydrological Response of flow to Climate Change. *Hydrological Processes* 27(26)



Figure 116. Map of Sangvor District, Tajikistan¹¹⁸³.

Socioeconomic profile

Sangvor District is sparsely populated, with a population of approximately 23,300 as of 2020, and is predominantly rural. The settlements are concentrated in high-mountain valleys, where agriculture and pastoralism dominate local livelihoods¹¹⁸⁴. Households rely heavily on subsistence farming and livestock rearing, while off-farm employment opportunities remain very limited due to remoteness, poor infrastructure, and long distances to major markets. As in many rural districts within the Districts of Republican Subordination (DRS), poverty levels are comparatively high: national poverty assessments show that rural areas and the DRS experience some of the highest poverty rates (25%) in the country, with many households engaged in informal, low-productivity work and experiencing under-employment or working poor conditions¹¹⁸⁵. Because domestic job creation is limited, labour migration, primarily to Russia, plays a crucial role in household survival, and remittances remain a significant source of income in Sangvor, mirroring national trends where a large share of working-age individuals seek employment abroad due to the scarcity of local jobs¹¹⁸⁶. These structural constraints — limited arable land, high dependence on subsistence agriculture, low employment diversification, and reliance on migration — collectively heighten the district's socio-economic vulnerability.

Agricultural profile

Agriculture in Sangvor District reflects the characteristics of high-mountain Tajikistan, shaped by steep terrain, small valley bottoms, and limited arable land. As part of the Rasht Valley and the mountainous Districts of Republican Subordination (DRS), the district relies primarily on irrigated cropping in valley-bottom plots, as rainfall alone is insufficient for reliable production. Upland areas are typically used for wheat, potatoes, and horticultural crops, complemented by rainfed pasture, while irrigated cotton and wheat dominate lower-elevation plots. In 2008, Tavildara farming units reported an average potato yield of 22.7 t/ha, four times higher than in 2001, producing a total of 9,557 tons, sufficient to meet local needs and supply the Dushanbe markets. The highest yields, 45–50 t/ha, were recorded by Jomi and Zuvai farms, as well as the Miyonadou farmers' association. Beekeeping was also crucial, with 120 tons of high-quality honey produced in 2008, exceeding the previous year's output by 15.6 tons. Additionally, a 2010 Japanese-funded project rehabilitated a 4.4 km irrigation canal to serve

¹¹⁸³ https://en.wikipedia.org/wiki/Sangvor_District

¹¹⁸⁴ https://en.wikipedia.org/wiki/Sangvor_District

¹¹⁸⁵ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹¹⁸⁶ https://www.un.org/humansecurity/wp-content/uploads/2017/08/7.Laiflet-Empowering-Rural-Communities-in-Rasht-Valley_UNDP-1.pdf

approximately 50 ha of agricultural land, enabling the cultivation of vegetables and fruits in mountainous areas¹¹⁸⁷.

Hazard profile

Sangvor District (Tavildara) is exposed to a range of hazards shaped by its mountainous geography. Climatic hazards include glacier retreat and altered river runoff, which threaten irrigation and water supply for agriculture and livestock; increased frequency of floods, debris flows, and glacial lake outburst floods (GLOFs); extreme weather variability such as droughts and heat; and avalanches or snow/ice-related hazards, all of which can undermine valley-bottom agriculture and pastoral livelihoods^{1188,1189}. Non-climatic hazards encompass rockfalls, avalanches, earthquakes and associated secondary effects, soil erosion and land degradation, and infrastructure vulnerability (roads, irrigation canals, bridges), which can disrupt agriculture, access to markets, and community livelihoods^{1190,1191}.

Flood and Mudflow Risk

Flood risk in Sangvor is dominated by mudflows and mudflows originating in narrow, steep sub-catchments rather than by prolonged inundation from main river systems. Intense rainfall events generate rapid runoff and sediment mobilisation on unstable slopes, producing debris-laden flows that affect settlements located on alluvial fans and valley margins¹¹⁹².

Disaster reporting highlights that flood and mudflow impacts in Sangvor primarily affect mountain villages, local roads, and access infrastructure rather than extensive agricultural floodplains or dense urban areas. Damage to roads and bridges frequently disrupts access to markets, health services, and emergency response, even when the spatial extent of flooding is limited¹¹⁹³. Channel avulsion and sediment deposition during mudflow events can render land temporarily unusable and damage household assets in valley pockets¹¹⁹⁴.

Comparative assessments for the Rasht Valley indicate that districts such as Sangvor experience a different flood risk profile from both upper-valley flash flood-dominated districts and mid-valley riverine flood districts. In Sangvor, slope-driven processes and sub-catchment dynamics play a greater role than mainstream river flooding in shaping impacts¹¹⁹⁵.

Climate change is expected to exacerbate mudflow and debris-flow risk in Sangvor. National climate assessments indicate a warming trend and increasing precipitation variability across Tajikistan, including a higher likelihood of intense rainfall events¹¹⁹⁶. Hydrological modelling for snow- and glacier-influenced basins indicates increasing frequencies of heavy precipitation

¹¹⁸⁷ <https://asiaplustj.info/en/news/tajikistan/20100328/japan-assists-grass-roots-agricultural-projects-tajikistan>

¹¹⁸⁸ <https://en.avesta.tj/2025/07/07/tajikistan-faces-threat-of-glacial-mudflows-and-rising-water-levels-in-rivers/>

¹¹⁸⁹ <https://www.geotajikistan.org/land-ecosystems/climate-migration-villages-relocating-from-risk/>

¹¹⁹⁰ <https://www.preventionweb.net/news/resilient-roads-protecting-critical-lifelines-mountainous-tajikistan>

¹¹⁹¹ <https://www.adrc.asia/countryreport/TJK/2005/english.pdf>

¹¹⁹² UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹¹⁹³ *Ibid*

¹¹⁹⁴ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁹⁵ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹¹⁹⁶ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

under future climate conditions, processes associated with heightened debris-flow activity in steep mountainous terrain.

In comparative terms, Sangvor faces higher exposure to mudflows and mudflows than Lakhsh and Tojikobod, but lower exposure to prolonged riverine flooding and waterlogging associated with wider valley floors and irrigation systems.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Sangvor is shaped by dispersed settlement patterns, heavy reliance on livestock and pasture-based livelihoods, and limited redundancy in access routes and services. Floods and mudflows disproportionately affect fodder availability, hillside agriculture, and pasture access, with knock-on impacts for household food security and income stability¹¹⁹⁷.

Adaptive capacity is constrained by limited protective infrastructure, high exposure of settlements on alluvial fans, and variable access to timely early warning information. While community-based coping mechanisms exist, limited institutional capacity and infrastructure investment increase sensitivity to recurrent mudflow events and prolong recovery periods following disasters¹¹⁹⁸.

Key Climate Risk Drivers

Climate risk in Sangvor arises from the interaction of steep sub-catchment morphology, sediment mobilisation on unstable slopes, and livelihood dependence on pasture and hillside agriculture. Settlement patterns on alluvial fans and in narrow valley pockets amplify exposure to channel shifts and debris deposition during flood events, while constrained adaptive capacity increases sensitivity to repeated disruption^{1199, 1200}.

Indicative Adaptation Priorities

Addressing climate risk in Sangvor will require a combination of mudflow risk reduction, slope and catchment management, and livelihood resilience measures. Priority needs include strengthening localised early warning systems for mudflows and mudflows, improving protection and maintenance of local roads and access routes, and supporting climate-resilient pasture and livestock management to reduce sensitivity to slope-related hazards¹²⁰¹. Strengthening district-level preparedness and community-based disaster risk management will be important to support sustained adaptation outcomes in this high-relief context¹²⁰².

District Profile of Tojikobod

¹¹⁹⁷ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹¹⁹⁸ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹¹⁹⁹ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹²⁰⁰ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁰¹ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹²⁰² World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

Geography

Tojikobod district borders Sangvor district to the south, Lakhsh district to the east, and Rasht district to the northwest. The total area of the district is 0.73 km². Tojikobod is situated in the valley network of the Surkhob River, a tributary of the Vakhsh River (Figure 117)¹²⁰³. The Surkhob is formed at the confluence of the Kysylsuu and Muksu rivers. It flows for approximately 150 km in a west-southwest direction. Eventually, it joins with the Obichingou, coming from the east, to form the Vakhsh River. The Surkhob drains the southern flank of the Alay Mountains. The A372 highway runs along the river. The towns of Tojikobod and Gharm lie on its banks. At the Gharm gauging station, the average discharge is 325 m³/s. During the summer months of July and August, the Surkhob carries its most significant volume of water. Thus, the district's hydrology is directly tied to the Surkhob–Vakhsh basin system^{1204,1205}. As part of the broader high-mountain region of Tajikistan, water supply and river discharge regimes in Tojikobod are heavily influenced by snow- and glacier-fed runoff. This is the general hydrological regime for mountain rivers in the country¹²⁰⁶.

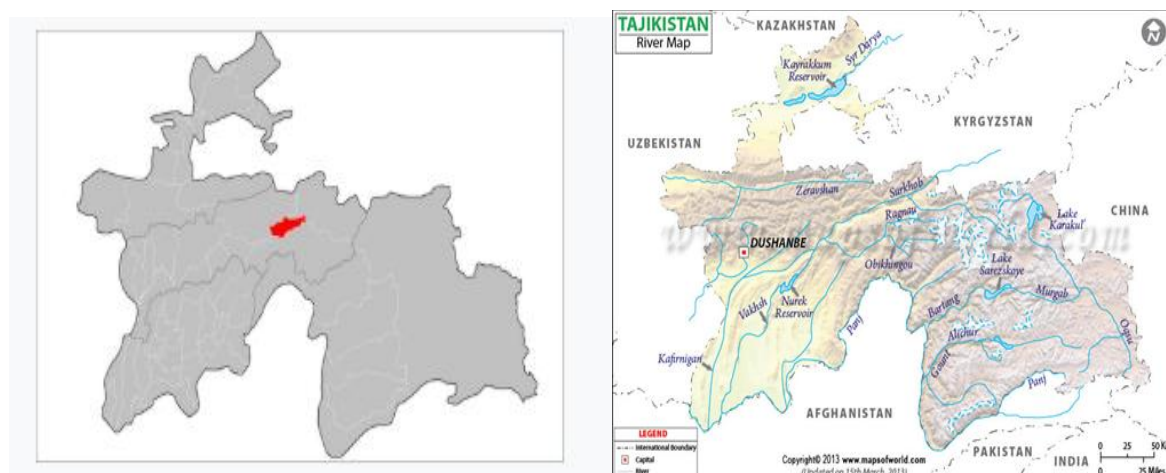


Figure 117. Tojikobod district (left)¹²⁰⁷ and its river basin system (right)¹²⁰⁸.

Socioeconomic profile

As of 2024, the Tojikobod District has an estimated population of 53,500 from approximately 46,900 in 2020, with a population density of 68 people per km². The population, comprising 25,317 males and 24,419 females, is concentrated mainly in valley jamoats, where public services and markets are accessible¹²⁰⁹. The district consists of 45 villages and five jamoats, encompassing 6,942 households, with approximately 40% of the population engaged in agriculture¹²¹⁰. The local economy is dominated by smallholder agriculture and livestock rearing, supplemented by remittances. Crop and livestock production, including potatoes, grains, vegetables, household plots, and mountain pasture grazing, forms the core of livelihoods, combining subsistence and semi-commercial farming activities¹²¹¹. Seasonal and longer-term labour migration to Russia and neighbouring countries provides a critical source

¹²⁰³ <https://it.wikipedia.org/wiki/Surchob>

¹²⁰⁴ <https://it.wikipedia.org/wiki/Surchob>

¹²⁰⁵ <https://www.mapsofworld.com/tajikistan/river-map.html>

¹²⁰⁶ https://www.cawater-info.net/bk/water_land_resources_use/english/docs/fiziko_geog_kharack_tajikistan.html

¹²⁰⁷ https://en.wikipedia.org/wiki/Tojikobod_District

¹²⁰⁸ <https://www.mapsofworld.com/tajikistan/river-map.html>

¹²⁰⁹ https://www.citypopulation.de/en/tajikistan/admin/noh%CC%A6ijah%CC%A6oi_tobei_%C3%A7umh/557_to%C3%A7ikobo/

¹²¹⁰ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹²¹¹ <https://cgspace.cgiar.org/server/api/core/bitstreams/c429fcab-f2a9-4326-8753-4f5871cb75cc/content>

of income, while casual construction and public-sector employment offer limited alternatives. Non-farm activities, such as small-scale trade, local services, and occasional agro-processing, remain constrained by the district's mountainous terrain and poor market access. While development initiatives in the Rasht Valley aim to diversify livelihoods, agriculture and remittances continue to be the primary sources of income¹²¹².

Agricultural profile

Agriculture in Tojikobod mirrors the broader patterns of the Rasht Valley's mountain landscapes. Farming is concentrated in small, irrigated plots along lower terraces, where households cultivate potatoes, vegetables, cereals, pulses, and wheat. Higher slopes are reserved for grazing, while hay and fodder are produced to sustain livestock through the long winters. Water availability, largely dependent on snowmelt and tributary streams, dictates cropping windows, and most production remains oriented toward household consumption rather than large-scale commercial farming¹²¹³. The valley's fertile soils support a diverse range of agricultural activities, yet land use is highly constrained. Of Tojikobod's 73,434 ha of total land area, only 3,188 ha is arable, with 497 ha under perennials and a vast 35,802 ha dedicated to pasture. Altogether, agricultural lands cover 39,490 ha, but household plots (2453 ha) and privately owned lands (437 ha) remain relatively limited (Table 18)¹²¹⁴. Irrigation systems, largely Soviet-era gravity-fed channels, cover approximately 74% of cultivated land, although inefficiencies often result in water scarcity during the summer months¹²¹⁵.

Agricultural livelihoods are dominated by small-scale dekhan farms¹²¹⁶, with over 11,000 active across the Rasht Valley. These farms form the backbone of local food systems, producing a range of products, including meat, dairy, and staple crops. Apples are a hallmark of the region, with more than 50 varieties cultivated, alongside other fruit trees. Most produce is sold in district markets, with smaller volumes reaching Dushanbe. However, proximity to the capital has driven down local food prices, while the cost of inputs and machinery remains high, reducing profitability for farmers¹²¹⁷.

Table 18. Land area (ha) by type of land cover as of 2021¹²¹⁸.

Land category	Tojikobod
Total land area, including irrigated lands	73,437
	4,222
Total arable land, including irrigated areas	3,188
	1,863
Perennials, including irrigated perennials	497
	425
Abandoned lands, including irrigated lands	-
	-
Grasslands, including irrigated lands	3
	-
Pastures, including irrigated lands	35,802
Total agricultural lands, including irrigated lands	39,490
	2,288
Total households' plots, including irrigated lands	2453
	1,820

¹²¹² <https://cgspace.cgiar.org/server/api/core/bitstreams/c429fcab-f2a9-4326-8753-4f5871cb75cc/content>

¹²¹³ https://www.preventionweb.net/files/73806_73806gizclimatechange profilerashtva.pdf?startDownload=true

¹²¹⁴ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

¹²¹⁵ https://www.landuse-ca.org/wp-content/uploads/2019/04/2020_GIZ-Climate-Change-Profile-Rasht-Valley_EN.pdf

¹²¹⁶ Smallholder, family-owned agricultural farm

¹²¹⁷ https://www.preventionweb.net/files/73806_73806gizclimatechange profilerashtva.pdf?startDownload=true

¹²¹⁸ <https://documents1.worldbank.org/curated/en/099555205042212287/pdf/P175356059851a0b5098a50ca06e50353cf.pdf>

Land category	Tojikobod
Privately owned lands, including irrigated lands	437
	88

Hazard profile

Tojikobod shares the Rasht Valley’s longstanding vulnerability to natural hazards, including seasonal floods, mudflows, and landslides — especially during the spring to early summer snowmelt and heavy rainfall periods — as well as winter avalanches and year-round seismic risk¹²¹⁹. Heavy rains and melting glaciers regularly trigger debris flows that damage roads, bridges, farmland, homes, and infrastructure¹²²⁰. Warming temperatures and shifting precipitation patterns have altered the local climate: winters have become warmer; snowfall seasons sometimes start unusually early. Since October 2016, heavy rainfall events have increased, exacerbating runoff, accelerating glacier melt, and heightening the likelihood of floods, landslides, and mudflows¹²²¹. For instance, a 2024 mudslide in Miraziyon village destroyed two houses, damaged several more, and impacted water pipelines, bridges, and livestock, demonstrating how geophysical hazards and human exposure intersect in the district¹²²². These climatic shifts have a detrimental impact on agriculture, resulting in soil erosion, nutrient loss, damage to fruit buds and crops, and increased pest pressure. Meanwhile, these climatic disasters often destroy or degrade infrastructure related to livelihoods (such as irrigation systems, water pipelines, and storage facilities) and block transportation routes, further disrupting livelihoods¹²²³.

