Strengthening Climate Resilience of the Lao People's Democratic Republic (PDR) Health System

Annex 2: Feasibility Study

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World Health Organization
Representative Office for Lao PDR

MONRE
Ministry of Natural Resources and Environment

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Acronyms

ACI	Adaptive Capacity Index
Am	Tropical Monsoon
AR6	Sixth Assessment Report
ASEAN	Association of Southeast Asian Nations
Aw	Tropical Savannah
CORDEX	Coordinated Regional climate Downscaling Experiment
Cwa	Temperate, dry winter, warm summer
Cwb	Temperate, dry winter, hot summer
EWE	Extreme Weather Event
ENSO	El Niño Southern-Oscillation
DHIS2	District Health Information Software 2
DHO	District Health Office
GCM	Global Circulation Models
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoL	Government of Lao PDR
HNAP	Health National Adaptation Plan
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
MoH	Ministry of Health
NDC	Nationally Determined Contribution
NHI	National Health Insurance
NMHS	National Meteorological and Hydrological Services
NSEDP	National Socio-Economic Development Plan
PHO	Provincial Health Office
RCP	Representative Concentration Pathway
RHMIS	Routine Health Management Information System
SEI	Sensitivity and Exposure Index
SSP	Shared Socio-economic Pathway
UNFCCC	United Nations Convention on Climate Change
USD	United States Dollar
WASH	Water, Sanitation, and Hygiene

Section 1 - Executive Summary

1. Lao PDR is a Least Developed Country (LDC) in the Mekong Region of Southeast Asia. Climate models predict the country will experience rising temperatures and changing rainfall patterns. This includes increases in mean temperatures with more frequent hot days, decreased incidence in the number of rainy days but more unpredictable and intense precipitation, and more frequent and intense extreme weather events (EWEs). These shifts are expected to impact the health sector directly (through more frequent and intense EWEs that could damage health facility infrastructure, including for water, sanitation, and hygiene [WASH] services) and indirectly (by creating conditions that increase the incidence of certain diseases, including dengue and diarrheal disease, ultimately placing new demands on the health system). The country's capacity to anticipate, adapt, and respond to these changes is limited, due to weak governance, high levels of poverty, and the limited participation of women and girls in all economic activities.
2. The proposed Strengthening Climate Resilience of the Lao PDR Health System Project aims to reduce the health sector's vulnerability to climate change while simultaneously strengthening community capacity to plan for and manage the health impacts of climate change. Activities are designed to advance the Government of Lao PDR's (GoL's) climate and health commitments and will build on current and past projects funded and implemented in country and regionally.
3. This Feasibility Study, which informs the Funding Proposal, details the potential for the project approach described above. It draws from desk research and consultations with communities, representatives from the GoL and international institutions active in country. These consultations enabled validation of the proposed activities and target beneficiaries and facilitated aligning project activities with the country's Nationally Determined Contribution (NDC), the draft Health National Adaptation Plan (HNAP), and other sectoral priorities.
4. Section 2 of this report provides contextual information on the baseline situation in Lao PDR. This includes a summary of Lao PDR's geography, demographics, human development progress, macro-economic context and challenges, health sector structure, and relevant climate and health policies and strategies. The section describes how Lao PDR has achieved significant development progress in the past two decades, though the COVID-19 pandemic and global economic context have impacted the country's economic and social recovery and constrained growth. It provides relevant context for the project's strategies and activities.
5. Section 3 details observed and projected climate change and provincial-level climate-related vulnerability assessments for the project's target provinces. It draws data from global open sources, such as the Global Circulation Models (GCM), the Sixth Assessment Report (AR6) from the Intergovernmental Panel on Climate Change (IPCC), and data from UN agencies, and uses projections made under the Representative Concentration Pathways (RCPs) and the Shared Socio-economic Pathways (SSP) scenarios. It also discusses the observed and projected changes and impacts of climate change and the associated risks to the health sector.
6. Section 4 details the direct and indirect impacts of climate change on health and the health system in Lao PDR. It highlights dengue, diarrheal disease, heat-related illness and acute malnutrition, which are the diseases the GoL has identified as most relevant for climate and health, and presents data on the relationship between these health risks and climate change. The section also details the impacts climate change is likely to have on health system infrastructure, including WASH infrastructure, summarizes impacts that have already been observed, and presents health sector vulnerability by province.
7. Section 5 summarizes current and recent health and climate change programs in Lao PDR.
8. Section 6 presents the project's Theory of Change (ToC) diagram and narrative.
9. Section 7 presents an illustrative menu of activities that selected communities will be able to implement with project support as part of their community health and climate action plans.
10. Section 8 presents relevant maps, including of each of the project's target provinces.
11. Section 9 directs readers to the location of the Logical Framework, Annex 2a. This includes beneficiary calculations and a summary of the methodology used to develop the calculations.
12. Section 10 directs readers to the Implementation Timetable, Annex 2b.
13. Section 11 directs readers to the Gender Assessment and Action Plan, Annex 4.
14. Section 12 directs readers to the Stakeholder Consultations Report, Annex 13.

Section 2 - Lao PDR's Context: Baseline Assessment

Geographical and Climate Context

15. Lao PDR is a mountainous, landlocked country with a geographic area of 236,800 square kilometers (see Figure 1). It shares borders with Cambodia to the south, Thailand to the south-west, Vietnam to the east, and Myanmar and China to the north. Except for in the Vientiane region, the country's northern provinces are covered by steep terrain and jagged mountain ranges, with the highest peaks reaching over 2,000 meters in altitude. The Mekong River, which runs through the country from north to south and marks the borders between Lao PDR and its neighbors Thailand and Myanmar, is a vital artery that irrigates almost 1,800 kilometers of the country.

16. Lao PDR's climate is tropical overall, but the mountains divide the country into three main climactic zones. The high-altitude northern areas have a temperate montane and subtropical climate and the lowest mean annual temperatures (20°C) nationally. The central mountainous areas, which are between 500 and 1,000 meters in altitude, experience a tropical monsoonal climate with higher rainfall and higher temperatures compared to the northern areas. The more densely populated lowland plains along the Mekong River and its main tributaries experience the highest mean annual temperatures (25-27°C). This area's temperature and precipitation rates are more sensitive to the El Niño- Southern Oscillation (ENSO).[1]

17. Lao PDR experiences two distinct seasons: a rainy or monsoon season from May to mid-October, and a dry season from mid-October to April. The southeast monsoon causes high humidity and brings 70% of the country's annual rainfall, which can be as high as 3,000 millimeters.

Figure 1. Map of Lao PDR

Source: iStock images: Laos Topographic Map Isolated

Demographic and Human Development Context

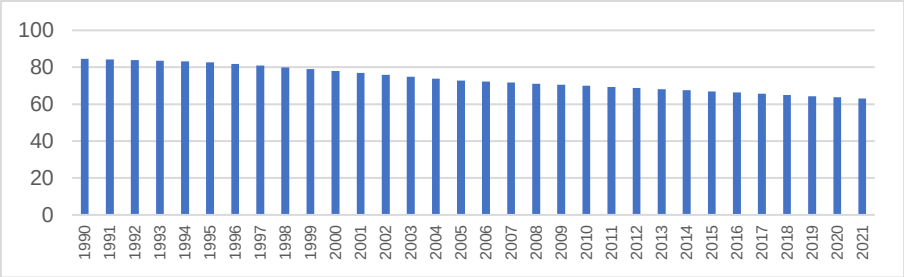
18. Lao PDR has one of the most ethnically diverse populations in Southeast Asia. There are four main ethno-linguistic families: Lao-Tai, Mon-Khmer, Hmong-Iu Mien, and Chinese-Tibetan. The Lao-Tai majority, which comprises roughly 62% of the total population, generally lives in lowland areas.[2] Ethnic groups besides the Lao Tai majority predominately reside in rural, rugged mountain locations and are considered marginalized due to their lower access to education, health care, and economic opportunities.[3] The GoL uses the term "ethnic group" to refer to indigenous people. It formally recognizes 49 ethnic groups and 240 sub-groups. All ethnic groups have equal status.

19. In 2021, Lao PDR's population was 7.42 million, up from 7.31 million in 2020.[4] The population is projected to reach ~8 million by 2030.[5] The population is nearly evenly divided by gender (49.8% female, 50.2% male),[6] and one third of people are between the ages of 10-24, making Lao PDR one of the youngest countries in Southeast Asia.[7] By 2030, the working-age population is expected to reach 5.5 million, an increase of 1.4 million since 2015, and working-age Laotians will outnumber their older and younger dependents.[8] Simultaneously, the country is undergoing one of

1 World Bank Climate Change and Knowledge Portal. Data on Lao PDR. Available here.
2 Open Development Laos. Ethnic Minorities and Indigenous People. Available here.
3 Lao PDR Ministry of Health. "Indigenous Peoples Planning Framework: Ethnic Group Development Plan." Vientiane, 2015. available here.
4 World Bank Indicator Data. Population, total – Lao PDR. Available here.
5 World Population Review. Laos 2023 Population and Projections. Available here.
6 Encyclopedia Britannica. Laos: Religion: Available here.
7 United Nations National Human Development Report 2022. Lao PDR Report Brief. Available here.
8 Ibid.

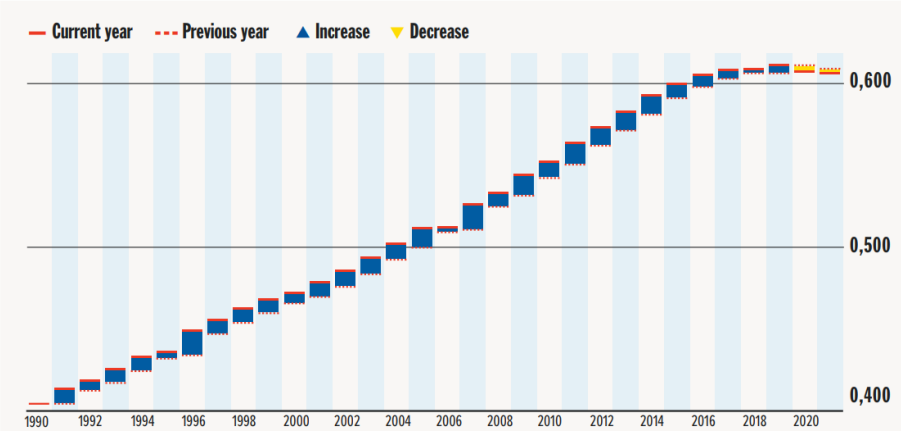
the most rapid urbanization processes in the Southeast Asia region, with the rural population consistently decreasing since 1990 (see Figure 2).

Figure 2. Rural population as a percentage of total population[9]



20. Lao PDR has achieved significant gains in human development in the past 30 years, as measured by the Human Development Index (see Figure 3), which is a combined measure of health, education, and income. Between 1990 and 2021, life expectancy at birth increased by 14.3 years, mean years of schooling by 2.28 years, and expected years of schooling by 3.55 years. Gross national income per capita also increased by almost 300% during this time. While the impacts of COVID-19 have slowed progress on some of these gains, Lao PDR's Human Development Index scores continue to place the country in the medium category.