In addition to climatic hazards, Tojikobod faces non-climatic hazards that further threaten livelihoods and infrastructure. The district is situated in a seismically active region, making it vulnerable to earthquakes that can cause damage to homes, schools, roads, and bridges. Past seismic events in the Rasht Valley have resulted in the partial or complete destruction of residential structures, as well as disruptions to transportation and communication networks. The mountainous terrain also increases the risk of land degradation, slope failures, and infrastructure collapse, particularly where human activities such as road construction, agriculture on steep slopes, and deforestation reduce slope stability. Non-climatic hazards in Tojikobod often exacerbate the effects of natural disasters, making recovery more challenging by impacting water supply systems, bridges, livestock, and storage facilities¹²²⁴.

Flood and Mudflow Risk

Flood risk in Tojikobod is shaped by its position along mid-valley reaches of the Surkhob–Rasht river system, where tributary confluences increase floodplain width and water accumulation during high-flow periods. As a result, flood events are more likely to involve overbank river flooding rather than only short-duration flash runoff¹²²⁵.

Flood impacts in Tojikobod are strongly mediated through irrigation and drainage systems. Ageing irrigation canals, limited drainage capacity, and canal crossings near settlements contribute to overtopping and blockage during high flows, leading to localised waterlogging of

¹²¹⁹ https://www.acaps.org/fileadmin/Data_Product/Main_media/170711_start_tajikistan_anticipatory_bn_flooding.pdf

¹²²⁰ https://www.preventionweb.net/files/73806_73806gizclimatechangeoprofilerashtva.pdf?startDownload=true

¹²²¹ https://www.acaps.org/fileadmin/Data_Product/Main_media/170711_start_tajikistan_anticipatory_bn_flooding.pdf

¹²²² https://www.acaps.org/fileadmin/Data_Product/Main_media/170711_start_tajikistan_anticipatory_bn_flooding.pdf

¹²²³ <https://www.acaps.org/en/countries/archives/detail/tajikistan-flooding-in-the-rasht-valley>

¹²²⁴ https://www.acaps.org/fileadmin/Data_Product/Main_media/170711_start_tajikistan_anticipatory_bn_flooding.pdf

¹²²⁵ *Ibid*

agricultural land and damage to crops¹²²⁶. Because the district centre and surrounding jamoats are located close to the river corridor, administrative buildings, markets, transport links, and irrigated fields are jointly exposed, increasing the potential for systemic service disruption during flood events¹²²⁷.

Comparative regional assessments for the Rasht Valley indicate that mid-valley districts such as Tojikobod experience a different flood risk profile from upper-valley districts, with a greater role of riverine inundation and infrastructure-mediated impacts, and less dominance of debris-flow-driven flash flooding¹²²⁸.

Climate change is expected to exacerbate flood risk in Tojikobod. National climate assessments indicate a warming trend and increasing precipitation variability across Tajikistan, including a higher likelihood of intense rainfall events¹²²⁹. Hydrological modelling for snow- and glacier-fed river basins indicates increasing peak flows and higher flood volumes under future climate conditions, processes that increase the likelihood of overbank flooding and drainage exceedance in mid-valley districts such as Tojikobod.

In comparative terms, Tojikobod faces lower exposure to rapid-onset flash floods than upper-valley districts such as Lakhsh, but higher exposure to riverine flooding and waterlogging due to floodplain development, irrigation systems, and settlement concentration near river confluences.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Tojikobod is driven by dependence on climate-sensitive irrigated agriculture, limited livelihood diversification, and exposure of key services and assets to flood impacts. Flood-related damage to crops, irrigation infrastructure, and local markets can disrupt household incomes and food availability, while impacts on administrative and service centres increase wider socio-economic disruption¹²³⁰.

Adaptive capacity is constrained by the condition of irrigation and drainage infrastructure, limited redundancy in transport and service networks, and variable access to timely flood early warning information. While Tojikobod benefits from better valley-floor access compared to upper-valley districts, the co-location of administrative, economic, and agricultural assets along flood-prone river corridors increases sensitivity to flood events¹²³¹.

Key Climate Risk Drivers

Climate risk in Tojikobod arises from the interaction of riverine flood hazards, irrigation and drainage system performance, and settlement concentration near river confluences.

¹²²⁶ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹²²⁷ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹²²⁸ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²²⁹ Agency for Hydrometeorology of the Committee for Environment Protection under the Government of the Republic of Tajikistan. *Fourth National Communication Of The Republic Of Tajikistan Under The United Nations Framework Convention On Climate Change*. 2022, <https://unfccc.int/documents/614376>.

¹²³⁰ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹²³¹ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

Floodplain development and ageing canal infrastructure amplify the impacts of elevated river flows, while reliance on irrigated agriculture increases livelihood sensitivity to waterlogging and crop damage¹²³². These factors distinguish Tojikobod from both upper-valley flash flood-dominated districts and lower-risk, more dispersed valley settings¹²³³.

Indicative Adaptation Priorities

Addressing climate risk in Tojikobod will require a combination of riverine flood management, irrigation system rehabilitation, and institutional strengthening measures. Priority needs include improving the capacity and maintenance of irrigation and drainage canals to manage high flows, strengthening flood forecasting and early warning systems for riverine flooding, and integrating flood risk considerations into settlement planning and protection of district centres¹²³⁴. Strengthening local disaster preparedness and coordination capacity will be important to reduce systemic service disruption during flood events¹²³⁵.

Gorno-Badakhshan Autonomous Oblast (GBAO)

Gorno-Badakhshan Autonomous Oblast (GBAO) occupies the vast eastern portion of the Republic of Tajikistan, encompassing approximately 45% of the country's total land area, but is home to only a small fraction of its population due to its extreme altitude and rugged terrain. The administrative centre of the region is Khorog, situated along the Panj River in the heart of the Pamir Mountain system. GBAO consists of seven districts and one city (Khorog), with most of its roughly 220,200 inhabitants living in intermontane valleys and high-altitude settlements scattered across steep slopes and remote plateaus. Its sparse population density reflects both the challenging physical environment and limited economic opportunities relative to Tajikistan's lowland regions^{1236,1237}.

The region's economy is primarily based on subsistence agriculture, livestock herding, and small-scale artisanal activities, with pastoralism and animal husbandry central to rural livelihoods. Valley floors support limited horticultural production of fruits and vegetables, while mountain pastures sustain yaks, sheep, and goats. Small-scale mining and processing of local raw materials also contribute to local economic activity; however, industrial output remains significantly lower than national averages due to geographic isolation and underdeveloped infrastructure. Tourism holds potential, given the region's dramatic alpine landscapes, but remains nascent and requires further investment¹²³⁸. There is a clear upward trend in the gross regional product (GRP) of GBAO from 2013 to 2019. In 2013, GRP amounted to 633.2 million Tajik somoni (approximately US\$133 million; based on the average annual exchange rate for that year). By 2019, GRP had increased to 1,063.4 million somoni (approximately US\$110 million), reflecting both nominal growth in regional output and the significant depreciation of the somoni over the period. Despite growth in nominal terms, the decline in US\$ value highlights the region's continued economic vulnerability and exposure to macroeconomic and external shocks, particularly in remote and structurally constrained regions such as GBAO¹²³⁹.

¹²³² World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹²³³ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²³⁴ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹²³⁵ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²³⁶ https://www.orexca.com/tajikistan/regions/gorno_badakhshan_region.htm

¹²³⁷ <https://tojikiston.info/>

¹²³⁸ https://www.orexca.com/tajikistan/regions/gorno_badakhshan_region.htm

¹²³⁹ Garibova, F.M. 2022. Socio-economic development of the Gorno-Badakhshan Autonomous Region. [Available online.](#)

Agricultural activity in GBAO occurs under extreme natural and climatic conditions, resulting in higher labour requirements, increased capital intensity, and lower productivity compared to other regions of Tajikistan. Consequently, sustained development requires higher levels of investment, targeted subsidies, and fiscal incentives. Recent government measures have aimed to stabilise socio-economic conditions and enable the operation of international development partners, including the Aga Khan Development Network and affiliated institutions, which play a critical role in supporting infrastructure, energy, health and livelihoods in the region¹²⁴⁰.

The sectoral structure of the GRP in GBAO shifted between 2013 and 2018, reflecting a gradual process of economic diversification (Table 19). In 2013, agriculture accounted for 47% of GRP, declining to 29% by 2018, while the share of industry and energy doubled from 6% to 12% over the same period. The construction sector remained significant, increasing from 19% in 2013 to 21% in 2018, highlighting sustained investment in physical infrastructure. Retail trade turnover in GBAO amounted to 101.3 million somoni in 2013 (approximately US\$21 million). It showed a steady upward trend, reaching 154.7 million somoni by 2019 (approximately US\$16 million), reflecting nominal growth alongside currency depreciation (Socio-economic development of the Gorno-Badakhshan Autonomous Region, 2022). Over the same period, industrial production increased markedly, from 75.1 million somoni in 2010 (approximately US\$17 million) to 249.3 million somoni in 2019 (approximately US\$26 million), indicating an expansion of industrial activity despite structural constraints¹²⁴¹.

GBAO possesses substantial natural resource endowments, particularly minerals and hydropower potential, and has historically been regarded as a strategic resource base, including during the Soviet period when it was considered a key gold reserve area. The region is often described as the “Golden Gate of Tajikistan”, reflecting its deposits of gold, silver, tin, iron ore, polymetals, gemstones and construction materials. However, exploitation remains limited due to harsh climatic conditions, remoteness, weak infrastructure, and a short effective working season of 3–5 months, which constrains investor returns despite the long-term potential of modern, technology-driven extraction¹²⁴².

Table 19. Gross regional product by sector in GBAO in 2013–2018, %.

Sector	2013 (%)	2018 (%)
Agriculture	47	29
Industry and energy	6	12
Construction	19	21
Trade and services	6	9
Transport and communications	1	6
State administration	2	3
Education	10	10
Healthcare	7	6
Utility bills	1	2
Taxes	1	2

GBAO's climate is predominantly alpine and continental, characterised by long, cold winters, cool summers, and sharp diurnal temperature fluctuations. High elevations and steep topography create strong microclimatic gradients, with large areas above 3,000 m that are permanently snow-covered or glaciated. Arable land is extremely limited, concentrated mainly in narrow river valleys, and agriculture is inherently sensitive to climatic variability and water availability. Extreme weather events, including drought, frost, and episodic intense

¹²⁴⁰ Garibova, F.M. 2022. Socio-economic development of the Gorno-Badakhshan Autonomous Region. [Available online.](#)

¹²⁴¹ Garibova, F.M. 2022. Socio-economic development of the Gorno-Badakhshan Autonomous Region. [Available online.](#)

¹²⁴² Garibova, F.M. 2022. Socio-economic development of the Gorno-Badakhshan Autonomous Region. [Available online.](#)

precipitation, regularly challenge food production and infrastructure stability. Natural hazards in GBAO include landslides, floods, avalanches, earthquakes, and soil erosion, exacerbated by steep slopes, seismic instability, and seasonal storms. These dynamics, combined with high transportation costs and isolation from major markets, constrain local development and exacerbate vulnerability among rural communities. Improving risk management, climate adaptation planning, and resilient infrastructure is therefore critical for sustainable development, particularly in remote jamoats where access to basic services remains limited¹²⁴³. Within the GBAO region, the districts of Rostqala and Ishkoshim have been selected for project interventions.

District Profile of Rostqala

Geography

Roshtqala District, located in the eastern part of Tajikistan within the Gorno-Badakhshan Autonomous Region (GBAO) (Figure 118). The district is a predominantly rugged and high-mountain area shaped by the Shakh dara River and its narrow valley. The administrative centre, Roshtqala village, lies in the western part of the district along this valley, which runs between the Shughnon Range to the north and the Shakh dara Range to the south. The district spans about 4,300 km², but only a very small share is arable due to steep slopes and narrow valley floors, resulting in dispersed settlements positioned on small terraces and side valleys with difficult access to services and infrastructure. Its landscape is dominated by high-altitude valleys, gorges, and towering peaks, including Karl Marx Peak to the south, which contribute not only to the district's dramatic scenery but also to exposure to natural hazards such as landslides, rockfalls, avalanches, and flash floods triggered by heavy rainfall or rapid snowmelt^{1244,1245,1246}.



Figure 118. Rostqala District, Tajikistan¹²⁴⁷.

Socioeconomic profile

Roshtqala District remains one of Tajikistan's most socio-economically vulnerable mountainous districts, with an estimated 27,400–28,100 residents residing in six remote jamoats, where livelihood opportunities are shaped by altitude, isolation, and limited market access¹²⁴⁸. Poverty levels in GBAO consistently exceed national averages, with regional estimates ranging between 26% a reflection of structural constraints such as poor connectivity, low industrial activity, and limited investment, all of which apply strongly to rural districts like

¹²⁴³ <https://visitsilkroad.org/destination/tajikistan/gorno-badakhshan/>

¹²⁴⁴ https://en.wikipedia.org/wiki/Roshtqal%27a_District

¹²⁴⁵ <https://mapcarta.com/27686704>

¹²⁴⁶ https://pamirs.org/discover/roshtkala_shokhdara/

¹²⁴⁷ https://en.wikipedia.org/wiki/Roshtqal%27a_District

¹²⁴⁸ https://en.wikipedia.org/wiki/Roshtqal%27a_District

Roshtqala¹²⁴⁹. Employment opportunities are limited, with subsistence agriculture and livestock rearing forming the backbone of household income. This mirrors national rural trends, where agriculture employs about 60% of the workforce¹²⁵⁰. In high-altitude GBAO districts such as Roshtqala, over 60% of rural households depend on livestock, mainly cattle, sheep, and goats, for food security and income, as crop production is restricted by harsh climate, short growing seasons, and lack of arable land¹²⁵¹. Non-farm employment remains scarce due to the minimal presence of industry, weak development of the service sector, and limited private sector investment across GBAO. As a result, many working-age residents rely on seasonal or long-term labour migration, with remittances forming a significant share of household income. This nationwide trend is particularly pronounced in economically isolated districts, such as Roshtqala¹²⁵². Development interventions led by the World Bank, AKDN, and NGOs have focused on improving water supply, local infrastructure, small-scale agricultural facilities, and community resilience, aiming to alleviate chronic vulnerability and expand livelihood options in this remote high-mountain district¹²⁵³.

Agricultural profile

Agriculture in Roshtqala District is highly constrained by its steep mountainous terrain, high-altitude climate, and limited arable land. Most cultivation occurs along narrow valley floors and terraces beside the Shakhdara River. The district encompasses approximately 4,300 km², but only a small fraction is suitable for farming, as cultivation is mainly limited to the narrow Shakhdara valley, reflecting Tajikistan's broader pattern where arable land is scarce and concentrated in irrigated river valleys¹²⁵⁴. The principal crops grown include potatoes, wheat, barley, and various horticultural crops, while household gardens provide vegetables and fruits for subsistence^{1255,1256}. Livestock rearing is a major component of agriculture, with families keeping sheep, goats, and cattle for meat, dairy, and wool, often grazing on high-altitude pastures in summer¹²⁵⁷. Irrigation is generally small-scale and community-managed, supporting both staple crops and garden plots; however, the combination of steep slopes, limited irrigation infrastructure, and harsh climatic conditions restricts productivity and the potential for commercial agriculture. Development initiatives by organisations such as the Aga Khan Foundation (AKF), the United States Agency for International Development (USAID), and other NGOs have aimed to improve storage, water management, and small-scale agricultural infrastructure to reduce post-harvest losses and enhance market access. However, subsistence farming continues to dominate livelihoods¹²⁵⁸.

Hazard profile

Roshtqala District, located in the high-mountain terrain of Gorno-Badakhshan Autonomous Region (GBAO), is exposed to a complex combination of climatic and non-climatic hazards that interact with its steep topography, glacier-fed rivers, and dispersed mountain settlements. Climatic and cryospheric hazards include glacial-lake outburst floods (GLOFs), flash floods,

¹²⁴⁹ <https://documents1.worldbank.org/curated/en/099091825032032367/pdf/P500758-944805c9-3b47-4447-8fb8-f00495f6546f.pdf>

¹²⁵⁰ https://en.wikipedia.org/wiki/Agriculture_in_Tajikistan

¹²⁵¹ <https://www.asiaplustj.info/en/news/tajikistan/economic/20250919/tajikistans-pastures-can-the-lost-be-restored>

¹²⁵² <https://www.worldbank.org/en/news/press-release/2025/09/22/tajikistan-reduces-poverty-but-job-creation-and-inequality-remain-key-challenges>

¹²⁵³ <https://www.worldbank.org/en/news/press-release/2025/06/06/tajikistan-to-boost-community-livelihoods-infrastructure-and-resilience-with-additional-financing-from-the-world-bank>

¹²⁵⁴ https://en.wikipedia.org/wiki/Roshtqal%27a_District

¹²⁵⁵ <https://documents1.worldbank.org/curated/en/721271637347625022/pdf/Environmental-and-Social-Management-Framework-ESMF-RESILAND-CA-Tajikistan-Resilient-Landscape-Restoration-Project-P171524.pdf>

¹²⁵⁶ <https://www.akfusa.org/our-stories/supporting-tajikistans-farmers-storage/>

¹²⁵⁷ <https://www.asiaplustj.info/en/news/tajikistan/economic/20250919/tajikistans-pastures-can-the-lost-be-restored>

¹²⁵⁸ <https://www.akfusa.org/our-stories/supporting-tajikistans-farmers-storage/>

mudflows, and debris flows, which are driven by intense rainfall, rapid snow and glacier melt, and the unstable moraine-dammed lakes¹²⁵⁹ that characterise the upper Shakhdara basin. Roshtqala has a recorded history of glacier- and weather-driven disasters, including a catastrophic glacial-lake outburst flood (GLOF) in the Shakhdara valley (near Dasht, Roshtqala District) in August 2002, which killed approximately 25 people and destroyed the village, providing a direct local example of GLOF impacts in Roshtqala¹²⁶⁰. The Shakhdara River, which drains the district, is glacier-fed (average discharge $\approx 35.2 \text{ m}^3/\text{s}$), so seasonal melt and extreme melt/precipitation events rapidly change the flow, driving flash floods and debris flows¹²⁶¹. During the widespread 2015 floods and mudslides across Gorno-Badakhshan, many houses and infrastructure were destroyed, underlining that intense rain/snowmelt events repeatedly impact the region (including Roshtqala's valley systems)¹²⁶². More recently (June 2023), authorities ordered the relocation of 210 families in Roshtqala because rising Shakhdara river levels and local flooding threatened settlements — a clear, contemporary example of climatic flood risk in the district¹²⁶³.

Non-climatic hazards are equally significant: the district is situated in an active seismic zone, as Tajikistan lies along the collision boundary of the Eurasian and Indian plates — a region of intense tectonic activity and high seismicity. According to the International Institute of Seismology and Earthquake Engineering, at least seven earthquakes with magnitudes above 6.5 have had epicentres in Tajikistan since 1900. Meanwhile, GBAO has recorded earthquakes with magnitudes ranging from 5 to 7.2 between 2015 and 2021, which have frequently triggered landslides, rockfalls, and slope failures, affecting road access and settlements¹²⁶⁴.

Flood and Mudflow Risk

Flood risk in Roshtqala is dominated by riverine processes along the Panj River, combined with sediment-laden inflows from steep tributary valleys. Snowmelt and heavy rainfall events generate high river stages and increase bank erosion and overbank flooding in areas where settlements, roads, and power infrastructure are located directly on narrow floodplain terraces¹²⁶⁵.

Disaster reporting for GBAO consistently documents floods and mudflows affecting river-adjacent communities and transport corridors, reflecting the district's exposure to sudden, high-energy hydrological events rather than slow-onset inundation¹²⁶⁶. Flood impacts in Roshtqala therefore combine direct damage to agricultural land with disruption of road access linking valley settlements to district and regional centres.

Climate change is expected to intensify these risks. National climate assessments indicate rising temperatures, altered snowmelt dynamics, and increasing precipitation variability across

¹²⁵⁹ a loose pile of rocks, soil, and debris left behind by a glacier

¹²⁶⁰ <https://glofca.org/wp-content/uploads/Atlas-%E2%80%94English.pdf>

¹²⁶¹ https://en.wikipedia.org/wiki/Shakhdara_River

¹²⁶² <https://www.rferl.org/amp/tajikistan-floods-mud-slides/27137809.html>

¹²⁶³ <https://old.asiaplustj.info/en/news/tajikistan/incidents/20230629/210-families-in-gbaos-roshtqala-district-to-be-relocated-to-safe-places-due-to-rise-in-the-level-of-river-water>

¹²⁶⁴ <https://glofca.org/wp-content/uploads/Atlas-%E2%80%94English.pdf>

¹²⁶⁵ World Bank. *Global Facility for Disaster Reduction and Recovery (GFDRR), Tajikistan Country Evaluation*. 2026, <https://documents1.worldbank.org/curated/en/099912501232636289/pdf/IDU-53650fa3-eb52-4fbb-82fa-79225fd2a861.pdf>.

¹²⁶⁶ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

Tajikistan, processes that are particularly relevant for glacier- and snowmelt-fed river systems such as the Panj¹²⁶⁷.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Roshtqala is shaped by reliance on climate-sensitive agriculture, livestock grazing, and limited livelihood diversification. Floods and mudflows affect both cropland and access to pasture, while damage to river-corridor roads can isolate communities and constrain access to markets, services, and emergency assistance¹²⁶⁸.

Adaptive capacity is constrained by limited engineered flood protection, challenging terrain, and logistical difficulties in maintaining infrastructure in high-mountain environments. These constraints increase recovery times following hazard events and disproportionately affect poorer households with limited resources for repair and adaptation¹²⁶⁹.

Key Climate Risk Drivers

Climate risk in Roshtqala arises from the interaction of mainstem river flooding, tributary sediment inflows, and linear settlement patterns along the Panj River. These physical drivers are compounded by livelihood dependence on river-adjacent agriculture and infrastructure, increasing sensitivity to both flood damage and prolonged isolation¹²⁷⁰.

Indicative Adaptation Priorities

Priority needs include strengthening riverbank protection and slope stabilisation along river corridors, improving the resilience of roads and bridges to flood and debris impacts, and enhancing local preparedness and early warning for flood and mudflow events. Strengthening district-level disaster response capacity will be essential to reduce isolation-related impacts and support recovery¹²⁷¹.

District Profile of Ishkoshim

Geography

Ishkoshim District is located in the extreme south-west of the GBAO in eastern Tajikistan (Figure 119). It borders Afghanistan along the Panj River to the south and west and shares a northern border with the Roshtqal'a District. Short borders exist with Shughnon District to the north and Murghab District to the east. The district is roughly V-shaped, lying northeast of the Panj River where it turns from west to north. The Shakh dara Range defines the northern border, while the Ishkoshim Range runs along the eastern boundary. Its administrative centre is the town of Ishkoshim, located on the bend of the Panj River, opposite the Afghan Ishkashim District^{1272,1273}.

¹²⁶⁷ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁶⁸ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹²⁶⁹ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁷⁰ *Ibid*

¹²⁷¹ *Annex 2: Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹²⁷² World Bank 2025. PID Rural Electrification Project (P170132)—Additional Financing Request 3. [Available online.](#)

¹²⁷³ https://en.wikipedia.org/wiki/Ishkoshim_District

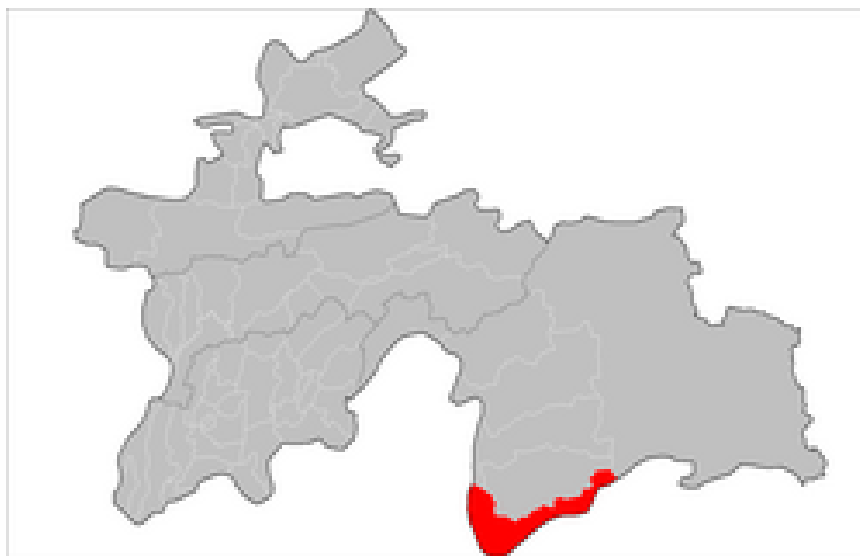


Figure 119. Location of Ishkoshim District, Tajikistan¹²⁷⁴.

The district area is 3,656 km², and it is divided into seven jamoats, with population concentrated in valley floor settlements rather than high plateaux. Official 2020 estimates place the district population at approximately 32,900, reflecting a low population density relative to lowland provinces, but substantial local clustering around rivers and road corridors¹²⁷⁵.

Socioeconomic profile

The district economy is predominantly rural and subsistence-based, with households relying on agriculture, livestock, remittances, and small-scale cross-border trade. The mountainous terrain and seasonal isolation limit market access, service delivery, and employment opportunities, resulting in higher poverty rates and increased vulnerability compared to national averages. Public services are concentrated in the district centre and a few larger villages, while remote jamoats experience limited access to infrastructure and social services.

Agricultural profile

Agricultural activity in Ishkoshim is primarily subsistence-oriented, focusing on small irrigated plots in valley floors. Key crops include potatoes, barley, wheat, vegetables, and fruit trees adapted to short growing seasons. Livestock—particularly yaks, sheep, and goats—is central to household livelihoods and food security, especially in higher elevations where cultivation is limited. The district's steep terrain, narrow arable terraces, and reliance on traditional irrigation make agricultural production sensitive to climatic variability. FAO and World Bank assessments note that such high-mountain agriculture is often marginal and seasonal, with low mechanisation and reliance on community-managed irrigation schemes.

Hazard profile

Ishkoshim District is exposed to a complex risk environment shaped by the interaction of climatic variability, fragile mountain ecosystems and challenging topography. Climate-related

¹²⁷⁴ https://en.wikipedia.org/wiki/Ishkoshim_District

¹²⁷⁵ <https://tojikiston.info/>

hazards include recurrent droughts and episodic intense precipitation, which disrupt irrigation systems and reduce crop yields, as well as frequent frost events and a short growing season that constrain agricultural productivity. Long-term climate trends, notably rising temperatures and altered precipitation regimes, are increasing hydrological variability and placing additional stress on valley-based irrigation systems that underpin local livelihoods.

In parallel, non-climatic hazards remain significant and include landslides, rockfall, avalanches and seismic activity, driven by steep slopes and active tectonics. Floods and mudflows originating from Panj River tributaries periodically damage roads, bridges and community infrastructure, resulting in temporary isolation of settlements and disruption to markets and basic services. These risks are compounded by soil erosion and the limited availability of arable land, particularly in remote jamoats, which heightens vulnerability and undermines livelihood resilience. Collectively, these hazard dynamics underscore the need for integrated disaster risk management, climate-resilient infrastructure, improved water governance and targeted adaptation measures at both community and district levels, consistent with GCF investment priorities¹²⁷⁶.

Flood and Mudflow Risk

Flood risk in Ishkoshim is shaped by the combined flows of the Panj and Wakhan rivers, which create higher water levels and prolong inundation in low-lying areas during peak flow periods. Unlike narrower upstream districts, flood impacts in Ishkoshim are characterised more by overbank flooding and waterlogging than by short-duration flash floods alone¹²⁷⁷.

Agriculture in Ishkoshim relies on dense networks of gravity-fed irrigation canals abstracting directly from river systems. During floods, canal overtopping, sediment deposition, and poor drainage can disrupt irrigation functionality and extend impacts beyond the flood peak, resulting in prolonged agricultural losses¹²⁷⁸. Disaster reporting across Tajikistan highlights that such flood–irrigation interactions are a recurrent pathway of impact in valley-floor districts¹²⁷⁹.

Climate change is expected to exacerbate these risks through increasing temperature, altered snowmelt regimes, and greater precipitation variability, increasing both flood magnitude and the likelihood of prolonged inundation in confluence zones such as Ishkoshim¹²⁸⁰.

Vulnerability and Adaptive Capacity

Socio-economic vulnerability in Ishkoshim is driven by dependence on irrigated agriculture, concentration of settlements and services on flood-prone land, and reliance on transport corridors for trade and access to markets. Floods can therefore disrupt crop production, local services, and cross-border trade simultaneously, amplifying economic impacts¹²⁸¹.

¹²⁷⁶ World Bank 2021. Assessment of Economic Impacts from Disasters Along Key Corridors. [Available online.](#)

¹²⁷⁷ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁷⁸ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

¹²⁷⁹ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

¹²⁸⁰ World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁸¹ UN OCHA. "Tajikistan Disasters." *reliefweb*, 2026, <https://reliefweb.int/disasters?advanced-search=%28C227%29>. Accessed 26 01 2026.

Adaptive capacity is constrained by limited drainage infrastructure, ageing irrigation systems, and challenges in maintaining flood protection in remote high-mountain settings. While the district benefits from relatively good connectivity compared to more isolated upstream areas, flood impacts can still substantially disrupt livelihoods and recovery processes¹²⁸².

Key Climate Risk Drivers

Climate risk in Ishkoshim arises from river confluence dynamics, irrigation-dependent agriculture, and settlement concentration on low-lying valley floors. These physical drivers interact with livelihood sensitivity and infrastructure exposure, increasing vulnerability to both direct flood impacts and prolonged post-flood disruption¹²⁸³.

Indicative Adaptation Priorities

Priority needs include improving floodplain drainage and irrigation system resilience, strengthening early warning and preparedness for riverine flooding, and enhancing protection of key service and trade infrastructure along the Wakhan corridor. Strengthening local institutional capacity for flood management and recovery will be important to reduce compound impacts on agriculture, services, and connectivity¹²⁸⁴.

8.3. *Theory of Change and barriers to implementation*

8.3.1. Theory of Change

The project's Theory of Change (ToC) is designed to reduce the impacts of climate change on vulnerable smallholder farmers in Tajikistan. In doing so, the project will shift Tajikistan from reactive, fragmented climate responses to a proactive, integrated model for community-based adaptation. A ToC diagram for the project is provided in (Figure 120) below.