Figure 3. Trends in Lao PDRs Human Development Index Scores, 2019-2021[10]



21. Despite these remarkable improvements, development challenges remain. Rates of maternal mortality (151 per 1,000) and under five mortality (46 per 1,000 live births) are the highest of any Southeast Asian country. Nearly one fifth of the overall population consumes less than the minimum dietary energy requirements and chronic malnutrition affects over 40% of children under five years of age.[11]

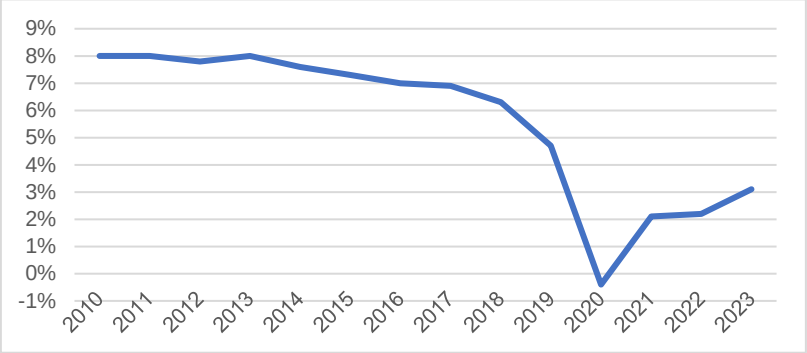
22. Women in Lao PDR also continue to experience persistent inequalities in reproductive health, empowerment, and economic activity. While the country has made great strides on girls' education and equity in the education system overall, tradition and deep-rooted cultural norms still prevent girls from having the same educational and economic opportunities as boys. Early marriage and childbearing also remain common in many communities, which further limits girls' access to education and ability to work outside the home. Estimates suggest that only 35% of adult women have attained at least a secondary level of education, compared to 46% of men. These challenges are reflected in Lao PDR's current rankings in global gender indices. The UNDP Gender Inequality Index places the country at 109 of 160, and the Women's Economic Opportunity Index, which factors such as schooling, access to contraception, political participation, and access to financial services, ranks Lao PDR 108 out of 128. See Annex 4: Gender Assessment & Action Plan for more details on gender norms and dynamics in Lao PDR and their impact on project activities.

9 World Bank Indicator Data. Rural population (% of total population) - Lao PDR. Available here.
10 United Nations National Human Development Report 2022. Lao PDR Report Brief. Available here.
11 United States Agency for International Development. Laos Health Strategy 2019-2023. Available here.

Macro-Economic Context

23. Lao PDR is a one-party parliamentary socialist republic. The country is a member of the Association of Southeast Asian Nations (ASEAN), a group of countries characterized by their rapid economic and gross domestic product (GDP) growth. The country's communist party leadership began decentralizing control of the economy and encouraging private enterprise in 1986. Between 2000 and 2019, GDP growth averaged 7% and Lao PDR had the fastest growing economy in Southeast Asia.[12] However, the COVID-19 pandemic caused a sharp economic contraction in 2020. While GDP rebounded to 2.1% in 2021, a second wave of COVID-19 in Lao PDR that year limited further recovery. Since then, Lao PDR's GDP has risen slightly but global economic conditions, including inflation, have slowed recovery into 2023 (see Figure 4).

Figure 4. Real GDP Growth (annual percent change)

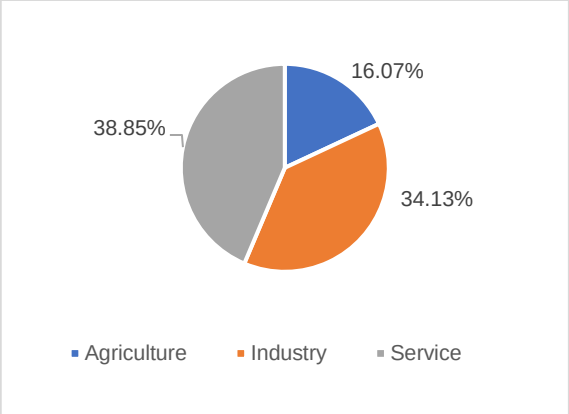


24. The country's steady GDP growth between 2000 and 2019 is largely attributed to its investment in capital-intensive resources (e.g., mining and hydropower) and to infrastructure development.[13] While economically beneficial, these investments have led to environmental consequences. The country's natural capital stocks have been depleted, albeit at a slower rate since 2015, and many of the country's forests and water resources remain under threat. Continued dependence on natural resources has also led to significant macroeconomic vulnerabilities; for example, the low rate of revenue collection and debt-financed investments in the electricity sector have contributed to a nearly 20% increase in public debt since 2010. The GoL's use of its limited public funds to invest in capital-intensive resources also risks undermining public services such as education, agriculture, and health, which could potentially lead to a decline in labor productivity in the future and increase the risk of poverty, especially for women, children, and vulnerable households.

25. Lao PDR's economy has historically been rural and agrarian, with only recent growth into the service and industry sectors (see Figure 5).[14] Details on each of these main sectors, along with each sector's relevant sub-sectors, are presented below.

The Service Sector

Figure 5. GDP Composition by sector, 2020



26. While the service sector in Lao PDR is nascent, it is already outpacing the agriculture and industry sectors in GDP share and employment growth. The service sector is expected to continue to expand as doing business in Lao PDR becomes easier, education and training improve, and as the infrastructure and tourism sub-sectors grow.

27. Tourism is a major sub-sector within the service sector. Lao PDR's rich cultural heritage and natural beauty have attracted an increasing number of visitors in recent years (see Table 1). The government and private sector are collaborating to increase tourism, for example by organizing campaigns like the "Year of Laos 2018," which increased international arrivals by 8.2% that year. However, the COVID-19 pandemic significantly impacted tourism, including

12 World Bank. Lao PDR Country Economic Memorandum – Summary, 2021. Available here.
13 Ibid.
14 IndraStra Global. The Role of the Services Sector in the Lao PDR's Economy, 2017. Available here.

through temporary closures of ports of entry to tourists, suspension of tourist visas, and the temporary banning interprovincial travel. In 2020, international tourism declined by 81.5%, leading to closures of many tourism businesses from which the sub-sector is still recovering.[15]

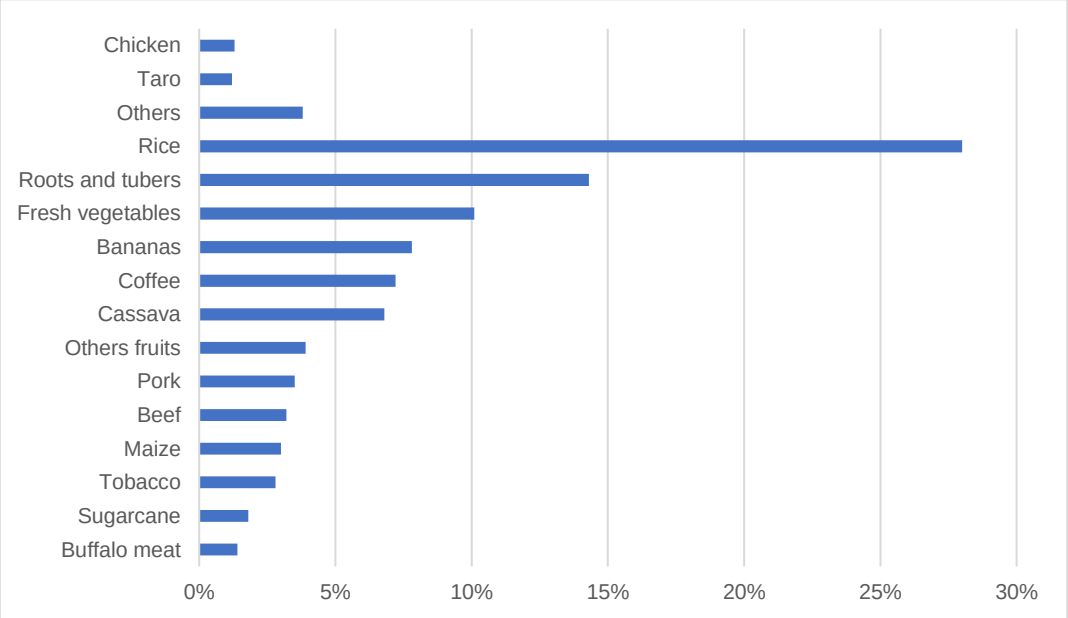
Table 1. Lao PDR International Tourist Arrivals, 2010-2019[16]

Year	Arrivals (million)	Year-on-Year Change %	Share of SE-Asia Arrivals %
2010	2.5	25.5	3.4
2011	2.7	8.8	3.3
2012	3.3	22.0	3.7
2013	3.8	13.2	3.6
2014	4.2	10.1	4
2015	4.7	12.8	4.3
2016	4.2	-9.6	3.6
2017	3.9	-8.7	3
2018	4.2	8.3	3
2019	4.8	14.4	3.3

The Agriculture Sector

28. 70% of Lao PDR's working population is employed in the agriculture sector, which remains a critical component of the country's economy.[17] Most of those employed work in subsistence agriculture, which is dominated by rice cultivation in irrigated fields in the country's lowland areas and rainfed fields in the upland areas. In addition to growing rice, farmers in Lao PDR produce sugarcane, fruits and vegetables, tobacco, and coffee (see Figures 6-8), which is the only crop exported in substantial quantities. Agricultural yields vary from year to year due to weather fluctuations, including floods and droughts. The lowland areas are more affected by these changes but because they have better access to pesticides, fertilizers, infrastructure, and technologies, they generally still have higher yields than the country's upland areas. Lao PDR has limited its ability to expand its cultivated farmland due to leftover unexploded ordinances from the Vietnam War. However, the GoL is working to modernize the agriculture sector and to introduce market-oriented production methods, which will lead to self-sufficiency in rice production in "normal" production years.[18]

Figure 6. Lao PDR Gross agricultural production value, 2019[19]



15 Asian Development Bank. Developing Agriculture and Tourism for Inclusive Growth in PDR, 2021. Available here.
16 Ibid.
17 Moody's Analytics. Laos - Economic Indicators. Available here.
18 Encyclopedia Britannica. Laos Agriculture, Forestry and Fishing. Available here.
19 Asian Development Bank. Developing Agriculture and Tourism for Inclusive Growth in PDR, 2021. Available here.

Figure 7. Share of crops to total area harvested, 1998-2019[20]

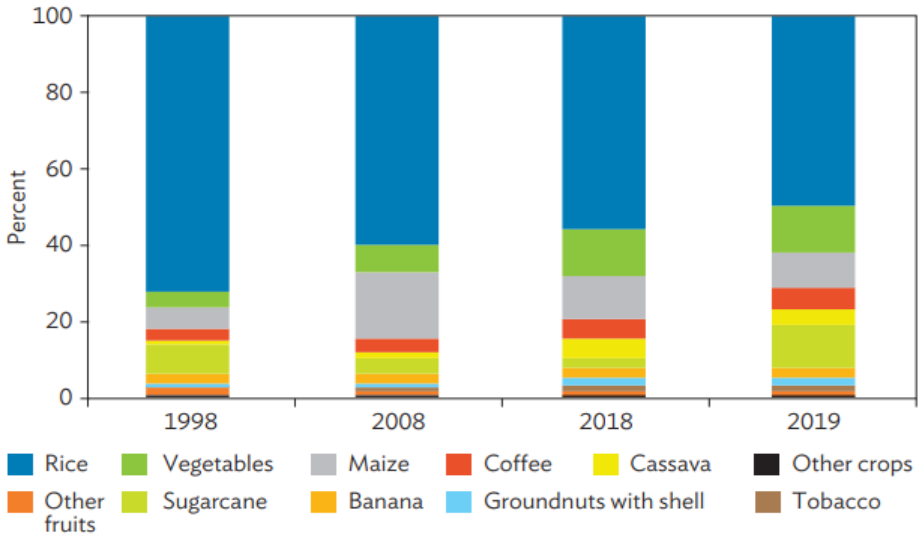
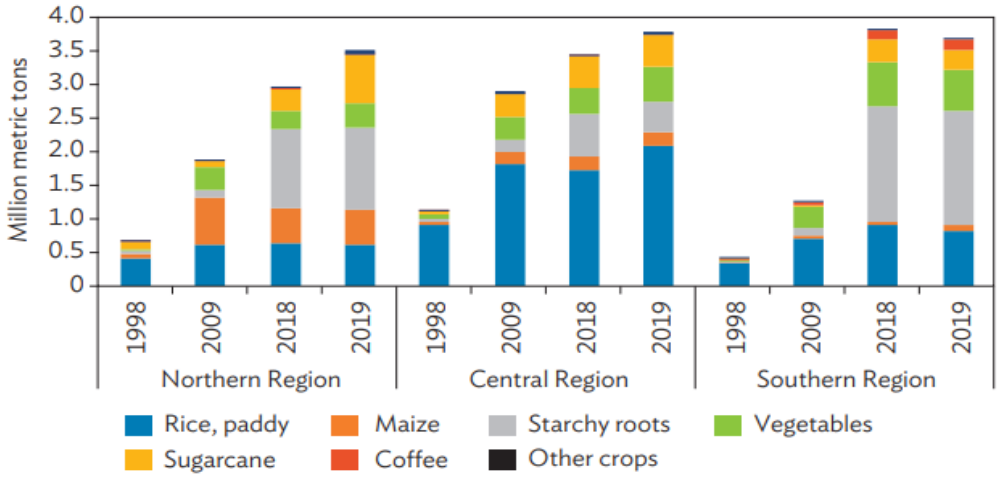