¹²⁸² World bank. *Disaster risk profiles - Tajikistan*. 2017, <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/372481493891899347>.

¹²⁸³ *Ibid*

¹²⁸⁴ Annex 2: *Feasibility Study, GCF Funding Proposal: Improving climate resilience security of vulnerable communities in Tajikistan through locally-led adaptation*. 2026.

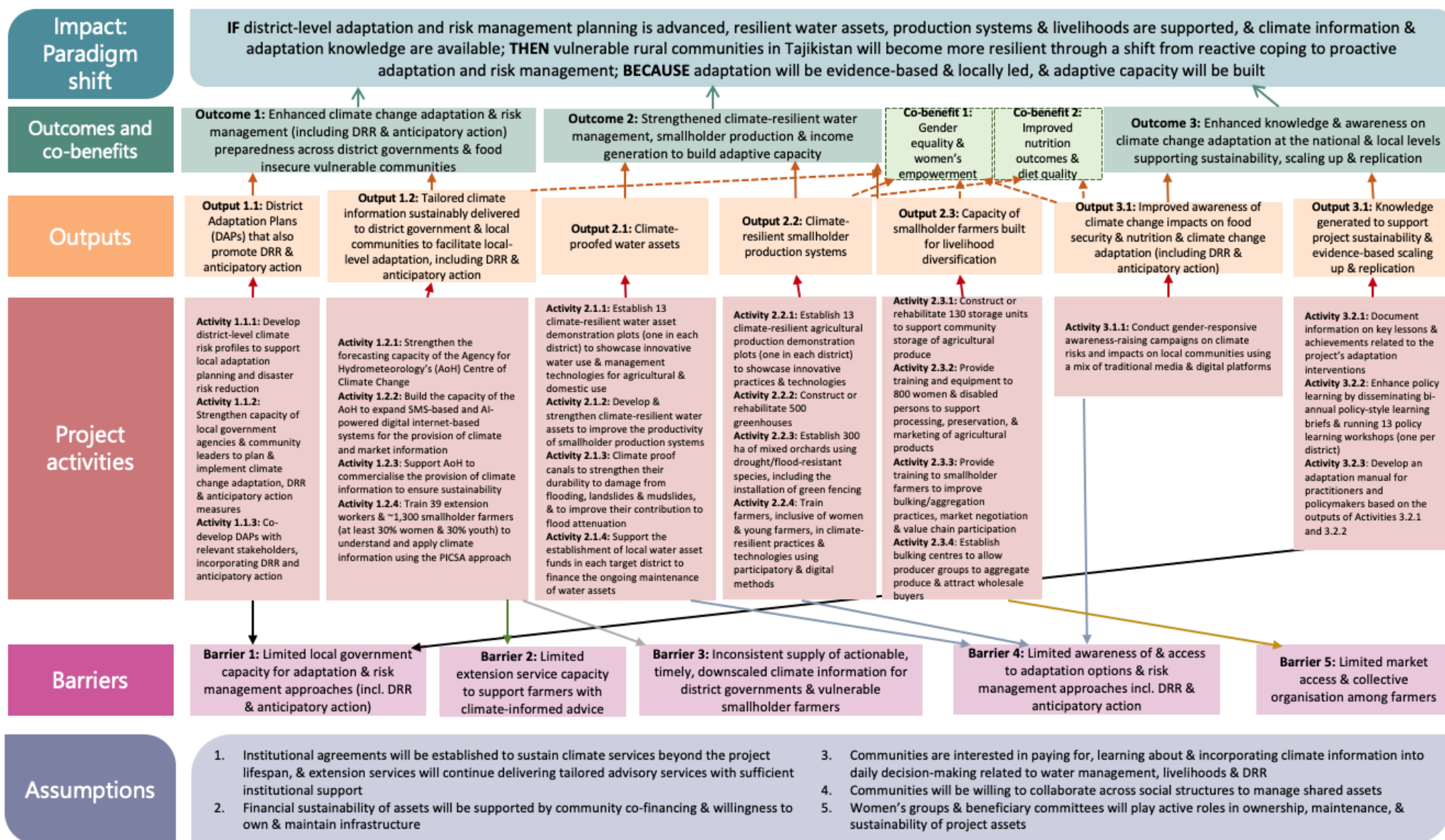


Figure 120. Theory of Change diagram.

8.3.2. Barriers to the proposed project

Barrier 1. Limited local government capacity for climate change adaptation and risk management (including DRR and anticipatory action)

Recent assessments consistently highlight that Tajikistan's subnational institutions remain weakly equipped to plan for and manage climate risks. Despite national-level progress under the ongoing National Adaptation Planning (NAP) process, district governments lack the technical skills, analytical tools, and institutional mandates to integrate climate risk, DRR and anticipatory action into development planning and investment decisions. Climate risks are insufficiently mainstreamed into sectoral and subnational planning, particularly in agriculture, water management and disaster preparedness, leading to reactive rather than preventive responses^{1285,1286}.

Capacity constraints are compounded by the fragmentation of responsibilities across institutions and the limited coordination between hydrometeorological, emergency management, and development planning bodies. Recent diagnostics of Tajikistan's disaster risk management system have identified gaps in linking climate risk information with early action protocols at the local level, thereby limiting the effectiveness of preparedness and anticipatory action^{1287,1288}. Moreover, district authorities have limited experience in translating climate risk assessments into costed and prioritised investment pipelines, which constrains access to climate finance and donor support.

The lack of systematically documented and locally relevant evidence on effective adaptation interventions further undermines the quality of planning and adaptive management. Evaluations of recent adaptation programmes in Tajikistan note that learning is often project-specific and not institutionalised within local governments, reducing prospects for scaling up and replication^{1289,1290}.

Barrier 2. Extension services lack training and agro-climatic data to support farmers with climate-informed advice

Agricultural extension services in Tajikistan are underdeveloped, underfunded and poorly equipped to support climate-informed decision-making. Fewer than 10% of farms have access to professional extension services, while demand for advisory support — particularly on climate-resilient practices — remains very high^{1291,1292}. Public extension agents often lack training in climate risk management, access to agro-climatic data, and tools to translate forecasts into farm-level recommendations.

These limitations are particularly acute in remote and hazard-prone districts, where climate variability, droughts, floods and glacier-fed water dynamics require location-specific advice. Extension curricula remain focused on conventional production practices and are insufficiently aligned with climate-smart agriculture, DRR or anticipatory action approaches. As a result, farmers rely on traditional knowledge or ad hoc advice that is increasingly misaligned with changing climate conditions¹²⁹³.

Barrier 3. Inconsistent supply of actionable, timely, downscaled climate information for district governments and smallholder farmers

¹²⁸⁵ World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

¹²⁸⁶ World Bank. 2022. *Strengthening Disaster Risk Management and Climate Resilience in Tajikistan*. World Bank Group.

¹²⁸⁷ Ibid.

¹²⁸⁸ UNDRR. 2021. *Disaster Risk Reduction in Central Asia: Regional Assessment*. United Nations Office for Disaster Risk Reduction.

¹²⁸⁹ GCF Independent Evaluation Unit (IEU). 2023. *Approaches to Scaling Up Climate Change Adaptation*. Green Climate Fund.

¹²⁹⁰ WFP. 2023. *Resilience and Food Security Programming in Tajikistan: Lessons Learned*. World Food Programme.

¹²⁹¹ World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

¹²⁹² IFPRI. 2024. *Transforming Agriculture in Tajikistan: Constraints, Opportunities and Policy Priorities*. International Food Policy Research Institute.

¹²⁹³ World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

While Tajikistan has made investments in hydrometeorological services, recent studies confirm persistent gaps in the availability and usability of climate information at local level. The Low station density, limited modelling capacity and insufficient downscaling constrain the provision of district-specific forecasts and advisories, particularly in mountainous areas with high micro-climatic variability^{1294,1295}.

Last-mile dissemination remains a critical challenge. Climate information is often delivered in technical formats that are not tailored to farmers' decision-making cycles, gender roles, or local contexts, limiting its uptake and use. Recent policy briefs on weather and climate services in Central Asia report that farmers in Tajikistan consistently identify timely, actionable forecasts (linked to concrete advisories) as a key unmet need for reducing climate-related losses^{1296,1297}. Institutional and financial constraints within the Agency for Hydrometeorology further limit the scaling of digital and mobile-based climate services.

Barrier 4. Limited awareness of and access to climate change adaptation and risk management options (including DRR and anticipatory action)

Recent national and international assessments indicate that awareness of climate change impacts, adaptation options, and anticipatory risk management remains low among rural communities and local decision-makers in Tajikistan. While communities increasingly experience climate shocks, understanding of long-term climate trends, adaptation pathways, and preventive actions remains limited^{1298,1299,1300}.

This awareness gap is reinforced by limited access to practical demonstrations, training opportunities and peer learning platforms, particularly for women, youth and people with disabilities. Behavioural assessments undertaken under food security and resilience programmes note that risk-reducing practices are often not adopted due to limited knowledge, perceived costs, and weak social diffusion mechanisms¹³⁰¹. The absence of structured awareness-raising and social learning processes hinders the adoption of climate-resilient technologies and practices, thereby weakening community-level preparedness.

Barrier 5. Poor market access and farmer organisation limit investment capacity for adaptation

Recent value-chain and agricultural sector diagnostics confirm that weak market integration is a major constraint to climate resilience among smallholder farmers in Tajikistan. Fragmented producer organisation, limited storage and processing infrastructure, and asymmetric market information result in early sales to intermediaries at low prices, reducing incomes and investment capacity^{1302,1303}.

Underdeveloped agro-processing and cold storage capacity exacerbate post-harvest losses and discourage diversification into higher-value and climate-resilient crops. Monopsonistic tendencies in some input and output markets suppress farm-gate prices and constrain farmer agency, particularly for women producers¹³⁰⁴. As a result, households have limited financial buffers to invest in adaptation technologies, improved water management, or livelihood diversification, perpetuating vulnerability to climate shocks.

¹²⁹⁴ World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

¹²⁹⁵ WMO. 2022. *State of Climate Services in Central Asia*. World Meteorological Organization.

¹²⁹⁶ Zoi Environment Network. 2021. *Weather, Water and Climate Services for Resilience in Tajikistan*. Zoi Environment Network.

¹²⁹⁷ WMO. 2022. *State of Climate Services in Central Asia*. World Meteorological Organization.

¹²⁹⁸ UNDP. 2021. *NAP in Focus: Lessons from Tajikistan*. United Nations Development Programme.

¹²⁹⁹ UNDP. 2023. *Climate Promise: Advancing Adaptation in Tajikistan*. United Nations Development Programme.

¹³⁰⁰ World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

¹³⁰¹ WFP. 2023. *Resilience and Food Security Programming in Tajikistan: Lessons Learned*. World Food Programme.

¹³⁰² World Bank. 2021. *Climate Risk Country Profile: Tajikistan*. World Bank Group.

¹³⁰³ IFPRI. 2024. *Transforming Agriculture in Tajikistan: Constraints, Opportunities and Policy Priorities*. International Food Policy Research Institute.

¹³⁰⁴ Ibid

8.4. *Project objective and description*

8.4.1. Project objective

The proposed project aims to improve the climate resilience and food security of vulnerable smallholder farmers, particularly women, in Tajikistan. This will be achieved by decentralising adaptation planning to the district level (as well as a focus on risk management including DRR and anticipatory action), enhancing access to and use climate information for adaptation, strengthening water asset management (supporting water supply and flood attenuation), promoting climate-resilient productive practices and livelihood diversification to build adaptive capacity, building knowledge and awareness to promote adaptation and risk management (including DRR and anticipatory action) at scale. It addresses key barriers such as the lack of local-level adaptation planning, limited access to timely climate information, and few options to build adaptive capacity.

8.4.2. Paradigm shift potential

The proposed project is designed to catalyse a structural and enduring shift in how climate change adaptation and risk management are planned, financed, and implemented at subnational level in Tajikistan. Anchored in the project's theory of change, the intervention addresses the root institutional, informational, financial, and behavioural barriers that currently trap vulnerable rural communities and local governments in cycles of reactive crisis response, climate-sensitive livelihoods, and fragmented development investments.

From reactive coping to proactive, locally led adaptation and risk management

At present, adaptation responses in rural Tajikistan remain largely reactive, underpinned by limited access to actionable climate information, weak decentralised planning systems, and insufficient integration between planning and investment. The project introduces a paradigm shift by embedding climate adaptation, disaster risk reduction (DRR), and anticipatory action within district governance systems, supported by institutionalised decision-making structures and sustained access to climate services.

Through the preparation of climate-risk-informed District Adaptation Plans (DAPs) aligned with the National Adaptation Plan, and the establishment or strengthening of District Adaptation Committees (DACs), the project shifts adaptation planning from isolated technical exercises to locally legitimate, decision-oriented processes. Unlike past approaches, DAPs will directly guide investment prioritisation under Component 2, ensuring that climate finance responds to locally identified risks and opportunities rather than externally determined project designs. This creates a durable planning–investment feedback loop that can persist beyond the project lifecycle.

De-risking climate-resilient investments and enabling scalable replication

The project reduces investment risk by combining decentralised planning with demonstration of climate-resilient solutions across water management, production systems, and livelihoods. Climate-proofed water assets, resilient agricultural systems, and diversified value chains will be selected through transparent, participatory processes and embedded within local operations and maintenance structures (e.g. Water User Associations and local water asset funds). This approach not only safeguards physical investments under future climate conditions but also builds confidence among public institutions and communities to sustain and replicate similar investments using domestic resources or other development finance.

The core delivery model (DAP-driven investment prioritisation, DAC-based shared decision-making, climate information-enabled anticipatory action, and community-managed assets) is inherently scalable and transferable. Once established, these systems can be replicated in

additional districts with relatively low marginal cost, as planning tools, governance arrangements, training curricula (e.g. PICSA), and digital climate advisory platforms can be expanded without proportional increases in financing.

Knowledge generation, inclusive learning, and institutionalisation

A central element of the paradigm shift lies in the project's structured learning architecture. The project will move beyond ad hoc documentation of lessons by institutionalising participatory monitoring, evaluation and learning processes that involve district authorities, women's groups, producer organisations, youth and people with disabilities. Local and informal knowledge will be systematically recognised and integrated into learning products, ensuring that adaptation solutions reflect lived experience as well as technical analysis.

Knowledge generated through implementation will be fed back into iterative updates of DAPs, disseminated through policy-learning workshops, and compiled into practical guidance for national stakeholders. This creates a pathway for scaling up evidence-based approaches within Tajikistan and contributing to regional learning through existing platforms, supporting replication in other fragile and climate-vulnerable contexts.

Gender-transformative and inclusive system change

The project's paradigm shift extends beyond technical adaptation to address structural exclusion. Women, youth and people with disabilities will move from marginal participation to shared decision-making authority through DACs, producer groups, and livelihood investment mechanisms. Targeted support for women-led processing, value addition, and market participation, combined with inclusive access to climate information and training, will help rebalance access to assets, income opportunities and institutional influence. This contributes to longer-term shifts in social norms and power relations that underpin climate vulnerability.

Contribution to climate-resilient development pathways

By strengthening decentralised institutions, mainstreaming climate risk into local development planning, enabling anticipatory action, and linking adaptation to resilient livelihoods and markets, the project contributes directly to Tajikistan's climate-resilient development trajectory as articulated in its NAP and related strategies. The result is not a one-off set of investments, but a self-reinforcing system in which local planning, finance, knowledge and institutions collectively support sustained resilience-building beyond the project's duration.

8.4.3. Project description

IF district-level adaptation and risk management planning is advanced, resilient water assets, production systems and livelihoods are supported, and climate information and adaptation knowledge are available; **THEN** vulnerable rural communities in Tajikistan will become more resilient through a shift from reactive coping to proactive adaptation and risk management; **BECAUSE** adaptation will be evidence-based and locally-embedded, and adaptive capacity will be built.

The project will adopt a phased implementation approach to ensure that investments are informed by climate risk analysis and validated through adaptive learning. In the initial phase, Component 1 activities will focus on climate risk assessments, development of District Adaptation Plans and strengthening of climate information services. These outputs will guide the prioritisation and design of investments under Component 2. Productive investments will be rolled out progressively, starting with pilot interventions and demonstration sites, followed by scaling across target districts based on performance, lessons learned and validated business models. This phased approach reduces implementation risks, improves targeting and enhances the effectiveness and sustainability of investments.

Component 1. Enabling environment for climate change adaptation at the district and local levels

Outcome 1. Enhanced climate change adaptation and risk management (including DRR and anticipatory action) preparedness across district governments and food-insecure vulnerable communities

This outcome will strengthen the enabling environment for locally-led adaptation by building institutional capacity, preparing climate risk-informed District Adaptation Plans (DAPs) — based on the National Adaptation Plan (NAP) — and improving access to and use of tailored climate information. It will decentralise adaptation planning, equipping local governments and rural communities to plan for and respond to climate hazards through adaptation and risk management approaches (including through DRR and anticipatory action) based on locally-relevant climate information, shifting from reactive responses to proactive, risk-informed decision-making.

Output 1.1. District Adaptation Plans (DAPs) that also promote DRR and anticipatory action

Activities under Output 1.1 will support district governments in integrating adaptation and resilience building into local development through climate risk profiling, capacity building, and the development of DAPs. Informed by the NAP, the DAPs will be developed to prioritise district-level adaptation needs and support risk management (including DRR and anticipatory action), ensuring that identified solutions are locally relevant. Consequently, the project will support a decentralised approach to adaptation and risk management planning in Tajikistan. The DAPs will be developed to complement District Development Plans and be based on the results of district climate risk profiles and watershed information. Adaptation priorities will promote the integration of anticipatory action and DRR approaches into the DAP and other frameworks through the development of triggers and protocols. The DAPs will include localised climate risk and vulnerability profiles, adaptation priorities and measures, DRR and anticipatory action triggers and protocols, a knowledge management and capacity development plan, a costed implementation plan and resource mobilisation strategies, underpinned by institutional and monitoring, evaluation and learning (MEL) frameworks to guide implementation. These will be developed in collaboration with local governments, and community-based participatory planning workshops at village and district levels delivered through locally-led adaptation planning modalities.

In addition to strengthening district-level adaptation planning, the District Adaptation Plans (DAPs) developed under Output 1.1 will serve as the formal decision-making framework for identifying, prioritising, and sequencing eligible investments to be financed under Component 2, ensuring that project investments directly reflect locally validated climate risks and adaptation priorities. District Adaptation Committees (DACs) (comprising CEP district authorities, jamoat representatives, women's groups, Water User Associations (WUAs), and community-based organisations) will be established or strengthened to validate DAP priorities and rank investment options. Annual investment plans for climate-resilient water assets, livelihood diversification interventions and climate-resilient production systems will be derived exclusively from DAP-identified priorities and endorsed through the DACs. DACs will not only validate DAP content but will also exercise shared decision-making authority over the prioritisation of Component 2 investments and the allocation of district-level micro-investment windows, ensuring that resources respond directly to locally identified needs. Community consultations, including village assemblies and thematic groups (women, youth, people with disabilities), will systematically

inform DAC decisions, ensuring that DAPs serve as actionable and locally legitimate drivers of adaptation investments rather than stand-alone planning outputs. Capacity building of DACs will extend beyond technical planning to include climate budgeting, basic fiduciary literacy, safeguards awareness, and participatory monitoring, enabling local institutions to meaningfully engage in decision-making and oversight processes.

In districts where CASP+ (FP233) is active (specifically Temurmalik and Khuroson) the DAP development process will fully integrate the Climate-sensitive Community Action Plans (CsCAPs) prepared under CASP+. CsCAPs represent community-level climate and natural resource priorities and will be used as formal inputs to district-level climate diagnostics, hazard mapping and prioritisation processes. This ensures vertical integration between community and district planning and avoids duplication of planning efforts. DACs will coordinate closely with CIIP district units to harmonise planning processes and ensure that DAPs consolidate and upscale local priorities already articulated in CsCAPs.

Activities under Output 1.1 will overcome institutional capacity gaps (Barrier 1) by training local authorities in adaptation and risk management (including DRR and anticipatory action) planning, while incorporating watershed and agro-climatic data will support targeted investments in resilient infrastructure and land management. Strengthening district capacity is essential for ensuring DAPs translate climate risk information into investments that directly reduce exposure and vulnerability. This output will improve long-term adaptation planning and risk management preparedness, reducing communities' exposure and vulnerability to floods, droughts and heatwaves, and climate-proofing district development gains.

Activities

Activity 1.1.1 Develop district-level climate risk profiles to support local adaptation and risk management planning (including DRR and anticipatory action).

This activity will develop district-level climate risk profiles that integrate climatic hazards, exposure and vulnerability, and include DRR and anticipatory action considerations. Using climate data, watershed information and participatory diagnostics (including inputs from CASP+ CsCAPs where applicable), profiles will identify priority risks and impact pathways affecting food security, water assets and livelihoods. The resulting profiles will inform hazard mapping, prioritisation and investment screening and provide the analytical foundation for DAPs, including the definition of early action triggers and protocols.

Sub-activities

- 1.1.1.1 Compile and analyse historical climate/hazard data and watershed information
- 1.1.1.2 Undertake participatory climate risk diagnostics (village + district), including thematic groups (women, youth, PWDs)
- 1.1.1.3 Integrate CASP+ CsCAP inputs in Temurmalik and Khuroson and validate vertical integration approach with CIIP district units
- 1.1.1.4 Produce and validate climate risk and vulnerability profiles (incl. hazard maps)

Activity 1.1.2 Strengthen the capacity of local government agencies and community leaders to plan and implement climate change adaptation and risk management (DRR and anticipatory action) measures.

This activity will strengthen district and community capacity to undertake locally-led adaptation planning and implementation, including DRR and anticipatory action. Training and mentoring will focus on interpreting climate risk profiles, integrating watershed/agro-climatic information, applying inclusive planning modalities, and translating risks into prioritised investment actions and protocols. The activity will build the operational capacity of district authorities, jamoats, WUAs and community organisations to support DAP implementation cycles, including annual investment planning, risk-informed decision-making and monitoring.

Sub-activities

- 1.1.2.1 Develop/adapt training modules on adaptation planning, DRR and anticipatory action (incl. triggers/protocols)
- 1.1.2.2 Deliver training to district authorities, jamoat reps, WUAs, women's groups and community leaders
- 1.1.2.3 Provide coaching during DAP drafting and annual investment planning cycles (hands-on support)
- 1.1.2.4 Conduct peer learning exchange(s) across districts and with CASP+ structures (PUUs/PUGs/Leskhoz groups)

Activity 1.1.3 Co-develop DAPs with relevant stakeholders (including DACs), incorporating risk management (DRR and anticipatory action).

This activity will co-develop climate risk-informed, NAP-aligned DAPs through locally-led, participatory planning workshops at village and district level. Building on climate risk profiles developed under Activity 1.1.1, watershed information, district development plans and other assessments, each DAP will include: localised risk and vulnerability profiles, prioritised adaptation measures, DRR and anticipatory action triggers and protocols, a knowledge management and capacity development plan, a costed implementation plan and resource mobilisation strategy, and institutional and MEL frameworks. DAPs will be anchored in district development priorities while remaining distinct planning instruments. While distinct from the district development plans, the DAPs will be anchored in them to ensure that they are aligned with district development priorities.

Sub-activities

- 1.1.3.1 Facilitate village assemblies and thematic consultations (women, youth, PWDs) to identify priorities and validate options
- 1.1.3.2 Draft DAPs (including costed implementation plan, resource mobilisation strategy, KM/capacity plan, and MEL framework)
- 1.1.3.3 Define DRR and anticipatory action triggers and protocols linked to climate information services
- 1.1.3.4 Align DAPs with District Development Plans and validate integration with district technical departments
- 1.1.3.5 Finalise and endorse DAPs through DACs (and consolidate CsCAP inputs where relevant)

Activity 1.1.4 Establish or strengthen District Adaptation Committees (DACs) (comprising CEP district authorities, jamoat representatives, women's groups, Water User Associations (WUAs), and community-based organisations) to validate DAP priorities and rank investment options.

This activity will establish or strengthen DACs comprising CEP district authorities, jamoat representatives, women's groups, WUAs and community-based organisations. DACs will

validate DAP priorities and exercise shared decision-making authority over the prioritisation of Component 2 investments and allocation of district-level micro-investment windows. DAC decisions will be systematically informed by community consultations (village assemblies and thematic groups), ensuring locally legitimate, inclusive and accountable resource allocation. In CASP+ districts, DACs will coordinate with CIIP district units to harmonise planning and avoid duplication.

Sub-activities

- 1.1.4.1 Develop DAC terms of reference, decision rules, and inclusivity requirements (women/youth/PWD representation)
- 1.1.4.2 Constitute/strengthen DAC membership and deliver induction on DAP governance and investment ranking
- 1.1.4.3 Establish investment ranking criteria aligned to DAP priorities and CASP+ duplication safeguards
- 1.1.4.4 Prepare and endorse annual investment plans derived exclusively from DAP priorities

Output 1.2. Tailored climate information sustainably delivered to district governments and local communities to facilitate local-level adaptation, including DRR and anticipatory action

Activities under Output 1.2 will improve access to practical, locally-relevant climate information for district governments and smallholder farmers (addressing Barriers 2 and 3). The Agency for Hydrometeorology will be capacitated to improve its climate forecasting and to expand SMS- and AI-powered internet-based tools for the provision of climate information. Support will also be provided to the agency to commercialise its climate information provision service to ensure sustainability. CEP extension workers will be trained to deliver localised adaptation support based on climate advisories, and up to 1,400 community members/smallholder farmers on how to use climate information for adaptation, DRR and anticipatory decision making, including informing the development of triggers and protocols. Expanding the dissemination of climate information and training on the use of climate information for adaptation, DRR, and anticipatory action will support the effective implementation of the DAPs developed under Output 1.1. This output will reduce vulnerability by enabling timely action against droughts, floods and erratic weather.

Where CASP+ has established community planning committees and user groups (PUUs, PUGs, Leskhoz groups), these platforms will serve as entry points for the delivery of climate advisories under Output 1.2 and ensure that they are shaped by local knowledge and local decision-making, rather than delivered through top-down channels. Building on CASP+'s strong foundations in community mobilisation, the project will use these structures to ensure inclusive dissemination of tailored climate information for adaptation, DRR and anticipatory action.

Activities

Activity 1.2.1 Strengthen the forecasting capacity of the Agency for Hydrometeorology's Centre of Climate Change through training and the provision of equipment.

This activity will strengthen the Agency for Hydrometeorology's capacity to produce actionable forecasts and climate advisories that support district-level adaptation, DRR and anticipatory action. It will address technical and operational gaps through a needs assessment, targeted training and provision of priority equipment. Improved forecasting workflows and products will

enhance the timeliness and credibility of climate information provided to districts and farmers, supporting trigger-based early action and risk-informed planning under the DAP process.

Sub-activities

- 1.2.1.1 Conduct forecasting/service delivery gap and needs analysis
- 1.2.1.2 Procure/install priority forecasting and data management equipment/software
- 1.2.1.3 Deliver technical training and coaching on forecasting and user-oriented products

Activity 1.2.2 Build the capacity of the Agency for Hydrometeorology to expand SMS-based and AI-powered digital internet-based systems — such as mobile apps, Telegram channels, or other locally appropriate digital tools — for the provision of climate and market information.

This activity will expand digital dissemination of tailored climate and market information using SMS and locally appropriate internet-based tools (e.g., apps, Telegram channels). It will strengthen the Agency's ability to manage digital channels, develop user-tested advisory content, and reach farmers and district authorities at scale. The systems will support DAP implementation, anticipatory action triggers and farmer decision-making. Where CASP+ community platforms exist (PUUs/PUGs/Leskhoz groups), these will be used as entry points for inclusive dissemination and feedback. Uptake will be monitored and used to iteratively improve content and delivery.

Sub-activities

- 1.2.2.1 Design and upgrade digital dissemination architecture (SMS + internet channels)
- 1.2.2.2 Co-produce and user-test climate and market advisory products with communities and extension staff
- 1.2.2.3 Establish user registration and targeting approach (incl. women/youth/PWD inclusion)
- 1.2.2.4 Implement dissemination and analytics tracking

Activity 1.2.3 Support the Agency for Hydrometeorology to commercialise the provision of climate information to ensure sustainability (including the development of a commercialisation strategy).

This activity will support the Agency for Hydrometeorology to establish a sustainability pathway for continued provision of climate information services beyond the project period. It will assess viable options for cost recovery and partnerships (e.g., public financing, telecom partnerships, service bundles for producer groups) and develop a commercialisation strategy that safeguards inclusivity while ensuring financial viability. The strategy will define governance, pricing principles (where applicable), quality assurance and reinvestment mechanisms.

Sub-activities

- 1.2.3.1 Conduct market and institutional assessment of commercialisation options
- 1.2.3.2 Develop and validate commercialisation strategy with key stakeholders
- 1.2.3.3 Pilot at least one sustainability mechanism (e.g., partnership or subscription model)

Activity 1.2.4 Train 42 extension workers (3 per district) and ~1,400 smallholder farmers (~100 per district) (at least 30% women and 30% youth) to understand and apply last-mile climate information services

This activity will train 42 extension workers (3 per district) and approximately 1,400 farmers (about 100 per district; at least 30% women and 30% youth) to interpret and apply last-mile climate information services. Training will support climate-informed farm decisions, DRR and

anticipatory action planning, and development of triggers and protocols. Nutrition-sensitisation will be integrated, linking climate-adaptive production choices to dietary diversity and food preparation practices. CASP+ community structures will be used where present to maximise inclusive outreach.

Sub-activities

- 1.2.4.1 Develop/adapt last-mile climate information service training materials (incl. AA/DRR modules)
- 1.2.4.2 Train extension workers (ToT) and certify facilitators
- 1.2.4.3 Deliver farmer training cycles and follow-up advisory support
- 1.2.4.4 Establish a simple feedback loop to refine advisories and triggers/protocols

Component 2. Local-level resilience building through water asset management and livelihood diversification

Outcome 2. Strengthened climate-resilient water management, smallholder production and income generation to build adaptive capacity

This outcome will result in enhanced resilience of smallholder farming systems through the adoption of climate-smart technologies, climate-proofed water infrastructure, value-added processing, and stronger market linkages. It will enable vulnerable households — especially women — to diversify livelihoods, reduce losses, and build financial stability in the face of increasing climate shocks.

Investments supporting the achievement of Outcome 2 will be informed by and align with priorities presented in the DAPs (developed under Output 1.1), which will define a prioritised, climate-risk-informed pipeline of locally identified adaptation actions. This will operationalise locally led climate action by embedding devolved decision-making and accountability mechanisms throughout the investment cycle. DACs will play a defined role in prioritising, validating, and sequencing DAP-derived investments, including through endorsement of annual investment plans and review of implementation progress. Structured community validation meetings and disclosure of approved investments will be used to promote transparency and downward accountability, while feedback from communities will inform adaptive management and subsequent investment cycles. Climate-resilient production investments are therefore not implemented in isolation, but are embedded within agro-ecologically appropriate systems and supported by value chain strengthening to ensure long-term sustainability, economic viability and scalability.

The project will play a catalytic role in mobilising additional finance for climate-resilient agriculture by strengthening both the enabling environment and market systems for investment. By improving climate information services, investment planning and technical design, the project reduces risks and enhances the bankability of adaptation investments. DAPs will serve as pipelines of prioritised, climate-informed investments that can be leveraged by government budgets, development partners and financial institutions. Applying a market systems approach, the project will engage key actors including financial institutions, input suppliers and service providers to co-develop viable and scalable business models. This is expected to crowd in additional public and private resources and support the expansion of climate-resilient agricultural practices beyond the initial project footprint.