Figure 8. Lao PDR Crop production by region, 1998-2019[21]



29. The agriculture sector also encompasses the forestry and fisheries sub-sectors. Two-fifths of Lao PDR is covered by forests, which has enabled the creation of industries growing, treating, and processing wood. Timber extraction has been temporarily banned due to brutal deforestation, which has in some areas resulted in rapid erosion of mountainsides and hillsides, silting up of rivers, and ultimately, an increase in the severity of droughts and floods.

30. Fishing is an important source of animal protein and micronutrients for the Laotian population and a key source of secondary income for many people, especially rice farmers who live near the Mekong and its tributaries. Estimated annual consumption of fish and marine products is 32.7 kg per capita, with freshwater fish accounting for most of this amount.[22]

The Industrial Sector

31. Lao PDR's main sources of energy are coal, oil, hydropower, and biomass. The country has intensively developed its hydropower resources since 1990 (see Figures 9-10). Lao PDR imports petroleum products and electricity to meet its domestic energy needs while both using and exporting its coal resources. Exports of electricity to Thailand and Cambodia generate a significant amount of funds annually. In 2020, 100% of the population had access to electricity.

20 Ibid.
21 Ibid.
22 Phonvisay Singkham, Phonvisay. Mekong River Commission Development Series. An Introduction to the Fisheries of Lao PDR. Available here.

Figure 9. Total energy supply by source 2019[23]

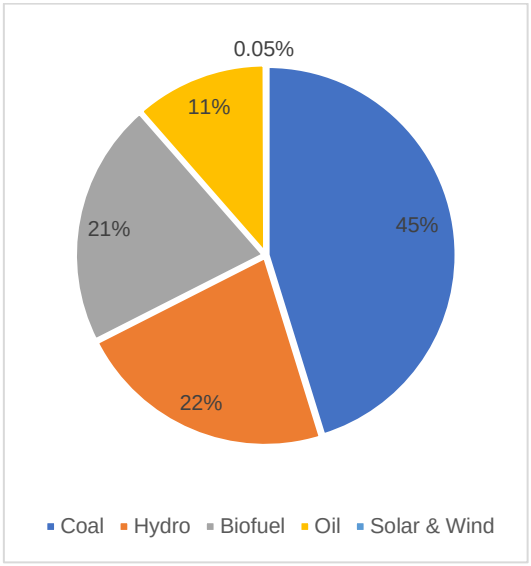
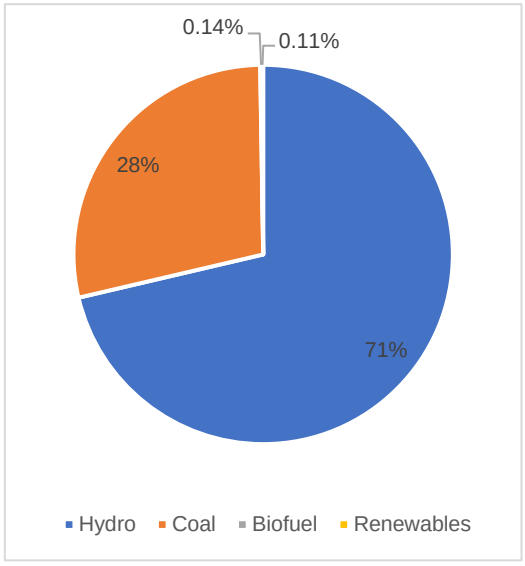


Figure 10. Electricity generation by source 2020[24]



32. Lao PDR has very large deposits of mineral resources and accessing these resources has significantly contributed to the country's economy. About 30% of total foreign direct investment (FDI) in Lao PDR supports mining,[25] and from 2003 to 2012, FDI in the sector amounted to USD 5.3 billion. However, the 2012 collapse in world commodity prices slowed mine production and permanently decreased the industrial sector's contributions to Lao PDR's GDP.[26] In 2020, mining accounted for less than 5% of the country's GDP and only 14% of exports, compared to 16% and 43% respectively in 2012.[27,28]

Trade

33. Lao PDR is one of five communist countries that have implemented market-based economic practices while maintaining a high degree of state control and welcoming FDI. The accession of Lao PDR to the World Trade Organization in 2013 and the establishment of the ASEAN Economic Community in 2015 have led to major reforms in economic policies and regulations to make it easier to do business in Lao PDR and improve the country's investment environment. Strong regional economic growth (e.g., in neighboring China, Vietnam, and Thailand) has also contributed to the expansion of trade (see Figure 11). The GoL is increasingly pursuing ASEAN economic integration, export-led development, and connectivity, seeking to move from a "landlocked" country to a "land-linked" country.[29] In 2021, Lao PDR recorded a trade surplus of USD 1 billion, with merchandise imports of USD 6 billion, a 16% increase compared to 2020, and exports of USD 7 billion, an 12% increase compared to 2020. China, Thailand, and Vietnam are Lao PDR's main trade and investment partners (see Figure 12). In 2021, Lao PDR's bilateral trade was approximately USD 5.18 billion with Thailand (USD 2.18 billion in exports, USD 3 billion in imports), USD 3.47 billion with China (USD 2.22 billion in exports, USD 1.25 billion in imports), and USD 1.71 billion with Vietnam (USD 1.22 billion in exports, USD 499 million in imports). These numbers have likely increased, particularly since the Lao-China Railway opened in December 2021.[30] Malaysia; the Republic of Korea; France; Hong Kong, China; and the Netherlands are also increasingly active in trade with Lao PDR.

23 International Energy Agency. Laos: Country Profile. Available here.
24 Ibid.
25 Government of Canada Trade Commissioner. Market Reports: Mining Market in Laos, June 16, 2022. Available here.
26 Hernando, Paolo ad Yonemura, Takashi. ASEAN+3 Macroeconomic Research Office. Transforming the Resource Sector in Lao PDR. Available here.
27 Trading Economics. Laos GDP: Summary, 2022. Available here.
28 U.S. International Trade Administration. Laos Country Commercial Guide: Market Overview. Available here.
29 Ibid.
30 Ibid.

Figure 11. Exports by major commodity [31]

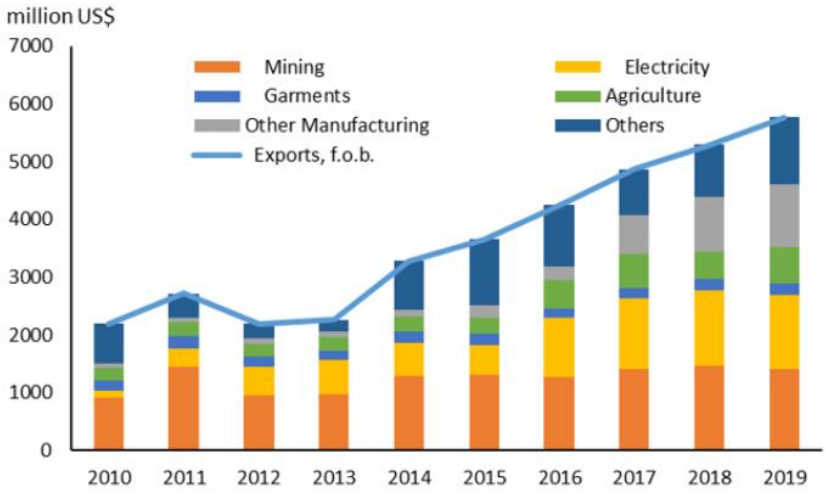
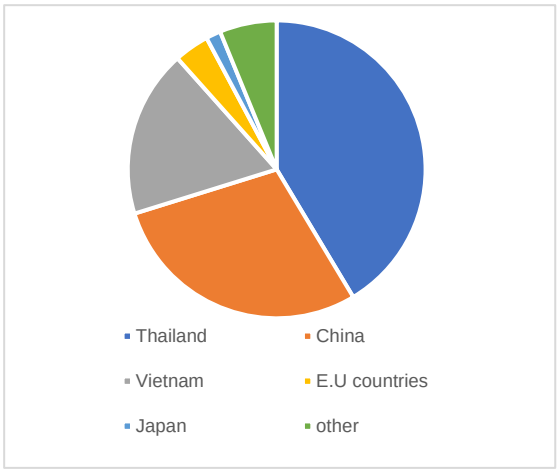


Figure 12. Lao PDR major export destinations, 2019[32]



Key Macro-Economic Challenges

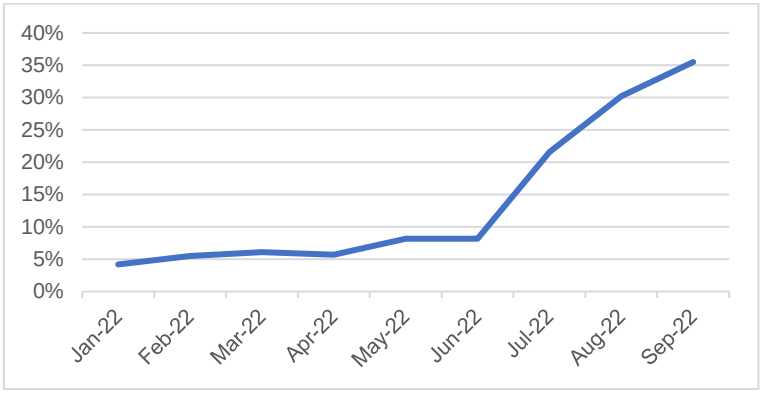
Inflation

34. The inflation rate in Lao PDR averaged 17% from 1989 to 2022, reaching a record high of 167% in March of 1999.[33] Inflation has risen again sharply in the past year, averaging around 20% and peaking at 39% in December 2022, due to in part to higher prices for food, non-alcoholic beverages, and other essential goods (see Figures 13 and 14). The continuing depreciation of Lao PDR's currency, the Kip, against strong currencies such as the US dollar, Thai Baht, and Chinese Yuan has also contributed to rising inflation.[34]

Figure 13. Annual Consumer Price Inflation in %[35]

31 Hernando, Paolo ad Yonemura, Takashi. ASEAN+3 Macroeconomic Research Office. Transforming the Resource Sector in Lao PDR. Available here.
32 Encyclopedia Britannica. Laos Agriculture, Forestry and Fishing. Available here.
33 Trading Economics. Laos GDP: Summary, 2022. Available here.
34 Vietnamplus. Inflation in Laos Skyrockets to 39.27% in December. Published January 09, 2023. Available here.
35 International Monetary Fund. Lao PDR Country Data. Available here.