Output 2.1. Climate-proofed water assets

This output will support the demonstration and development of drought- and flood-resilient water assets, including water-efficient irrigation systems/technologies, and renewable energy-powered pumps, amongst others (addressing Barrier 4). Demonstration plots and farmer trainings will ensure knowledge transfer. The project will also support the climate proofing of water supply canals and promotion of water-efficient irrigation systems. These interventions will support DRR and anticipatory action, directly reducing vulnerable smallholder farming communities' sensitivity to water scarcity and flood damage, safeguarding water supplies and boosting productivity under climate change conditions. DACs will oversee selection of water asset sites based on transparent criteria, with community representatives participating directly in decision-making to ensure that investments reflect DAP priorities (Output 1.1) and local governance systems. The ongoing operations and maintenance of the water assets will be supported by Water User Associations (WUAs) (where present) and the establishment of local water asset funds in each target district.

To avoid duplication of investments, climate-resilient water assets financed under Component 2 will not be implemented in villages receiving similar or overlapping community-level infrastructure support through CASP+. A joint mapping of existing and planned CASP+ investments (facilitated by CIIP district units) will inform site selection. Investments will only proceed in locations not supported under CASP+ and fully aligned with priorities identified through district-level DAPs.

Activities

Activity 2.1.1 Establish 14 climate-resilient water asset demonstration plots (one in each district) to showcase innovative water use, management technologies and nature-based methods for agricultural and domestic use.

This activity will establish one demonstration site per district to showcase innovative, climate-resilient water use and management technologies and nature-based methods for agricultural and domestic use. Demonstration plots will serve as learning hubs linked to farmer training and extension services and will be aligned with DAP priorities. DACs will oversee transparent selection, ensuring no duplication with CASP+ infrastructure-supported villages.

Sub-activities

2.1.1.1 Define demonstration packages (technology/NbS options) and selection criteria aligned to DAPs

2.1.1.2 Select sites with DAC endorsement and CASP+ investment mapping check

2.1.1.3 Establish and commission demonstration plots with O&M guidance

2.1.1.4 Run demonstration events and document learning

Activity 2.1.2 Develop and strengthen climate-resilient water assets (for example, drip irrigation, sprinkler irrigation, energy-efficient/renewable energy-powered pumps, reservoirs, and irrigation channels) combined with NbS to improve the productivity of smallholder production systems.

This activity will finance and implement climate-resilient water assets that improve reliability and productivity of smallholder production systems under increasing drought and flood risks. Investments may include drip or sprinkler irrigation, energy-efficient or renewable energy-powered pumps, reservoirs and improvements to irrigation channels for agroforestry, pasture recovery, counter terracing for slope stabilization, reducing risks of flood, landslide and other disasters. Selection will be derived exclusively from DAP priorities and endorsed by DACs,

with safeguards to avoid overlap with CASP+ infrastructure investments. Interventions will integrate climate-resilient design standards and strengthen O&M arrangements with WUAs and local authorities.

Sub-activities

2.1.2.1 Conduct technical feasibility screening and preliminary designs/BoQs

2.1.2.2 Procure and install/rehabilitate priority water assets and NbS

2.1.2.3 Train users/WUAs on operation, maintenance and climate-risk informed use of water assets and NbS

2.1.2.4 Verify alignment to DAP priorities and document adaptation benefits

Activity 2.1.3 Climate proof canals to strengthen their durability to damage from flooding, landslides and mudslides, and to improve their contribution to flood attenuation.

This activity will climate-proof priority canals to improve durability against flooding, landslides and mudslides while enhancing flood attenuation and reducing siltation risks. Interventions may include reinforced canal structures, bank stabilisation, green engineering measures, sediment trapping and improved drainage interfaces. Designs will consider future climate conditions and forecast-informed risk scenarios. Implementation will be guided by DAP priorities and DAC oversight, and will include clear O&M responsibilities and financing mechanisms.

Sub-activities

2.1.3.1 Identify and prioritise canal segments based on climate risk diagnostics and DAP priorities

2.1.3.2 Develop climate-resilient engineering designs (grey/green) and method statements

2.1.3.3 Implement canal climate-proofing works with supervision and safeguards compliance

2.1.3.4 Establish maintenance schedule and performance monitoring approach

Activity 2.1.4 Support the establishment of local water asset funds (potentially funded via a tariff system) in each target district to finance the ongoing maintenance of water assets.

This activity will support the establishment of local water asset funds in each target district to finance the ongoing operation and maintenance (O&M) of climate-resilient water infrastructure. This responds directly to sustainability challenges identified in the FP067 Terminal Evaluation, which highlighted insufficient financial mechanisms for maintaining water assets after project completion. The activity focuses on developing institutional, financial and operational systems to ensure that water infrastructure remains functional and effective over the long term. Importantly, the project will not transfer GCF funds into the water asset funds. Instead, the activity will facilitate the design and operationalisation of locally managed financing mechanisms, such as user tariffs or community contributions, tailored to local socio-economic conditions and affordability constraints.

Sub-activities

2.1.4.1 Conduct feasibility assessment and stakeholder consultations on fund design (including affordability analysis).

This sub-activity will assess the financial, institutional and socio-economic feasibility of establishing water asset funds in each target district. It will include analysis of O&M cost requirements, willingness and ability to pay, and potential tariff structures. Stakeholder consultations will be conducted with Water User Associations (WUAs), local authorities, and

communities to ensure that proposed models are socially acceptable, equitable, and context-appropriate. The output will be a district-specific fund design framework.

2.1.4.2 Develop governance framework (rules, transparency, auditing, grievance handling)

This sub-activity will establish governance structures and operational rules for the water asset funds. This will include defining roles and responsibilities of WUAs and local authorities, financial management procedures, transparency and reporting requirements, auditing provisions, and grievance redress mechanisms. The framework will ensure accountability, minimise risks of mismanagement, and align with broader project safeguards and governance systems.

2.1.4.3 Establish funds and operationalise collection and allocation procedures (pilot cycle)

This sub-activity will support the formal establishment of the water asset funds and pilot the operational procedures for revenue collection, fund management, and allocation of resources for O&M activities. This may include testing tariff collection systems, financial tracking, and expenditure processes over an initial pilot cycle. No GCF funds will be deposited into the funds; instead, the focus will be on establishing functional and sustainable local financing mechanisms.

2.1.4.4 Train WUAs and local actors on fund administration and accountability

This sub-activity will build the capacity of WUAs, local authorities, and relevant stakeholders to manage and oversee the water asset funds. Training will cover financial management, record-keeping, reporting, transparency, and accountability mechanisms. It will also include awareness on equitable access, affordability considerations, and grievance handling. This will ensure that local institutions are equipped to sustainably manage the funds beyond the project lifetime.

Output 2.2. Climate-resilient smallholder production systems

This output will support the development of drought- and flood-resilient agricultural systems, including climate-resilient crops and orchards (addressing Barrier 4). Demonstration plots and farmer trainings will ensure knowledge transfer, while climate-resilient inputs will be made available through the establishment of greenhouses and mixed orchards using climate-resilient species. Agroforestry, joint forestry management and intercropping (amongst other measures) of complementary species will be introduced to improve soil health, increase soil moisture retention and diversify smallholder income sources under changing climatic conditions. DACs will oversee selection of water asset sites based on transparent criteria, with community representatives participating directly in decision-making to ensure that investments reflect DAP priorities (Output 1.1) and local governance systems. The ongoing operations and maintenance of the water assets will be supported by Water User Associations (WUAs) (where present) and the establishment of local water asset funds in each target district. These interventions will directly reduce vulnerable farmers' sensitivity to water scarcity and extreme weather events and related hazards, while also boosting productivity.

The selection of climate-resilient crops and production systems is informed by district-level climate risk profiling, agro-ecological conditions and existing farming systems. Climate projections for the target districts indicate increasing temperatures, greater precipitation variability and heightened water stress, which directly affect crop productivity and stability. In response, the project prioritises drought- and heat-tolerant crop varieties, diversified orchard systems, and protected agriculture (including greenhouses) to reduce exposure to climate variability and stabilise yields. Agroforestry and intercropping systems are also promoted to enhance soil moisture retention, reduce erosion and improve microclimatic conditions, thereby strengthening overall system resilience.

All production investments are tailored to agro-ecological conditions through the application of district-level zoning based on elevation, soil characteristics, water availability and watershed dynamics. This ensures that crop types, irrigation technologies and production models are matched to local environmental conditions, avoiding maladaptation such as the promotion of water-intensive crops in water-scarce areas. Differentiated approaches are applied across high-altitude, mid-altitude and lowland systems, ensuring that interventions are technically appropriate, resource-efficient and climate-resilient. Demonstration plots and participatory validation processes will further support the local adaptation and optimisation of selected production systems.

To support scaling and financial sustainability, the project will pilot blended finance approaches that combine grant funding with concessional and commercial finance. Climate-resilient assets, including greenhouses, orchards, storage facilities, bulking centres and water-efficient technologies, will be financed through a combination of matching grants from WFP, credit from partner financial institutions and contributions from beneficiary farmers (e.g. labour, inputs or co-financing). WFP will apply a market systems approach, engaging financial institutions, input suppliers and service providers as core partners in the delivery model.

Through a structured process, WFP will pre-select partner financial institutions and service providers and support the joint development of standardised technical packages and business models for each type of productive asset. These business models will be translated into tailored financial products by partner financial institutions (e.g. MFIs, micro-lending organisations and commercial banks). Farmer applications will be assessed by financial institutions, with approved investments financed through a combination of i) credit provided by the financial institution, ii) grant financing from WFP disbursed directly to service providers for installation of technologies, and iii) farmer contributions. Financing may be released in tranches to align with implementation milestones.

In parallel, the project will strengthen the capacity of service providers to deliver integrated services, including installation, maintenance and advisory support. Where capacity gaps exist, targeted support will be provided to enable service providers to offer embedded advisory services alongside technology provision, ensuring that farmers receive ongoing technical guidance. This approach reduces investment risks, improves performance and establishes scalable, market-based delivery models that can be replicated beyond the project lifecycle.

To ensure technical soundness and scalability, standardised technical packages and business models will be developed for each type of productive infrastructure. Technical standards will define specifications related to climate resilience, water efficiency, durability and suitability to local agro-ecological conditions. Business models will outline investment costs, financing structures (including blended finance arrangements), operational requirements, expected returns and roles of different actors. These packages will be co-developed with financial institutions and service providers and will form the basis for financial products and investment decisions. This approach ensures consistency, quality control and replicability of investments across districts.

The project applies a market systems approach to facilitate access to finance for climate-resilient productive use investments (e.g. greenhouses, orchards, storage, and water-efficient technologies). This approach is designed to address key barriers identified in the feasibility assessment, including limited availability of tailored financial products, high perceived risk by financial institutions, and lack of standardized, investment-ready business models.

Under this approach, the project will support:

- Development of standardized technical packages and bankable business models for priority investments, including cost structures, expected returns, and risk profiles;
- Engagement with selected financial institutions (e.g. MFIs, MLOs, and commercial banks) to co-develop appropriate credit products based on these business models;
- Capacity building for financial institutions on appraisal of climate-resilient investments and associated risk mitigation;
- Capacity building for farmers and producer groups to prepare loan applications and manage financed assets;
- Facilitation of linkages between farmers, service providers, and financial institutions.

No GCF proceeds will be transferred to financial institutions, nor will the project establish any financial intermediary or on-lending mechanism. All financing provided to beneficiaries will be sourced from financial institutions' own capital, complemented where applicable by beneficiary contributions and project-supported technical assistance. Financial institutions will be responsible for loan appraisal, approval, and disbursement in accordance with their internal procedures and regulatory requirements. Service providers (e.g. suppliers of irrigation technologies, greenhouses, and storage systems) will operate under commercial arrangements with beneficiaries and/or financiers. Partnerships between the project and financial institutions or service providers will be governed through non-financial agreements such as memoranda of understanding and technical cooperation arrangements, which define roles, responsibilities, and collaboration modalities without involving the transfer of GCF funds. Importantly, the implementation of project activities is not dependent on the uptake of financing by financial institutions. The project will deliver demonstration investments, training, and technical assistance regardless of whether financial institutions engage at scale. However, successful engagement is expected to enhance replication, crowd in private sector financing, and support long-term sustainability beyond the project lifecycle.

Output 2.2 will complement CASP+ livelihood and ecosystem restoration activities by targeting gaps in district-level productive systems rather than village-level interventions already supported under CASP+. Opportunities for synergy include using CASP+ Pasture User Unions (PUUs), Pasture User Groups (PUGs), and community forestry groups as platforms for training, farmer field schools, and climate-resilient production demonstrations, ensuring community continuity and institutional coherence.

Activities

Activity 2.2.1 Establish 14 climate-resilient agricultural production demonstration plots (one in each district) to showcase innovative practices and technologies.

This activity will establish one climate-resilient agricultural demonstration plot per district showcasing drought-tolerant nutrient-rich crop varieties, agroforestry, multi-cropping and water-efficient technologies (including drip irrigation and water harvesting systems). Demonstration plots will function as farmer learning hubs linked to extension services, reinforcing climate-informed production decisions. Sites will be aligned with DAP priorities and coordinated with CASP+ platforms (PUUs/PUGs/community forestry groups) to strengthen continuity, avoid duplication and ensure inclusive participation.

Sub-activities

- 2.2.1.1 Define demonstration packages (crop/technology/NbS) and establish site selection criteria
- 2.2.1.2 Select sites with DAC endorsement and CASP+ synergy mapping
- 2.2.1.3 Establish and manage demonstration plots across seasons, ensuring that they are resilient to observed climate change impacts
- 2.2.1.4 Conduct field days and document lessons for scaling

Activity 2.2.2 Construct or rehabilitate 200 greenhouses.

This activity will construct or rehabilitate 200 greenhouses to enable climate-resilient production, reduce exposure to weather variability, and support nutrient-rich crop cultivation. Greenhouse support will be targeted based on DAP priorities and DAC-approved investment plans. Designs will incorporate climate-resilient features and resource efficiency measures, and beneficiaries will receive training on operation, integrated pest management and safe practices. This activity will contribute to improved yields, reduced climate-related losses and enhanced dietary diversity through year-round production.

Sub-activities

- 2.2.2.1 Develop technical design options and beneficiary selection approach aligned with DAP priorities
- 2.2.2.2 Procure materials/contractors and construct/rehabilitate greenhouses
- 2.2.2.3 Provide operational training (water efficiency, climate risk, nutrition-sensitive crops)
- 2.2.2.4 Monitor functionality and production outcomes

Activity 2.2.3 Establish 500 ha of mixed orchards using drought/flood-resistant species, including the installation of green fencing¹³⁰⁵ using appropriate species to prevent livestock damage to orchards. Seedlings will be provided by local or Forestry Department nurseries.

This activity will establish 500 ha of mixed orchards using drought- and flood-resistant species to diversify income and increase resilience. The activity includes installation of green fencing using appropriate species to protect orchards from livestock damage. Initially, wire fencing will be used so that the green fencing can be fully established. Seedlings will be sourced from local or Forestry Department nurseries. Orchard establishment will promote agroforestry and complementary species to improve soil health and moisture retention. Site selection will be DAP-driven and endorsed by DACs, with training to ensure long-term management and survival rates.

Sub-activities

- 2.2.3.1 Select sites and species mixes (incl. fencing species) with Forestry Department inputs
- 2.2.3.2 Establish orchards and install green fencing
- 2.2.3.3 Train service providers and farmers/producer groups on orchard management and climate risk practices
- 2.2.3.4 Monitor survival rates and undertake gap-filling/replanting as required

Activity 2.2.4 Train farmers, inclusive of women and young farmers, in climate-resilient practices and technologies using participatory and digital methods.