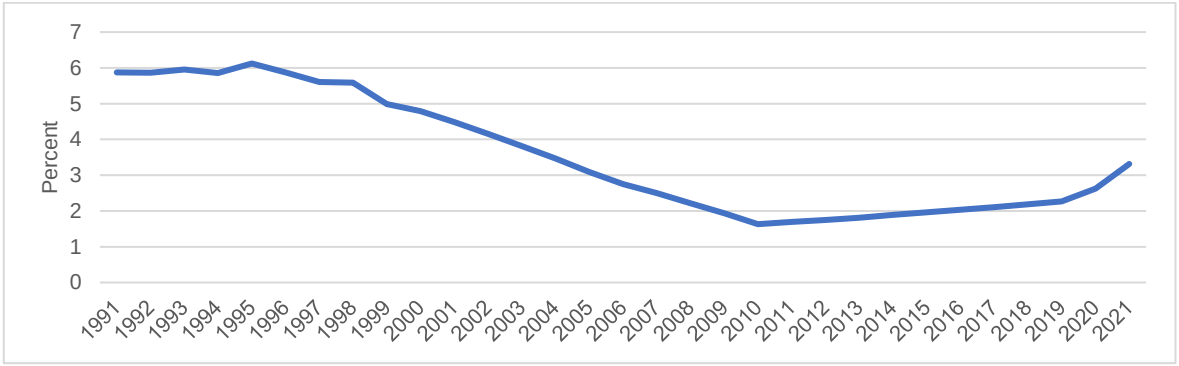
Figure 14. Food Price Inflation[36]



Youth Employment

35. As a country with one of the youngest populations in the Southeast Asia region, creating meaningful opportunities for youth employment outside the agriculture sector is a high priority for the GoL. Despite this, the youth unemployment rate has begun to rise again after a period of decline and relative stagnation (see Figure 15). Around 80,000 young people enter the job market each year to compete for limited opportunities that rarely align with their interests or training.[37] The recent COVID-19 pandemic has exacerbated this challenge by contributing to instability in the service sector, as described above.[38]

Figure 15. Unemployment, youth total (% of total labor force ages 15-24) (modelled International Labor Oraganization estimate)



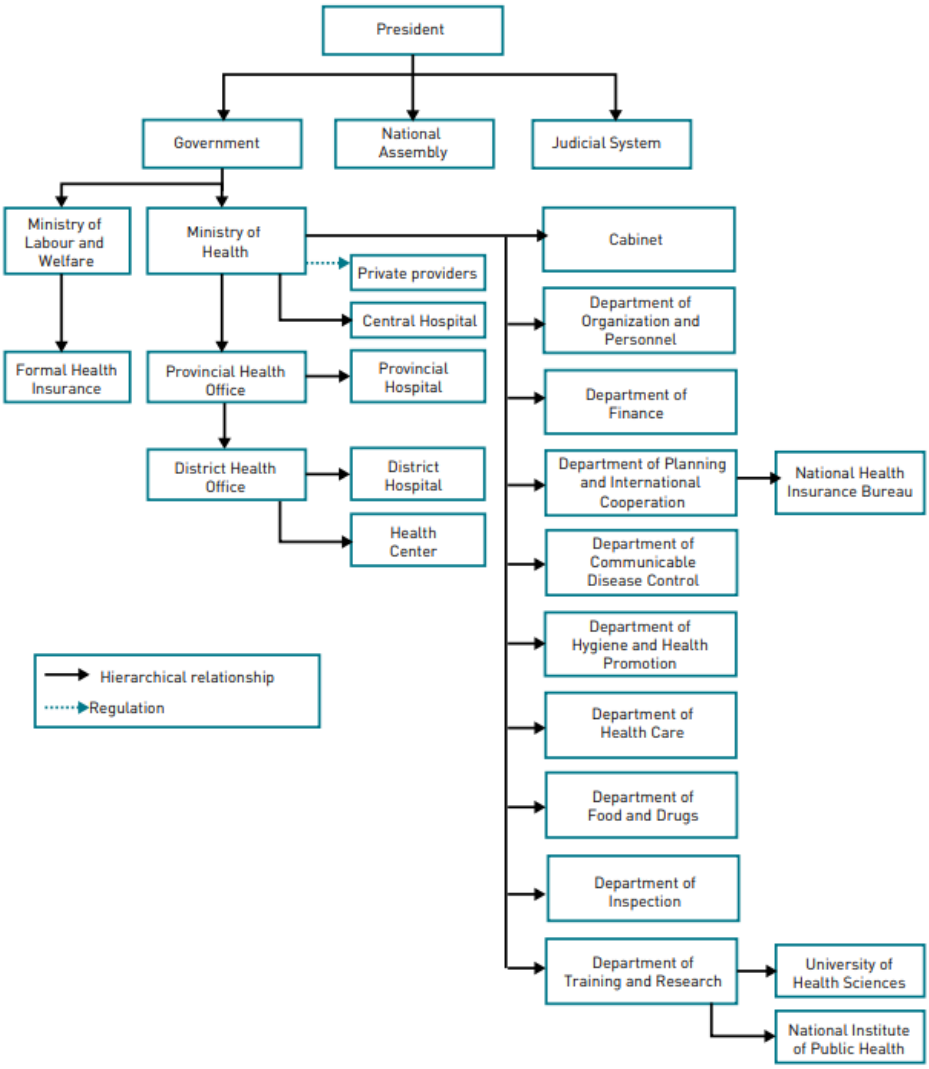
The Health Sector

Structure of the health sector

36. In Lao PDR, public sector health facilities provide health services to most of the population. The public health system has three administrative levels: 1) central, which includes hospitals led directly by the MoH; 2) provincial, which includes provincial health offices (PHOs) that manage provincial hospitals; and 3) district, which includes district health offices (DHOs) that manage district hospitals, community-level health centers, and village-based health outreach services. Figure 16 presents the health system's structure and hierarchy. The roles and responsibilities of each administrative level are further detailed below.

36 Trading Economics. Laos GDP: Summary, 2022. Available here.
37 United Nations National Human Development Report 2022. Lao PDR Report Brief. Available here.
38 Statista. Laos: Youth unemployment rate from 2022 to 2021. Available here.

Figure 16. Structure of the Lao PDR Health system[39]



37. *Central level:* As the national health authority in Lao PDR, the MoH manages, organizes, and oversees all public preventive, promotive, curative, and rehabilitative health services. The MoH manages health information, human resources for health, health financing, and international health cooperation. It regulates the growing private sector as well as traditional medicine, food and drug safety, and pharmaceutical and medical supplies. MoH includes seven technical agencies: the Department of Planning and Cooperation; the Department of Communication and Disease Control; the Department of Hygiene and Health Promotion; the Department of Healthcare and Rehabilitation; the Food and Drugs Department; the National Center for Laboratory and Epidemiology; and the National Center for Communication and Education in Health. These departments work in close cooperation with PHOs and DHOs to implement health sector activities and priorities. The MoH directly oversees three general hospitals, two specialized hospitals, and three specialist centers (for ophthalmology, dermatology, and rehabilitation).

38. *Provincial level:* PHOs advise the provincial government and governor on health affairs; allocate budget for provision of health services; oversee the technical direction, monitoring, and supervision for DHOs; and perform other tasks as assigned by the provincial governor. PHOs are made up of a cabinet, technical and professional divisions, and health facilities (provincial hospitals). While the provincial government oversees the management, operation, and funding of PHOs, the MoH is responsible for providing them with technical direction, monitoring, and supervision. In Lao PDR, there are currently 16 PHOs and 16 provincial hospitals, plus one Capital Health Office in Vientiane.

39 UNFPA. Mid-term Evaluation of the UNFPA Supplies Programme (2013-2016). Available here.

39. *District level, including health centers and village-based health services:* DHOs supervise district hospitals; district units for preventive medicine, such as mother and child health, immunization, and hygiene and prevention units; community-level health centres; and village-based outreach activities. District hospitals, which have a catchment area of 30,000-80,000 people, provide treatment for common illnesses and emergencies. They are divided into two categories: type A, which has the capacity to provide surgery requiring anesthesia, though lack of staff often limits provision of these services; and type B, which offer only minor surgery. District mayors provide DHOs with organizational and operational oversight that complements the technical direction PHOs provide. There are currently 135 district hospitals in Lao PDR (25 type A and 110 type B).

40. As the first level of government health facilities, Lao PDR's 1,060 health centers provide primary care services (e.g., prevention, diagnosis, and treatment of common diseases; health promotion). This network of facilities covers all districts and communities. It continues to grow annually due to the need to provide coverage for newly established groups of villages. Under the oversight of the DHO, health centers supervise and monitor Village Health Volunteers (VHVs) who provide community-level outreach services, coordinating these services between the village and district levels. Each village has two or three VHVs who provide basic curative care and promote good hygiene and sanitation. Village Health Committees select and oversee VHVs, who receive three months of training.

41. Lao PDR has two types of private sector health facilities: hospitals and private clinics. Eighteen of the country's 29 hospitals are in Vientiane, and three more are under construction. The country has 1,050 private clinics offering different services, including urgent care, general practice, dental, rehabilitation, and traditional medicine. The capacity and quality of services offered by Lao PDR's private sector clinics is variable.

Relevant Health Sector Policies and Strategies

42. Over the last several decades, Lao PDR has successfully developed and adopted policies, strategies, and laws to guide the health sector and improve the quality of health service delivery. A summary of the key laws, policies, and strategies relevant to climate and health programs is presented in Table 2 below. A comprehensive social and environmental legal and policy overview has been provided in Annex 15.

Table 2. Key Health Sector Laws, Policies, and Strategies Relevant to Climate and Health Programs

Key Health Sector Law, Policy, or Strategy	Summary
Revised Constitution 2015	Per Lao PDR's revised constitution, "*the State attends to improving and expanding public health services to take care of the people's health.*" The constitution mandates that the GoL provide all Laotians with fair and equal access to health care, especially the women, children, and the most vulnerable, and enhance the quality of services by introducing drug revolving funds and a cost recovery system with user fees.
Vision 2030 & National Socio-Economic Development Plan (NSEDP)	Vision 2030 envisions Lao PDR as an Upper Middle Income Country, with stable, inclusive, and sustainable economic growth and equitably distributed and geographically balanced social services. Vision 2030 is implemented through time bound NSEDPs. The 2016-2020 NSEDP targeted poverty reduction, graduation from LDC status, effective management and use of natural resources, addressing the impacts of climate change, improvement of access to clean water, and supporting the Health Sector Reform Strategy (described below). The NSEDP 2021-2025 targets outcomes for economic growth, development of human resources, enhanced wellbeing of the people, enhanced environmental protection, reduction of disaster-related risks, enhanced regional and international cooperation and integration, and strengthening public governance. The plan aims to develop Lao PDR's potential to grow its productive and service sectors in a green and sustainable way, while also improving people's wellbeing. This plan ties action on climate change to economic development instead of health.
National Health Specific Adaptation Plan to Climate Change (HNAP) 2023	The HNAP is still under development. Available in draft form, it is expected to be finalized, adopted, and rolled out in 2023. Guided by the National Strategy on Climate Change and Health Adaptation and Action Plan (see below) it recognizes the need to integrate climate/weather and environment data with the country's existing RHIMS to enable climate-sensitive disease surveillance and prediction. This data integration will facilitate vulnerability assessments, regular

	risk monitoring, and refining early warnings in a changing climate, allowing climate-related information to inform health decision-making. The HNAP also identifies dengue, diarrheal disease, malnutrition, and heat-related illnesses as among the most important climate-related illnesses for the country to address.
Strategy on Climate Change and Health Adaptation and Action Plan (2018)	The MoH's 2018 Strategy on Climate Change and Health Adaptation and Action Plan aligns health priorities with national climate change priorities. The Strategy's overarching vision is to ensure "people are healthy and strong." This vision is to be met via six strategic directions that will promote "the capacity of the public health and community sectors to prevent and protect the health of people from unstable and changing climate conditions." Its goal is to save energy and water and reduce waste. The strategy largely adopts WHO's 2020 guidance, *Climate and Resilient and Environmentally Sustainable Health Facilities,* which includes four action areas: 1) health workforce; 2) WASH and waste management; 3) energy; and 4) infrastructure, technologies, and products. The HNAP, described above, is guided by this national strategy.
The National Strategic Plan for Adaptation of the Health Sector to Climate Change 2017-2025	This plan includes six strategic directions that align with the strategic directions presented in the WHO's Operational Framework for Building Climate Resilient Health Systems (2015) and support successful implementation of the Sustainable Development Goals. The strategic directions are: 1) leadership and governance; 2) organizational and staff capacity strengthening; 3) health information systems, including vulnerability and adaptation capacity assessment, integration of risk monitoring and early warning systems, and climate and health research; 4) climate resilient and sustainable technologies and infrastructure; 5) service delivery, including management of environmental determinants of health, climate-informed health programs, and emergency preparedness and management; and 6) climate and health financing.
Health Sector Reform Strategy 2013-2025	The Health Sector Reform Strategy was developed to enable the health sector to achieve UHC. It includes five pillars: 1) service delivery, which focuses on improving the quality of health services, ensuring access to essential health services, integrating relevant services across programs, improving the referral network, and strengthening preparedness, surveillance, and response for public health emergencies; 2) human resources for health, which focuses on strengthening the capacity of the health work force and improving recruitment, distribution, and incentives for health workers; 3) health financing, which focuses on ensuring financial protection through adequate and sustainable domestic government financing, accountability for funds and strategic purchasing of efficient and high-quality services; 4) governance and management, which focuses on strengthening governance and coordination throughout the health sector to achieve health sector reform, strengthening district-level management capacity, private sector regulation, and hospital autonomy; and 5) monitoring and evaluation, which focuses on improving health information governance, applying modern technologies effectively and efficiently, and using information for decision-making at all levels.
Law on Health Care 2014	As stated in Article 1, The Law on Health Care 2014 "determines the principles, regulations and different measures relating to the organization, activities, management and inspection of health care activities…." The law aims to ensure equal, full, equitable access to quality health care and to protect the rights and interests of health workers. It was developed to support implementation of the national health strategy and focuses on the delivery of health services. Activities to strengthen climate resilience of health facilities will need to be implemented in compliance with this law.
Law on Hygiene, Disease Prevention, and Health Promotion 2001[40]	This law defines the principles, regulations and measures that organize activities on hygiene, disease prevention, and health promotion to maintain the population's good health, quality of life, and longevity. In the context of the law, hygiene includes the hygiene of persons, families, communities, and specific settings, such as hospitals, dispensaries, and clinics. The law states that health facilities "shall be clean, tidy, and hygienic, and shall be free from germs" and that they "shall be equipped with latrines, sufficient drinking water and water supply, a system for waste-water treatment, and a system for waste separation, storage and disposal." There is no exemption from these obligations for health facilities that may be impacted by climate change.

40 This law was updated in 2021. An English-language translation is not yet available.

Access and Use of Health Services

43. Although the number of health facilities in Lao PDR has increased in recent decades, inequality in access to services persists, with rural populations and those in the lowest wealth quintile most impacted. Inadequate transportation infrastructure, particularly during the wet season, remains a major barrier to access and use of health services in rural areas. Other substantial factors include ethno-linguistic barriers, cultural barriers, and supply-side challenges, such as health facility and health worker readiness to provide high-quality care. Many district and community health facilities also have degraded infrastructure and lack medical equipment and supplies, including medicine. As a result of these challenges, clients often perceive that district and community-based health services are poor quality and prefer to access care at central and provincial hospitals. Health services and facilities in remote areas also struggle to provide needed care for climate-related diseases, particularly in ethnic minority communities. This creates an excessive patient load at the higher-level facilities, while district and community-level facilities are underutilized. Underutilization of district and community-level facilities can exacerbate challenges by contributing to low productivity and low clinical ability among the health providers based in them.[41]

44. The GoL is committed to achieving universal health coverage by 2025, particularly for those in the lowest wealth quintiles and other vulnerable groups. Public sector facilities provide maternal and child health services for free; however, other services can be costly for the population to access and the cost of health services remains a persistent challenge for many Laotians. The GoL is working to eliminate financial barriers through its heavily subsidized, tax-based National Health Insurance (NHI) scheme, which includes a low co-payment for non-insured Laotians as well as transportation and food allowances for the most vulnerable. In 2019, 94% of the population was covered by the GoL's NHI scheme.

45. The GoL's expenditure in the health sector is rising slowly but remains low overall. From 2010 to 2016, government health expenditure as a percentage of total government spending increased from 4.4% to 5.9%. However, this is still significantly lower than other countries in the region, such as China, Thailand, and Vietnam, which allocate approximately 10% of government funds to healthcare.[42] In 2018, per capita health expenditure for Lao PDR was estimated at USD 68.22, a significant increase from the estimated 2010 expenditure of USD 34.99 but still markedly lower than neighboring countries in the Southeast Asia region.[43]

Health Information Systems

46. Lao PDR uses the WHO's District Health Information Software (DHIS2) as its national Routine Health Information Management System (RHIMS). The system houses data on the country's major health programs, including data from maternal, newborn, and child health, tuberculosis, malaria, and HIV/AIDS programs. Public health facilities nationwide report into the RHIMS, and MoH officials use the data to generate reports and statistics and monitor program quality.[44] Strengthening the quality of the RHIMS is a focus of the 2013-2025 Health Sector Reform Strategy (see Table 4) and the forthcoming Health National Adaptation Plan (HNAP).

Water, Sanitation, and Hygiene (WASH) Infrastructure in Lao PDR's Health System

47. WASH services in health facilities—defined as installations providing safe water for consumption and cleaning; hygiene stations for medical practitioners and disinfection of medical equipment; sanitation facilities for patient and staff use; and infrastructure for the treatment and safe disposal of effluents—are prerequisites for infection prevention and control and providing quality health care services.

48. From April 2020 to September 2021 and with support from WHO, Lao PDR's MoH conducted a survey of WASH services in 1,225 health facilities. The survey was based on WHO/UNICEF core indicators for monitoring water, sanitation, hygiene, waste management and resilience to climate change in health facilities. Results showed that very few health facilities in Lao PDR had consistent and reliable access to WASH services. Survey results are summarized below.

49. *Water services:* Eleven percent of health facilities had no access to water services, while 19% had limited water services available. The remaining 70% of facilities had access to a basic water service, but very few were connected to piped water systems operated by Nam Papa, Lao PDR's

41 World Bank. A Policy Snapshot of Health and Nutrition in Lao PDR. Available here.
42 United States Agency for International Development. Laos Health Strategy 2019-2023. Available here.
43 OECD. Health at a Glance: Asia/Pacific, 2022. Available here.
44 Ibid.

water company. All provincial hospitals surveyed and 4 out of 5 district hospitals surveyed had access to a basic water service. Among the project's target provinces, facilities in Khammouane and Salavane were most likely to have access to basic water services (97% and 92%, respectively), followed by Luangnamtha (78%), Sekong (77%), Odomxay (76%), Phongsaly (55%) and Luang Prabang (25%). Health centers (community-level health facilities) were more likely to have no or limited water service. Eighty eight percent of health facilities reported experiencing water shortages during the dry season, and 4% reported experiencing water shortages due to water supply infrastructure being damaged by floods or EWEs.

50. *Sanitation services:* All health facilities used improved sanitation and all toilets in hospitals were the flushed or weak flushed type. However, only 2% of health facilities had a dedicated toilet for staff, sex-separated toilets with menstrual hygiene facilities, and toilets with accessibility for persons with limited mobility. Provincial hospitals were mostly likely to have these facilities available. Eighty-six hospitals reported their toilets were unusable.

51. *Hygiene facilities:* Only 16% of surveyed health facilities had functional hand hygiene facilities with water and soap and/or alcohol-based hand sanitizer at points of care and within five meters of toilets. In 74% of health facilities, functional hand hygiene facilities were found at either point of care or toilets, but not both. District hospitals were most likely to have these services in place; however, nearly 10% of health facilities surveyed had no functional hand hygiene facilities available at either points of care or toilets.

52. *Waste management:* Only 19% of health facilities surveyed had basic waste management services, meaning that they safely segregate waste into at least three bins and sharps and infectious waste are treated and disposed of safely. Provincial and district hospitals were most likely to have basic waste management services in place as compared to community-level health centers. Seventy seven percent of surveyed facilities had limited separation and/or treatment and disposal of sharp and infectious waste but did not meet all requirements for basic service.

Health Sector Greenhouse Gas (GHG) Emissions

53. Lao PDR transitioned from a net carbon sink to a carbon emitter between 1990 and 2000.[45] The land use, land use change, and forestry sector contributed approximately 98% of Lao PDR's emissions in 2000, with the remainder comprising emissions from the energy and industrial sectors, including the health sector.[46] The health sector's contribution to national GHG emissions has not been quantified, but global estimates suggest that the sector contributes between 1-5% of overall emissions.[47]

54. While estimates of health sector contributions to the national emissions profile[48] for Lao PDR are limited, estimates of emissions from waste management activities offer a useful proxy since the majority of the health sector's emissions on a global scale (71%) are driven by the supply chain (through the production, transport, and disposal of goods and services, such as pharmaceuticals and other chemicals, food and agricultural products, medical devices, hospital equipment, and instruments).[49] While the exact percentage of the health sector's contribution to the volume of solid and liquid municipal waste in Lao PDR is not known, an indicative but unverified estimate from two studies at district level suggests that these activities generate approximately 110,000 and 34,000 tons of $C0_2$ equivalent ($tC0_2e$) annually in Vientiane and Luang Prabang, respectively, equating to approximately 1 megaton (mt) of CO_{2e} at country level, if scaled up proportionally.[50,51] Emissions of this magnitude would equate to approximately 5% of total annual emissions for the country.

45 World Bank. Draft National Strategy on Climate Change of Lao PDR, 2021. Available here.
46 Ibid.
47 Lenzen et al. The Environmental Footprint of Health Care: a Global Assessment, 2020. *The Lancet*. Available here.
48 Energy consumption from Lao PDR's health sector is not disaggregated from national energy consumption, so the focus here is on GHG emissions from the supply chain and waste management activities.
49 Health Care Without Harm. Healthcare's Climate Footprint: How the Health Sector Contributes to the Global Climate Crisis and Opportunities for Action, 2019. Available here.
50 Climate Watch. Historical GHG Emissions. Available here.
51 The Humanitarian Data Exchange. Lao DPR's Sub-National Population Statistics. Available here.

Section 3 - Lao PDR's Climate Profile and Climate Change Impacts

Overview of Lao PDR's Climate

55. Lao PDR's climate is tropical, with high rainfall and humidity during the monsoon season (May to mid-October) and the lowest average monthly precipitation from mid-October until April (See Figure 17). The average annual precipitation is 1,826.87 mm.[52] Mean annual temperatures range from 20°C in the country's mountainous regions to 25-27°C in its lowland plains. The mean annual temperature nationally is 24.14°C, with the highest mean monthly temperatures from April until September.