This activity will train farmers (including women and young farmers) on climate-resilient practices and technologies using participatory and digital approaches, and will establish an accessible

¹³⁰⁵ Initially, wire mesh fencing will be installed to allow green fencing to be established.

online learning resource hub for ongoing learning and advisory support. Training will emphasise nutrient-rich, climate-resilient crop cultivation to enhance resilience and dietary diversity. When possible, training will take place at demonstration plots established under Activities 2.1.1 and 2.2.1. The hub and training content will be adapted for people with visual and hearing impairments, promoting inclusivity and recognising persons with disabilities as agents of change. Offline access points (“centres”) will also be supported for farmers with limited connectivity.

Sub-activities

- 2.2.4.1 Develop training curriculum and inclusive content (including disability-adapted materials)
- 2.2.4.2 Establish an online learning resource hub and offline access points/centres
- 2.2.4.3 Deliver participatory training cycles and digital learning sessions (disaggregated tracking)
- 2.2.4.4 Provide ongoing Q&A/advisory support through the hub and monitor engagement

Output 2.3. Capacity of smallholder farmers built for livelihood diversification

Livelihood diversification activities under this output will also reduce food loss and increase value addition through solar drying, improved storage and processing skills — especially targeting women producers. Women’s cooperatives and community producer groups will participate in allocating district micro-investments for livelihood diversification, strengthening local ownership and accountability over resource allocation. The activities will support sustainable, low-cost technologies and better asset management, and will result in increased household income. With increased income, households will be less vulnerable to climate shocks. This output will also link farmers to markets via training, bulking centres, and real-time market data, improving access to buyers and negotiation power. It will create infrastructure and networks that foster collective action and enterprise growth. By connecting climate-resilient production with reliable markets, farmers will experience reduced vulnerability to price volatility and improved income security, bolstering their adaptive capacity.

The project explicitly integrates climate-resilient production with value chain development and market access. Investments in storage, processing, bulking centres and market information systems are designed to reduce post-harvest losses, improve product quality and enhance price realisation. By strengthening linkages between producers and local markets, the project ensures that increased production translates into stable and diversified incomes. This reduces climate-induced income volatility and strengthens the economic resilience of vulnerable households, thereby creating sustained incentives for the adoption and scaling of climate-resilient agricultural practices.

This output will address Barriers 4 and 5.

Activities

Activity 2.3.1 Construct or rehabilitate 120 storage units to support community storage of agricultural produce. In high-lying areas, the units will be naturally cooled, while in low-lying areas (warmer) solar-powered cooling will be used.

This activity will construct or rehabilitate 120 community storage units to reduce post-harvest losses and strengthen food security and income stability under climate stress. Storage designs will be adapted to local conditions: naturally cooled units in high-lying areas and solar-powered cooling in warmer low-lying areas. Storage investments will be selected through DAP-derived priorities and DAC endorsement, and will be managed through community producer structures where feasible. The activity will improve resilience by reducing spoilage during heat and weather variability and enabling better market timing.

Sub-activities

- 2.3.1.1 Develop storage design standards and site selection criteria (climate-appropriate and low-emission cooling options)
- 2.3.1.2 Select sites and management arrangements (including women's groups/producer groups)
- 2.3.1.3 Construct/rehabilitate storage units and commission solar cooling where relevant
- 2.3.1.4 Train operators on safe use, maintenance and recordkeeping

Activity 2.3.2 Provide training and equipment to 800 women and disabled persons to support processing, preservation, and marketing of agricultural products. This will include the distribution of 800 solar dryers, along with training on their safe and efficient use. This will also be supported by the online learning research hub established under Activity 2.2.4.

This activity will strengthen women's and persons with disabilities' livelihoods through training and equipment for processing, preservation and marketing, including distribution of 800 solar dryers and training on safe and efficient use. Training will cover product quality, food safety, storage, packaging, basic business skills and market engagement, and will be supported by the online learning hub established under Activity 2.2.4. By enabling value addition and reducing food loss, the activity increases income stability and reduces vulnerability to climate shocks.

Sub-activities

- 2.3.2.1 Develop inclusive beneficiary selection and safeguarding procedures (women/PWD focus)
- 2.3.2.2 Procure and distribute solar dryers and associated equipment
- 2.3.2.3 Procure and distribute agroforestry product processing equipment
- 2.3.2.4 Deliver training on processing, preservation, safety and marketing (accessible modalities)
- 2.3.2.5 Integrate trainees into the learning hub for ongoing support and troubleshooting

Activity 2.3.3 Provide training to smallholder farmers to improve bulking/aggregation practices, market negotiation and value chain participation.

This activity will build smallholder capacity to aggregate produce, negotiate prices and participate effectively in value chains, strengthening income resilience and reducing vulnerability to price volatility. Training will include bulking/aggregation practices, quality standards, business basics, and negotiation, and will facilitate linkages with village shops, community markets and school vendors. Improved local supply linkages can support dietary diversity and reduce unhealthy snacking among schoolchildren. This activity complements market information services and bulking centres to ensure practical market access.

Sub-activities

- 2.3.3.1 Develop training modules and tools for aggregation and negotiation (incl. quality standards)
- 2.3.3.2 Deliver training to producer groups and farmers (inclusive participation tracking)
- 2.3.3.3 Facilitate partnership/linkage agreements with local shops/markets/schools
- 2.3.3.4 Conduct follow-up mentoring on aggregation and negotiation practices

Activity 2.3.4 Establish bulking centres to allow producer groups to aggregate produce and attract wholesale buyers.

This activity will establish bulking centres that enable producer groups to aggregate produce, meet buyer volume and quality requirements, and attract wholesale buyers. Centres will support improved storage, handling, sorting and basic logistics and will be aligned with DAP priorities and DAC-endorsed investment plans. The activity will strengthen collective action, reduce transaction costs, improve market power and stabilise incomes. Governance arrangements will promote transparency and inclusion, with women's cooperatives and producer groups engaged in oversight and management.

Sub-activities

- 2.3.4.1 Define bulking centre model, governance and site selection criteria
- 2.3.4.2 Select sites and establish management committees/operating procedures
- 2.3.4.3 Construct/equip bulking centres and commission operations
- 2.3.4.4 Train management committees and pilot aggregation operations

Activity 2.3.5 Implement market information services, including price alerts and access to local demand data targeted at farmers and producer groups to support informed market participation.

This activity will operationalise market information services (price alerts and local demand data) targeted to farmers and producer groups to support informed market participation. Using the information hub strengthened under Activity 2.2.4, the activity will provide timely, accessible market signals and promote uptake through training and feedback loops. This supports improved negotiation, better timing of sales, reduced exploitation and stronger linkages to buyers. The activity complements bulking centres and aggregation training, strengthening income stability under climate stress, ultimately building adaptive capacity.

Sub-activities

- 2.3.5.1 Define market information content, data sources and update frequency
- 2.3.5.2 Configure dissemination through SMS/digital channels and enrol target users
- 2.3.5.3 Deliver training on interpretation and use of market information
- 2.3.5.4 Monitor usage and refine services based on user feedback

Component 3. Knowledge management and awareness raising on climate change adaptation

Outcome 3. Enhanced knowledge and awareness on climate change adaptation, supporting sustainability, scaling up and replication

This outcome will promote long-term adaptation by increasing awareness of climate risks, particularly their impact on food security, nutrition and livelihoods. It will foster community learning, support gender-responsive behaviour change, and strengthen the policy environment for scaling up successful practices beyond the project area. This will be supported by the generation of knowledge in the form of lessons learned and best practices to inform the adaptive management, scaling up and replication of activities under Component 2, as well as to support the revision of DAPs developed under Component 1 and drafting of DAPs in other districts.

Output 3.1. Improved awareness of climate change impacts on food security and nutrition, and adaptation and risk management (including DRR and anticipatory action) responses

Activities under this output will raise awareness about the links between climate change, food security and nutrition through community campaigns (addressing Barrier 4). Building on the regional knowledge generated under the G2F programme (particularly its climate-risk insights, gender-responsive guidance and early warning knowledge products) the project will translate national and regional messages into culturally appropriate, locally relevant content. The project will also build on CASP+ community action planning processes, which have established trusted participatory mechanisms for awareness-raising and community dialogue. Climate–nutrition and climate–risk awareness activities under Output 3.1 will be coordinated with existing CASP+ platforms to maximise outreach, reduce duplication of mobilisation efforts, and reinforce consistent messaging across programmes. Communities, including women, youth, and people with disabilities, will be capacitated to better understand climate-food security linkages and to adopt risk-reducing behaviours, dietary shifts, and anticipatory actions.

Activities

Activity 3.1.1 Conduct gender-responsive awareness-raising campaigns on climate risks and impacts on local communities using a mix of traditional media and digital platforms.

This activity will deliver gender-responsive awareness campaigns on climate risks and their impacts on food security and nutrition, and on practical adaptation, DRR and anticipatory action responses. Building on G2F knowledge products and CASP+ participatory mechanisms, the project will translate national and regional messages into culturally appropriate local content and disseminate through traditional media and digital platforms. Social and behaviour change (SBC) approaches will include school-led initiatives, mobilisation of local influencers (mahalla leaders, religious leaders, teachers, health workers), and community theatre/storytelling to strengthen uptake and behavioural change.

Sub-activities

3.1.1.1 Develop audience-specific communication and SBC strategy (including disability-accessible formats)

3.1.1.2 Implement community campaigns using mixed channels (radio, community events, digital)

3.1.1.3 Implement school-led climate and nutrition initiatives (fairs, competitions, debates)

3.1.1.4 Mobilise community influencers and implement theatre/puppet/storytelling activities

Output 3.2. Knowledge generated to support project sustainability and the evidence-based scaling up and replication of climate change adaptation

The project will systematically monitor and document the implementation of its adaptation interventions, including key achievements and lessons learned (addressing Barrier 5). Local knowledge products will be designed to complement, rather than duplicate, the regional learning structures of G2F. The project will institutionalise participatory monitoring structures, enabling DACs, PUUs/PUGs, women's groups and youth groups to co-monitor progress, validate results, and feed learning into annual DAP reviews and future investment decisions, ensuring downward accountability and adaptive management. Project evidence and lessons will be shared with national institutions and, where relevant, channelled into G2F's regional knowledge platforms and policy-learning processes, supporting cross-country exchange. Lessons learned from CASP+ implementation (especially on participatory planning, gender inclusion, community governance, and natural resource management) will be incorporated into the project's adaptive learning processes.

Knowledge generated under this project will complement CASP+ knowledge products and will be shared through CEP/CIIP district units to strengthen institutional memory across both GCF-funded projects. Knowledge generated will be used to revise DAPs developed under Output 1.1 and to inform the preparation of new DAPs in other districts. Documentation will be compiled into practical guidance materials for national stakeholders and practitioners, strengthening the institutionalisation and long-term sustainability of locally-led adaptation, DRR and anticipatory action.

Activities

Activity 3.2.1 Document information on key lessons and achievements related to the project's adaptation interventions.

This activity will systematically document implementation progress, achievements and lessons learned across Components 1 and 2 to support adaptive management, sustainability and replication. Participatory monitoring structures will engage DACs, PUUs/PUGs, women's and youth groups to co-monitor results, validate evidence and ensure downward accountability. Lessons from CASP+ implementation (participatory planning, gender inclusion, governance and natural resource management) will be incorporated. Outputs will feed into annual DAP reviews and inform development of DAPs in additional districts.

Sub-activities

- 3.2.1.1 Establish participatory monitoring approach and documentation templates
- 3.2.1.2 Compile periodic results stories, case studies and lessons learned (incl. inclusion focus)
- 3.2.1.3 Feed learning into annual DAP review cycles and investment planning adjustments

Activity 3.2.2 Enhance policy learning by disseminating bi-annual policy-style learning briefs and running 14 policy learning workshops.

This activity will strengthen policy learning and vertical dialogue between on-the-ground beneficiaries and policymakers by producing bi-annual policy-style learning briefs and convening one policy learning workshop per district (14 total), inclusive of national government representatives, local governments, farmers and producer groups. Workshops will distil evidence from project implementation and discuss practical implications for strengthening locally-led adaptation, DRR and anticipatory action. The process will help institutionalise learning within CEP/CIIP district units, and inform scaling strategies.

Sub-activities

- 3.2.2.1 Prepare bi-annual policy learning briefs synthesising evidence and recommendations
- 3.2.2.2 Convene and document 14 district policy learning workshops (incl. national reps)
- 3.2.2.3 Produce workshop action recommendations for uptake into district/national processes
- 3.2.2.4 Lobby for policy issues at national level through participating in the National, Regional Water Council and other national policy platforms

Activity 3.2.3 Coordinate sharing of knowledge products on a preexisting knowledge management platform and develop an adaptation manual for practitioners and policymakers based on the outputs of Activities 3.2.1 and 3.2.2.

This activity will consolidate and disseminate project knowledge products through a pre-existing knowledge management platform and develop an adaptation manual for practitioners and policymakers. The manual will synthesise practical guidance on DAP development and implementation, climate services uptake, anticipatory action triggers/protocols, climate-resilient water assets and livelihood diversification measures, including inclusion approaches and governance arrangements. Knowledge products will complement, rather than duplicate, G2F regional learning structures and will be channelled through CEP/CIIP systems to strengthen institutional memory and support replication in other districts.

Sub-activities

3.2.3.1 Curate and upload knowledge products to the selected platform (metadata, tagging, access rules)

3.2.3.2 Develop adaptation manual and validate with national and district stakeholders

3.2.3.3 Produce dissemination plan and implement targeted dissemination sessions/webinars

8.4.4. Maladaptation Avoidance Strategy

Maladaptation is defined as “action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups”¹³⁰⁶. There are at least five types or pathways through which maladaptation arises¹³⁰⁷; increased GHG emissions; disproportionately burdening the most vulnerable; reduced incentive to adapt; path dependency; and high opportunity costs. Project development and planning have taken these factors into account, and thus, the following will ensure that maladaptation does not occur in terms of local-level resilience building through water asset management and livelihood diversification. This will ensure that the outcome is achieved and that climate-resilient water management, smallholder production and income generation to build adaptive capacity are strengthened.

1. **Emission reduction** will be maintained by ensuring that project activities pertaining to water management, value chain development and agricultural production are developed according to site selection criteria and design standards. This includes selecting sites which have potential for emission reduction through improved water management, cooling, infrastructure and farming practices. Training will also be provided to ensure that storage units, irrigation systems and cooling units related to water management, value chain development, and agricultural production are developed in accordance with and operated correctly, thereby preventing sites, infrastructure and equipment from becoming emitters of GHG. Furthermore, training in sustainable agricultural practices will promote long-term soil conservation, thereby enhancing carbon sequestration. Maintenance of farming equipment and enhanced access to improved equipment will also promote long-term carbon sequestration and soil health.

2. **Disproportionate burdening of the most vulnerable** could be avoided by relying on Pasture User Unions (PUUs), Pasture User Groups (PUGs) established under the CASP project. As part of the present project however, DACs and WUAs would play an important role in ensuring that vulnerable people groups are not disproportionately burdened during the project and after completion. Targeted support for women-led processing, value addition, and market participation, combined with inclusive access to climate information and training, will help balance access to assets, income opportunities and institutional influence. Activity 2.2.4 will train farmers (including women and young farmers) on climate-resilient practices and technologies using participatory and digital approaches. Establishing an accessible online learning resource hub for

¹³⁰⁶ Barnett, J. and S. O'Neill, 2010: Maladaptation. *Global Environmental Change*, 20(2), 211-213

¹³⁰⁷ Barnett, J. and S. O'Neill, 2010: Maladaptation. *Global Environmental Change*, 20(2), 211-213

ongoing learning and advisory support will ensure that continuous support is provided to vulnerable communities and promote the long-term adaptation of vulnerable groups. The training content being adapted for people with visual and hearing impairments will promote inclusivity and recognise persons with disabilities as essential in promoting long-term climate change adaptation. Offline access points will ensure support for farmers with limited connectivity and vulnerable due to isolation from essential infrastructure. Activity 2.3.2. will strengthen the livelihoods of women and persons with disabilities through training and equipment for food processing, preservation, and marketing.

Training of vulnerable individuals in these skills will also aid in enhancing long-term adaptation and ensure that women farmers and those with disabilities are not disproportionately burdened in terms of land tenure and access to income. Farmer training will include women and young farmers, and the project's paradigm shift extends beyond technical adaptation to address the exclusion of minority groups. Women, youth and people with disabilities will move from marginal participation to shared decision-making authority through DACs, producer groups, and livelihood investment mechanisms.

Furthermore, project interventions will address the root institutional, informational, financial, and behavioural barriers that trap vulnerable rural communities and local governments in cycles of reactive crisis response, climate-sensitive livelihoods, and fragmented development investments. The disproportionate burdening of vulnerable communities will also be discouraged through inclusive, participatory planning and stakeholder engagement processes, minimising unequal engagement and access to benefits. Additionally, the project grievance mechanism and transparent benefit targeting will reduce the risk of conflict and discrimination.

3. **Reduced incentive to adapt**, which includes encouraging unnecessary dependence on others, stimulating rent-seeking behaviour, or penalising early actors, which could lead to maladaptation. Maladaptation through reduced incentive to adapt will be discouraged at the local and national levels. At a national level, the proposed project is designed to catalyse a structural and enduring shift in how climate change adaptation and risk management are planned, financed, and implemented. Furthermore, maladaptation will be prevented by DAPs guiding investment prioritisation under Component 2. Thus, ensuring that climate finance responds to locally identified risks, needs and opportunities. On a local level, long-term adaptation will be encouraged through the establishment of demonstration plots, interactive learning opportunities and field days. Training agriculture producer groups on climate-resilient farming practices and climate risk will reduce dependence on others for income and food security. Demonstration plots will serve as learning hubs for farmers, linked to extension services and PICSA advisories. Sites will be selected and designed to strengthen continuity, incentivise the adoption of climate-resilient practices, and ensure inclusive participation. Training in value chain development will also be promoted through an online learning hub. This will incentivise adaptation due to increased income stability, value chain diversification, and reduced vulnerability to climate shocks. Furthermore, the project will build on lessons learned and best practices from the implementation to foster long-term uptake of climate-resilient agricultural practices. Participatory vulnerability assessments and information sessions will also ensure the long-term adoption of climate-resilient practices, while demonstrations will disseminate knowledge and build trust in new approaches. Extension services and multi-stakeholder platforms will be leveraged to support and encourage long-term adoption. In addition, the project will also focus on promoting economically viable practices that have been tested with farmers in the target districts. Ensuring that farmers have access to the necessary inputs and services after the project concludes will also discourage maladaptation.

4. Infrastructure developments commit capital and institutions to trajectories which may change in the future. Such **path-dependent responses** may lead to decreased flexibility in responding to unforeseen changes in climatic, environmental, economic, and social conditions in the future. The project will ensure the long-term adaptability of water, agriculture, energy, and irrigation infrastructure to climatic, environmental, economic, and social conditions by avoiding

duplication of investments and relying on water asset funds (Activity 2.1.4). Long-term adaptation will be achieved by ensuring that climate-resilient water assets financed under Component 2 are not implemented in villages receiving similar or overlapping community-level infrastructure support. A joint mapping of existing and planned CASP+ investments will also inform site selection for infrastructure development. Investments will only proceed in locations not supported under CASP+ and fully aligned with priorities identified through district-level DAPs.

The selection of sites will be derived from DAP priorities and endorsed by DACs, with safeguards in place to avoid overlap with other infrastructure investments. Project interventions will integrate climate-resilient design standards and strengthen O&M arrangements with WUAs and local authorities, which will also promote long-term adaptation of water systems and infrastructure. Furthermore, Activity 2.1.4 will support the establishment of local water asset funds in each target district to finance the ongoing maintenance of water assets. Unlike past approaches, DAPs will directly guide investment prioritisation under Component 2, ensuring that climate finance responds to locally identified risks and opportunities rather than externally determined project designs. This creates a durable planning–investment feedback loop that can persist beyond the project lifecycle, promoting long-term adaptation in the water sector. Furthermore, engaging local beneficiary groups and associations will ensure ownership and, consequently, the long-term sustainability and maintenance of equipment and infrastructure after the project concludes. The project will integrate climate-risk screening into all infrastructure designs, accounting for glacial melt, landslide risk, and flood extremes. This includes developing contingency plans for extreme events and incorporating a flexible design to allow for long-term adaptive management.

5. Approaches may be maladaptive if **economic, social, or environmental costs are high relative to alternatives**. Economic and environmental costs will be reduced through borehole-by-borehole expansion and solar pumping, thereby lowering operating costs. Also, small catchments and micro-irrigation will minimise environmental damage, and existing channels will be reused where possible. When considering demonstration plots and orchards, drought- and flood-tolerant species will be used in addition to climate-smart site selection to minimise erosion risks. Low-cost, green fencing will be used to prevent grazing damage and promote soil stability. To reduce long-term input costs and the environmental impact of activities, focus will be given to education, training and the promotion of non-chemical pest management. A SWOT analysis of options alternative to those presented by the project is presented in Appendix 1.

Annexes

Appendix 1: SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis of Alternative Adaptation Options

Alternative option	Strengths	Weaknesses	Opportunities	Threats
1) Construction of large water storage infrastructure (e.g., dams and large reservoirs)	<ul style="list-style-type: none"> • Buffers drought and seasonal variability by storing water for later use, supporting more reliable irrigation and water supply services^{1308,1309}. • Can reduce downstream flood exposure where dams are designed/operated for flood control (context-dependent and varies by basin and operations)¹³¹⁰. 	<ul style="list-style-type: none"> • High capital cost and long lead times, with documented risk of cost overruns and delays in large dam/hydropower megaprojects¹³¹². • Significant environmental and social risks, including displacement/resettlement and downstream livelihood impacts, which can be difficult to fully mitigate¹³¹³. • High dam-safety and technical oversight requirements, including expert review panels and emergency preparedness for large dams¹³¹⁴. 	<ul style="list-style-type: none"> • Tajikistan faces more frequent/severe droughts, floods and landslides. This option create policy attention and momentum for strategic water-security investments (including storage), if justified by basin-level options analysis^{1315,1316}. • Opportunity to embed large storage within an integrated “system” approach (built + natural storage + demand management), which the global storage literature increasingly emphasises¹³¹⁷. 	<ul style="list-style-type: none"> • Sedimentation can significantly reduce reservoir storage over time, undermining long-term performance unless actively managed^{1318,1319}. • Rising hydro-climatic extremes (floods/droughts) and water variability can reduce reliability and increase safety/design demands; large dams can require special design in high-flood or high-seismicity contexts^{1320,1321,1322}.

¹³⁰⁸ World Bank (2023) What the Future Has in Store: A New Paradigm for Water Storage—Overview for Policy Makers. Washington, DC: World Bank. [Available online.](#)

¹³⁰⁹ World Bank (2023). Water Storage Is at the Heart of Climate Change Adaptation. [Available online.](#)

¹³¹⁰ Boulange, J., Hanasaki, N., Yamazaki, D. et al. Role of dams in reducing global flood exposure under climate change. Nat Commun 12, 417 (2021). [Available online.](#)

¹³¹² Minocha, S. and Hossain, F.: GRILSS: opening the gateway to global reservoir sedimentation data curation, Earth Syst. Sci. Data, 17, 1743–1759. [Available online.](#)

¹³¹³ Boulange, J., Hanasaki, N., Yamazaki, D. et al. Role of dams in reducing global flood exposure under climate change. Nat Commun 12, 417 (2021). [Available online.](#)

¹³¹⁴ World Bank (2013). Operational Manual OP 4.37 - Safety of Dams. [Available online.](#)

¹³¹⁵ World Bank (2024). Tajikistan Country Climate and Development Report. [Available online.](#)

¹³¹⁶ World Bank (2023) What the Future Has in Store: A New Paradigm for Water Storage—Overview for Policy Makers. Washington, DC: World Bank. [Available online.](#)

¹³¹⁷ World Bank (2023) What the Future Has in Store: A New Paradigm for Water Storage—Overview for Policy Makers. Washington, DC: World Bank. [Available online.](#)

¹³¹⁸ Minocha, S. and Hossain, F.: GRILSS: opening the gateway to global reservoir sedimentation data curation, Earth Syst. Sci. Data, 17, 1743–1759. [Available online.](#)

¹³¹⁹ World Bank (2024). Tajikistan Country Climate and Development Report. [Available online.](#)

¹³²⁰ World Bank (2013). Tajikistan Overview of Climate Change Activities. [Available online.](#)

¹³²¹ World Bank (2013). Operational Manual OP 4.37 - Safety of Dams. [Available online.](#)

¹³²² World Bank (2023) What the Future Has in Store: A New Paradigm for Water Storage—Overview for Policy Makers. Washington, DC: World Bank. [Available online.](#)

Alternative option	Strengths	Weaknesses	Opportunities	Threats
	<ul style="list-style-type: none"> Multipurpose potential (e.g., irrigation + water supply + hydropower) can generate co-benefits if governance and operations are strong¹³¹¹. 			<ul style="list-style-type: none"> Tajikistan is exposed to multiple hazards with material damages and displacement. Disasters can impose major design, O&M and residual-risk burdens for large storage assets^{1323, 1324}.
2) Hard infrastructure for flood/landslide control <i>(levees/embankments, flood walls, gabions, river training; debris-flow barriers; slope stabilisation with retaining walls, drainage, rockfall protection)</i>	<ul style="list-style-type: none"> Rapid reduction of physical exposure in priority hotspots (settlements, canals, roads). Can protect existing assets and critical infrastructure corridors. Highly visible “risk-reduction” investments that can be targeted by hazard maps. 	<ul style="list-style-type: none"> Often shifts risk downstream; benefits can be localised while costs are high. Maintenance-intensive; effectiveness drops sharply if O&M is weak. Ecological impacts on rivers and riparian systems; potential ES-category escalation. 	<ul style="list-style-type: none"> Can be paired with upstream catchment management (revegetation, slope drainage, sediment control) for better performance. Labour-based works can support short-term employment if designed safely. 	<ul style="list-style-type: none"> Events exceeding design standards can cause catastrophic failures. High sediment/debris loads can overwhelm barriers and channel works. False sense of security can increase exposure (more assets built behind protection)¹³²⁵.
3) Infrastructure for groundwater-based water supply and irrigation expansion <i>(new boreholes/wellfields, solar/electric pumps, storage and distribution;</i>	<ul style="list-style-type: none"> Can provide more stable water supply than rain-fed sources in some settings. 	<ul style="list-style-type: none"> High uncertainty and risk of “dry wells” without strong hydrogeological data¹³²⁶. Over-abstraction risk; difficult to regulate and monitor at scale. 	<ul style="list-style-type: none"> Opportunity to introduce groundwater governance (permits, monitoring, caps) and managed aquifer recharge pilots¹³²⁸. 	<ul style="list-style-type: none"> Declining recharge under climate change and land degradation can reduce sustainability.

¹³¹¹ World Bank (2023) What the Future Has in Store: A New Paradigm for Water Storage—Overview for Policy Makers. Washington, DC: World Bank. [Available online.](#)

¹³²³ CAREC (2022). Country Risk Profile Tajikistan. [Available online.](#)

¹³²⁴ GFDRR/World Bank. Crisis Preparedness Gap Analysis Tajikistan Briefing Note. [Available online.](#)

¹³²⁵ World Bank (2015). Disaster Risk Management in the Transport Sector: A Review of Concepts and International Case Studies. [Available online.](#)

¹³²⁶ UNESCO (2022). The United Nations World Water Development Report. [Available online.](#)

¹³²⁸ UNESCO (2022). The United Nations World Water Development Report. [Available online.](#)

Alternative option	Strengths	Weaknesses	Opportunities	Threats
<i>expansion of groundwater-fed irrigation)</i>	<ul style="list-style-type: none"> Less directly exposed than surface canals to flood/mudflow washouts. Scalable via borehole-by-borehole expansion; solar pumping can reduce operating costs. 	<ul style="list-style-type: none"> Potential water-quality constraints (salinity/contamination) and treatment costs¹³²⁷. Requires strong O&M and spare parts supply chains. 	<ul style="list-style-type: none"> Can be integrated into resilient rural water supply schemes where feasible. 	<ul style="list-style-type: none"> Groundwater depletion can trigger user conflict and rising pumping costs. System failures can be widespread if pumps/parts supply is disrupted.
4) Climate shock response assistance at household/farm-level	<ul style="list-style-type: none"> Rapidly reduces acute vulnerability and prevents negative coping (asset sales, crisis strategies), especially after shocks¹³²⁹. Can be triggered by forecasts (“anticipatory action”) where systems exist^{1330,1331}. 	<ul style="list-style-type: none"> Primarily protects consumption; does not necessarily build durable resilience of water systems, production systems, or local institutions. Can create recurrent financing needs if not paired with investments that reduce underlying risk. 	<ul style="list-style-type: none"> Can integrate with national DRF improvements under emerging strategies and platforms¹³³². 	<ul style="list-style-type: none"> Funding volatility and donor dependence can threaten continuity; Tajikistan is described as depending on donors/development partners for disaster response and recovery finance¹³³³. Repeated shocks can outstrip contingency mechanisms; resources in the Contingent Fund are described as limited and competing with other unexpected expenses¹³³⁴.
5) Private-sector / finance-led model (market-first)	<ul style="list-style-type: none"> Potential to leverage private capital, enhance 	<ul style="list-style-type: none"> Risk of excluding the most vulnerable (low collateral, high transaction costs, low 	<ul style="list-style-type: none"> Opportunities to pilot de-risking instruments and tailored products for 	<ul style="list-style-type: none"> Macroeconomic and climate risks elevate default risk; repeated

¹³²⁷ UNESCO (2022). The United Nations World Water Development Report. [Available online.](#)

¹³²⁹ WFP (2025). WFP’s updated evidence base on anticipatory action 2025: lessons from 16 studies across 12 countries. [Available online.](#)

¹³³⁰ GFDRR/World Bank. Crisis Preparedness Gap Analysis Tajikistan Briefing Note. [Available online.](#)

¹³³¹ WFP (2020). The evidence base on Anticipatory Action. [Available online.](#)

¹³³² WFP (2022). From Forecasts to Action: WFP’s Global Anticipatory Action (AA) Strategy 2022-2025. [Available online.](#)

¹³³³ GFDRR/World Bank. Crisis Preparedness Gap Analysis Tajikistan Briefing Note. [Available online.](#)

¹³³⁴ World Bank (2019). Disaster Risk Finance Country Note: Tajikistan. [Available online.](#)

Alternative option	Strengths	Weaknesses	Opportunities	Threats
	<p>sustainability, and create market services for inputs, storage, processing, and irrigation technologies.</p> <ul style="list-style-type: none"> • May stimulate entrepreneurship and local job creation where value chains are viable^{1335,1336}. 	<p>risk appetite from lenders). Tajikistan rural finance constraints include lack of collateral and low risk appetite of financial institutions.</p> <ul style="list-style-type: none"> • Hard to finance “public-good” elements (district planning, climate information services, community governance) through private mechanisms. 	<p>smallholders/women/youth (where institutions exist), consistent with constraints/opportunities identified in rural development programming.</p>	<p>shocks can quickly erode repayment capacity.</p> <ul style="list-style-type: none"> • If concessional finance is not carefully structured, may crowd out viable local finance or concentrate benefits among better-off farmers/enterprises¹³³⁷.

¹³³⁵ OECD (2018). DAC Blended Finance Principles. [Available online.](#)

¹³³⁶ OECD (2025). DAC Blended Finance Guidance. [Available online.](#)

¹³³⁷ IC (2017). DFI Working Group on Blended Concessional Finance for Private Sector Projects. [Available online.](#)