56. According to the Köppen Geiger Climate Classification, Lao PDR has predominantly tropical monsoon (Am) and tropical savanna (Aw) climates (see Figure 18). The tropical monsoon climatic zones have a characteristic warm and humid equatorial climate with monsoon precipitation. The tropical savanna climatic regions have an equatorial climate but with a drier winter season. The country also has areas with warm, temperate climates, dry winters, and warm summer seasons (Cwa) or hot summer seasons (Cwb).

Figure 17. Monthly mean temperatures and precipitation for Lao PDR from 1991 to 2020[53]

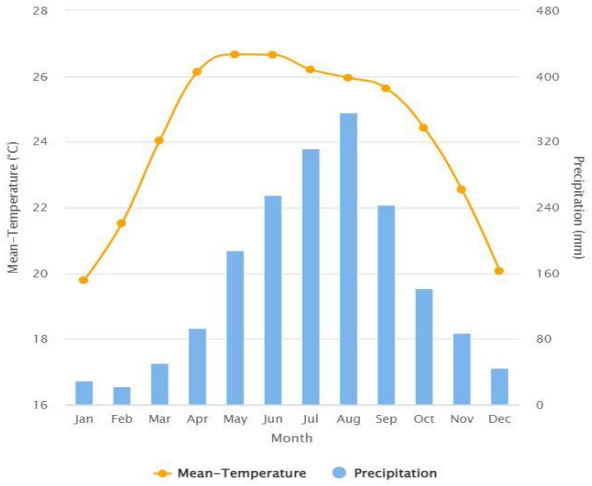
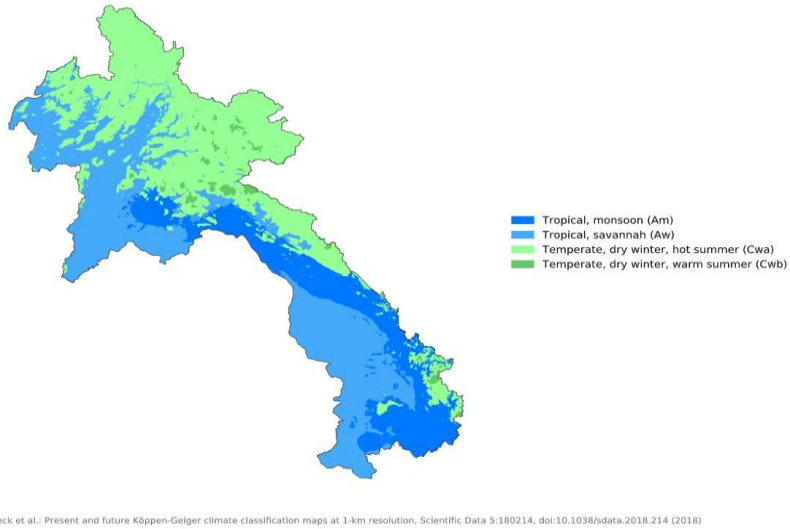


Figure 18. Köppen Geiger climate classification for Lao PDR (1980 to 2016) [54]



52 World Bank Climate Change and Knowledge Portal. Data on Lao PDR. Available here.
53 Ibid
54 Nature Scientific Data. Köppen–Geiger climate classification map for Lao PDR, 2018. Available here.

Lao PDR's Observed Climate Change

57. This section summarizes Lao PDR's observed climate change and its impacts. It presents national and provincial level information on temperature and precipitation. A summary of the projections for climate change and anticipated impacts at national and provincial levels follows.

Temperature

58. Recent data suggests that average temperatures across Lao PDR have increased since the start of the 21st century, with notable temperature increases evident since 1991 (see Figure 19). Temperatures increased by as much as 0.05°C per year between 1970 and 2010, with the most pronounced changes in the country's southern regions.[55] In the Vientiane region, data shows that temperatures increased an average of 1.03°C between 1900 and 2017. The number of days with temperatures exceeding 35°C have also shown a notable increase since 1991 as compared to earlier decades (see Figure 20). In 2016, climate change is estimated to have had a 29% contribution to the extreme temperatures experienced across Southeast Asia, compared to the ENSO, which is estimated to have had a 49% contribution to warming in the same year.[56]

Figure 19. Historic average annual temperatures for Lao PDR from 1901 to 2020[57]

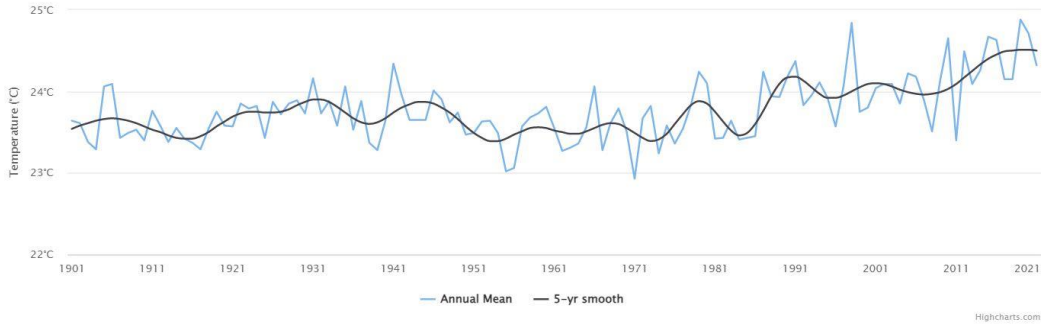
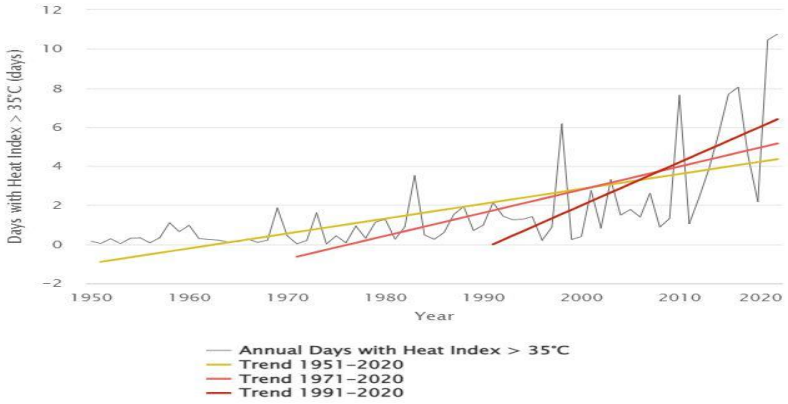


Figure 20. Average number of days in which maximum temperatures exceed 35°C, for Lao PDR from 1950 until 2020[58]



Precipitation

59. Precipitation trends in Lao PDR remain largely influenced by the relationship between the Southeast Asian climate and the ENSO.[59] Precipitation trends since 1951 show increased variability, with historic data suggesting that mean annual rainfall has decreased to below 2,000 mm (see Figure 21). Despite average annual rainfall decreasing, data also suggest rainfall is increasing in intensity and frequency. Between 1991 and 2020, the volumes of precipitation in one day (mm) have shown an increasing trend nationwide (see Figure 22).[60] Monthly rainfall volumes of 600 mm and above, or nearly a third of the country's average annual precipitation, have been recorded between 1954 to 2006. There have also been indications that the rainfall season is shifting, with delays in the monsoon season becoming evident.[61]

55 Lao PDR. National Communication 2. Available here.
56 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR. 2021. Available here.
57 World Bank Climate Change and Knowledge Portal. Data on Lao PDR. Available here.
58 Ibid
59 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR. 2021. Available here.
60 World Bank Climate Change and Knowledge Portal. Data on Lao PDR. Available here.
61 Lao PDR. National Communication 2. Available here.

Figure 21. Average annual rainfall distribution changes across Lao PDR from 1951 until 2020[62]

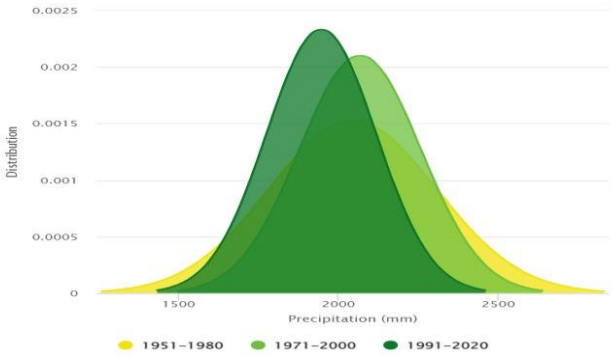
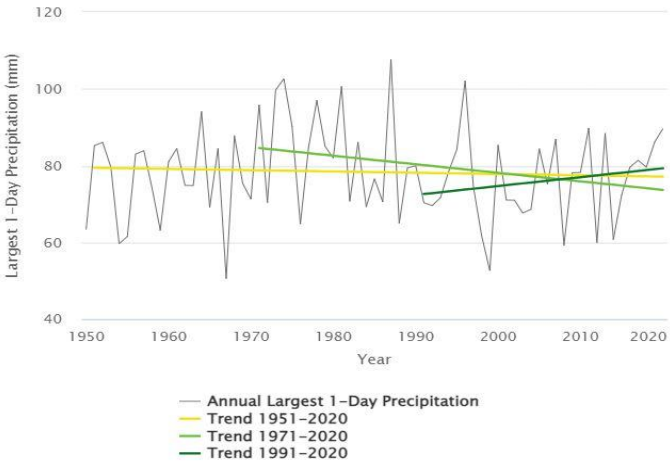


Figure 22. Average one-day precipitation changes across Lao PDR from 1950 until 2020[63]

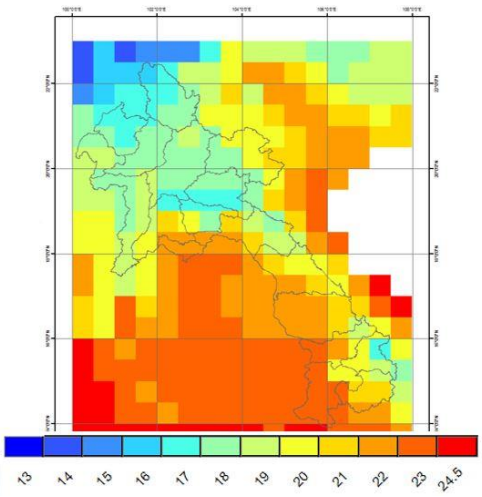


Observed Climate Change – Province Level

Temperature

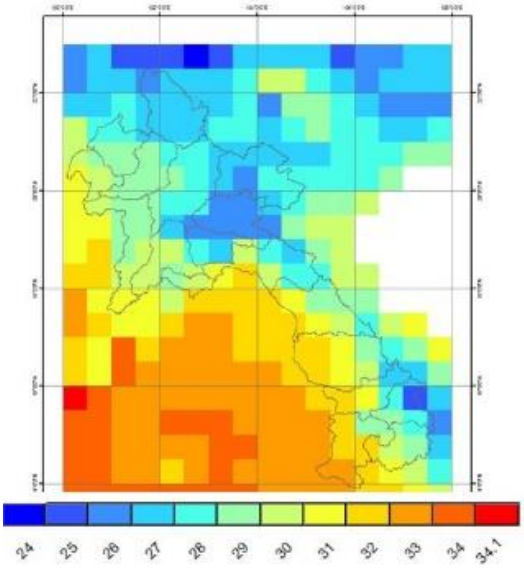
60. Data indicates that minimum average temperatures in Lao PDR's southern regions have typically ranged from 21 to 24°C (see Figure 23). The maximum temperatures in most of the project's target provinces have ranged from 26 to 29°C annually, but the target provinces of Khammouane, Sekong, and Salavane have experienced higher annual average temperatures, with maximum temperatures in Khammouane and Salavane reaching up to 32°C (see Figure 24).

Figure 23. Observed minimum average annual temperatures by province (°C)[64]



62 World Bank Climate Change and Knowledge Portal. Data on Lao PDR. Available here.
63 Ibid
64 MONRE Department of Climate Change Management. Presentation on National Climate Change Vulnerability Assessment, 2021. Not publicly available.

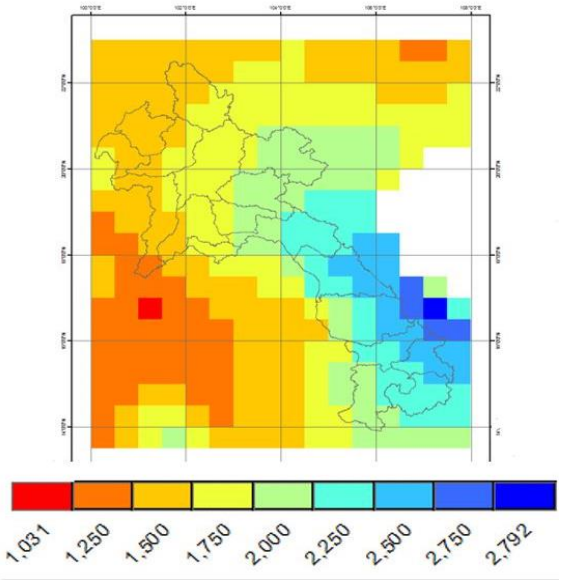
Figure 24. Mean maximum annual temperature (°C)[65]



Precipitation

61. Mean annual precipitation ranges from 1,500 mm in Lao PDR's northern provinces to 2,750 mm across the southern provinces (see Figure 25). Historic climate data suggest that the project's northern target provinces (Phongsaly, Luang Prabang, Luang Namtha and Odomxay) have experienced reduced average annual rainfall compared to the southern target provinces.

Figure 25. Observed average annual precipitation in mm across Lao PDR, according to province[66]



Lao PDR's Projected Climate Change

62. According to the Intergovernmental Panel on Climate Change's (IPCC's) Working Group atlas, there is high confidence that extreme heat, surface temperatures and precipitation events will increase across Lao PDR.[67] Based on these models, climate change is expected to intensify weather events, both in number and magnitude, with flooding, extreme heat, and erratic rainfall increasing in frequency in the future. Details on expected temperature and precipitation changes at national and provincial levels are below.

Temperature

63. There is high confidence that average annual, minimum, and maximum temperatures and extreme heat events will increase across Southeast Asia and Lao PDR by 2050. The mean

65 Ibid
66 Ibid
67 IPCC WGI Interactive Atlas. Available here.

annual minimum and maximum temperatures across Lao PDR are expected to increase more rapidly than the global average temperature increase, with monthly minimum temperatures expected to rise at a 10–20% faster rate than the global average.[68] According to the IPCC's Sixth Assessment Report (AR6), the mean annual temperature across Lao PDR is expected to increase by 0.8°C by 2040 under a mid-emission scenario (Shared Socioeconomic Pathway [SSP] 2-4.5) relative to the baseline period 1981 to 2010, with no regional variation foreseen (see Figures 26 and 27). SSP2-4.5 also projects that in the near term (2021–2040), the number of days where maximum temperatures exceed 35°C is expected to increase by 1.6 days, relative to a baseline period of 1981 to 2010 (see Figure 28). SSP2-4.5 also predicts greater increases in annual mean temperatures could occur by 2100 as compared to 2040 (see Figure 29).

Figure 26. CMIP6 - Mean temperature (T) Change degrees Celsius, Southeast Asia. Near Term (2021-2040) SSP2-4.5 (rel. to 1981-2010)[69]

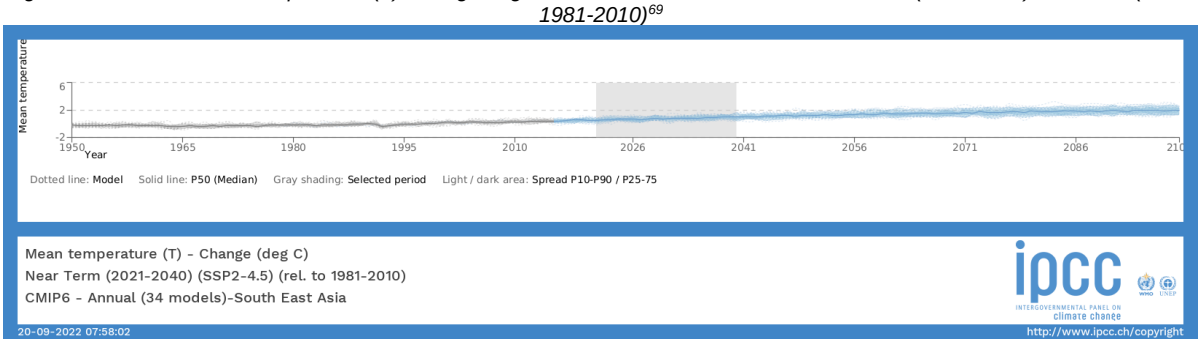


Figure 27. Projected °C annual mean temperature across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[70]

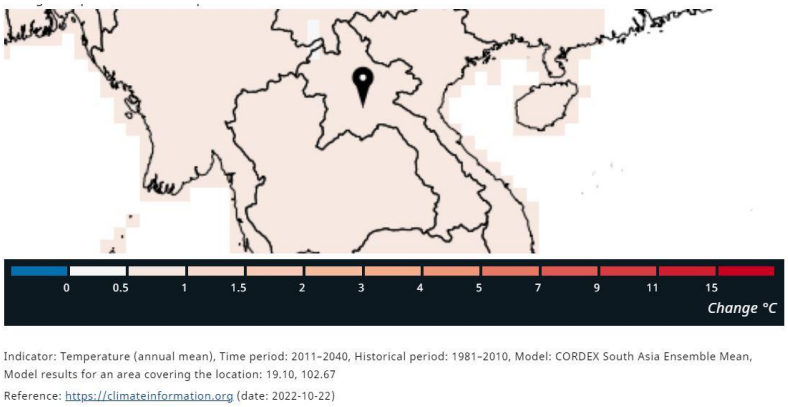
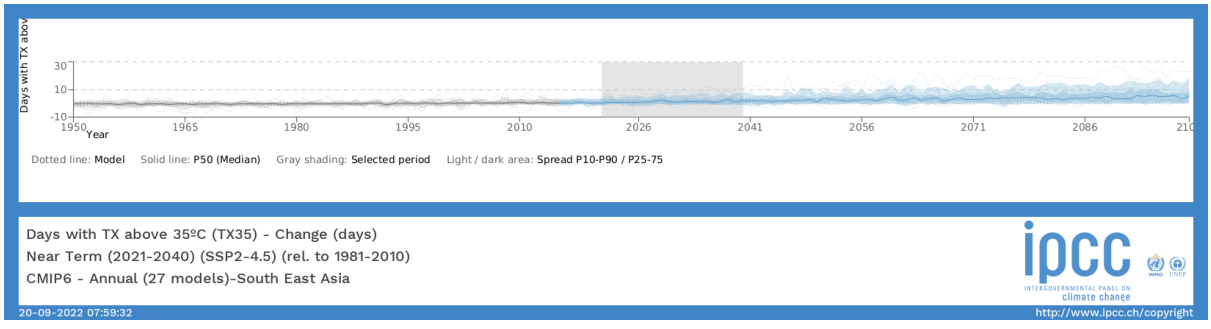
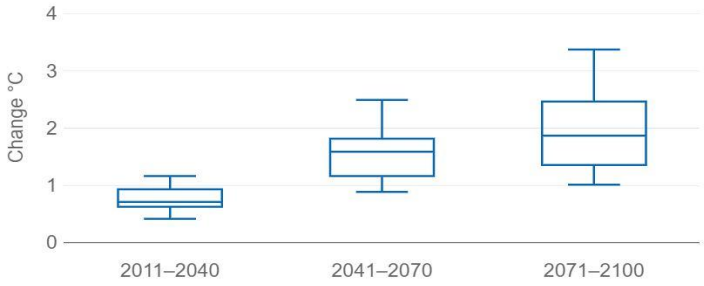


Figure 28. CMIP6 - Days with Temperature above 35ºC, Southeast Asia. Near Term (2021-2040) SSP2-4.5 (rel. to 1981-2010)[71]



68 Ibid
69 Ibid
70 Climate Information. Site-Specific Reports. Report for 19.10, 102.67. Available here.
71 IPCC WGI Interactive Atlas. Available here.

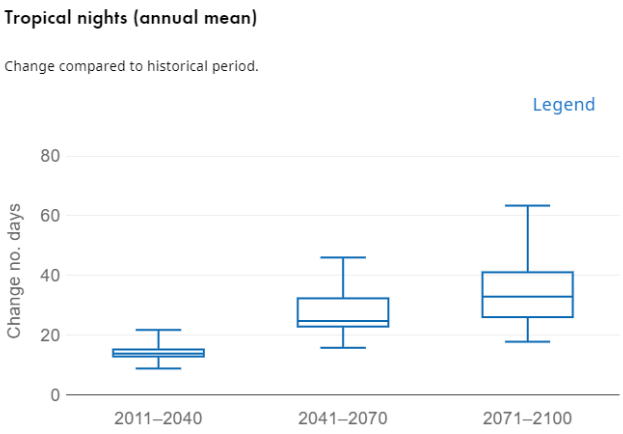
Figure 29. Change in °C in annual mean temperature across Lao PDR from 2011 to 2100 (RCP 4.5, baseline 1981 to 2010)[72]



Indicator: Temperature (annual mean), Time period: 2011–2040, Historical period: 1981–2010, RCP 4.5, Model: CORDEX South Asia Ensemble Mean, Model results for an area covering the location: 19.04, 103.14

64. Modelled climate change projections suggest that mean and minimum daily temperatures will increase by as much as 2°C from 2040 to 2100 under a Representative Concentration Pathway (RCP) 4.5 scenario. The average annual number of days with minimum temperatures exceeding 20°C is expected to increase, reaching 14 days by 2040, with further increases expected by 2100. These trends are likely to result in a decrease in the number of "cool" days each year in the future across Lao PDR.[73] The number of nights in which minimum temperatures remain above 20°C is also expected to increase considerably after 2040 (See Figure 30).

Figure 30. Change in annual mean number of days in which minimum temperature exceeds 20°C across Lao PDR from 2011 to 2100 (RCP 4.5, baseline 1981 to 2010)[74]



Indicator: Tropical nights (annual mean), Time period: 2011–2040, Historical period: 1981–2010, RCP 4.5, Model: CORDEX South Asia Ensemble Mean, Model results for an area covering the location: 19.60, 102.99

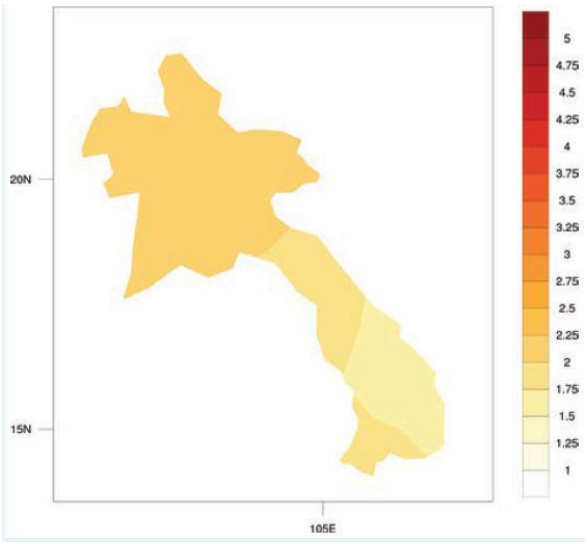
Reference: https://climateinformation.org (date: 2022-10-24)

65. Seasonal variations lead to some uncertainty in temperature projections. However, by 2050 under an RCP 4.5 scenario, average temperature increases across Lao PDR are expected to be highest in April and May and more pronounced from June to August (1.5°C) compared to December to February (1.4°C). [75] The duration of cold spells is likely to decrease by 2040 (SSP 2-4.5).[76]

66. Regional variations in projected temperature increases exist depending on the data source and the emissions scenario. Some sources suggest the northern regions of the country will experience higher mean temperatures compared to the southern parts of the country between 2040 and 2090 under an RCP 8.5 scenario (see Figure 31).[77]

72 Climate Information. Site specific reports. Report for 19.04, 103.14. Available here.
73 Ibid
74 Climate Information. Site specific reports. Report for 19.60, 102.99 Available here.
75 World Bank Climate Change and Knowledge Portal. Climatology data on Lao PDR. Available here.
76 Ibid
77 Ibid

Figure 31. CMIP5 ensemble projected change (32 GCMs) in annual temperature (ºC) across Lao PDR by 2040–2059 relative to 1986–2005 baseline under RCP 8.5[78]



Precipitation

67. According to the mid-emission scenario (SSP 2-4.5), there is high confidence that annual rainfall intensity, frequency, and quantity will increase across Southeast Asia and Lao PDR by 2050. Greater amounts of rainfall are expected to occur over shorter periods, with an increased number of dry days interspersed.[79] The mean annual precipitation across Lao PDR is expected to increase by 0.8% by 2040 under SSP2-4.5 against the baseline period 1981 to 2010 (see Figure 32).[80] However, unlike the more uniform expected temperature changes, precipitation increases will be most prominent in the country's central and southern regions (see Figure 33). Annual mean precipitation is likely to further increase by 2100 compared to 2040 (see Figure 34).

Figure 32. CMIP6 – % Total precipitation Change, Southeast Asia, Near Term (2021-2040) SSP2-4.5 (rel. to 1981-2010)[81]

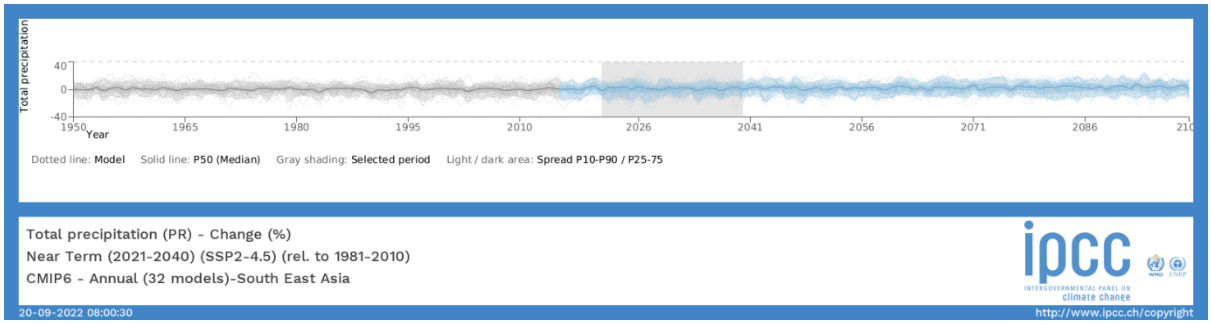
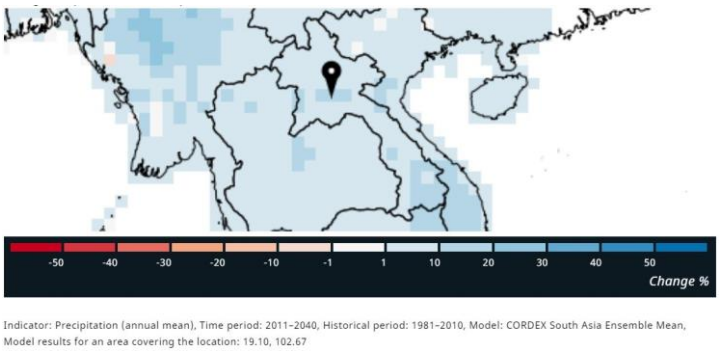
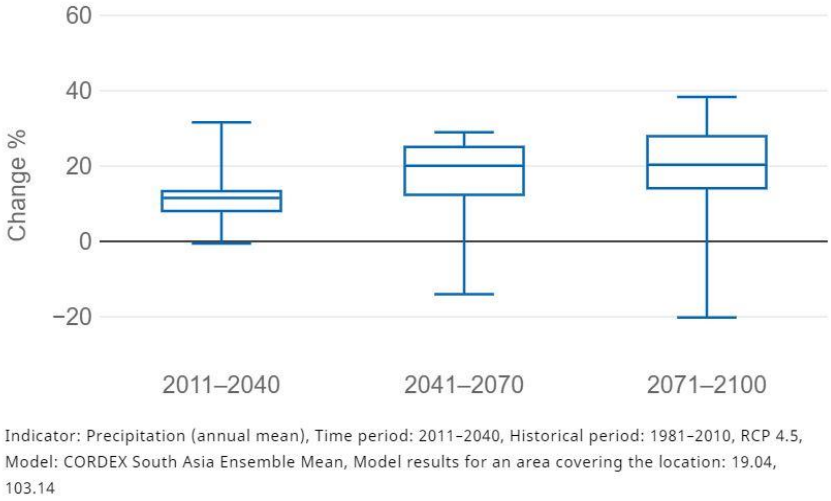


Figure 33. Projected % annual mean precipitation across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[82]



78 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR, 2021. Available here.
79 World Bank Climate Change and Knowledge Portal. Climatology data on Lao PDR. Available here.
80 IPCC WGI Interactive Atlas. Available here.
81 Ibid
82 Climate Information. Site-Specific Reports. Report for 19.10, 102.67. Available here.

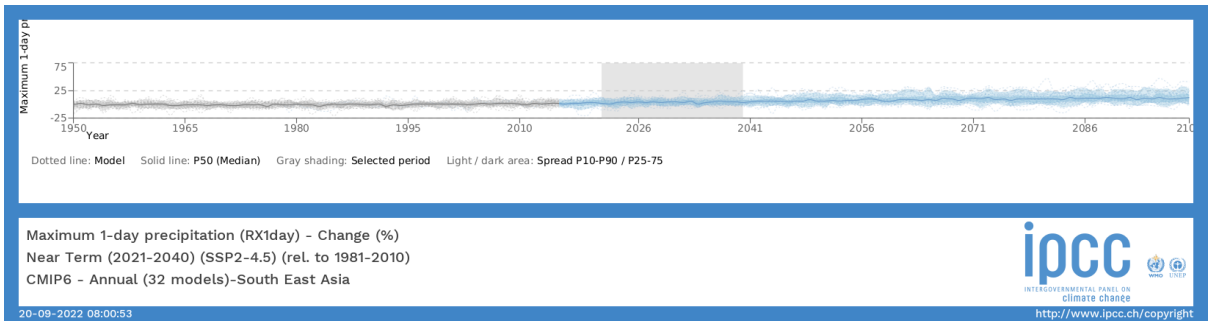
Figure 34. % change in annual mean precipitation across Lao PDR from 2011 to 2100 (RCP 4.5, baseline 1981 to 2010)[83]



Indicator: Precipitation (annual mean), Time period: 2011-2040, Historical period: 1981-2010, RCP 4.5, Model: CORDEX South Asia Ensemble Mean, Model results for an area covering the location: 19.04, 103.14

68. Lao PDR is also expected to experience more variability in precipitation events, with intensified extreme rainfall events and increases in maximum one-day precipitation expected. SSP2-4.5 near-term projections (2021–2040) show maximum one-day precipitation increasing by 4% relative to a baseline period of 1981 to 2010, as modelled for the IPCC's AR6 (see Figure 35).[84] The number of consecutive dry days the country experiences is also expected to increase.

Figure 35. CMIP6 - Maximum 1-day precipitation (RX1day) % change, Southeast Asia. Near Term (2021-2040) SSP2-4.5 (rel. to 1981-2010)[85]



69. In addition to the intensified rainfall described above, projections suggest precipitation will likely decrease during the start of the monsoon season in May, with a commensurate increase as the season ends in October. This suggests the monsoon season may shift, which will lead to impacts on both seasonal and spatial variability of rainfall across Lao PDR.[86]

Projected Climate Change – Province Level

Temperature

70. Coordinated Regional Downscaling Experiment (CORDEX[87]) South Asia Model projections suggest that mean annual temperatures across the project's target provinces will increase by 1°C by 2040 (RCP 4.5), as compared to the baseline period 1981 to 2010 (see Table 3).[88] Increases in average minimum temperatures are likely to be more pronounced in Phongsaly (8-8.75%), followed by Luang Prabang, Luangnamtha, and Odomxay (7-8%), and Sekong, Salavane, and Khammouane (5-6%) (see Figure 36). Average minimum temperatures are likely to show a greater increase (5-8.75%) compared to mean maximum temperatures (3.51-5.07%). Average maximum temperatures in the northern provinces are likely to show a greater increase (4.51-5.07%) as compared to Khammouane, Sekong and Salavane (3.5- 4%) (see Figure 37).

83 Climate Information. Site specific reports. Report for 19.04, 103.14. Available here.
84 IPCC WGI Interactive Atlas. Available here.
85 Ibid
86 Lao PDR. National Communication 2. Available here.
87 WCRP Coordinated Regional Downscaling Experiment (CORDEX). Available here.
88 Climate Information. Site specific reports. Available here.

Table 3. Projected annual temperature and precipitation change across Lao PDR by province (RCP 4.5, 2011 to 2040)[89]

Province	Increased annual mean temperature (°C)	Increased annual mean precipitation (%)
Sekong (Xekong city)	1	14
Salavane (Salavan city)	1	13
Oudomxay (Maung Xai)	1	4
Luang Prabang (Luang Prabang city)	1	9
Luangnamtha (Luangnamtha city)	1	4
Khammouane (Thakhek)	1	6
Phongsaly (Phongsaly city)	1	3

Figure 36. Projected % change in average annual minimum temperatures to 2050 by province in Lao PDR (RCP 4.5 from 1986-2015 baseline, using CRU TS high resolution gridded datasets v4.01)[90]

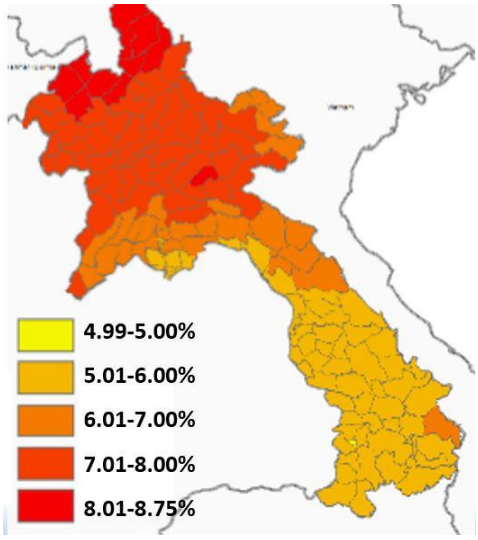
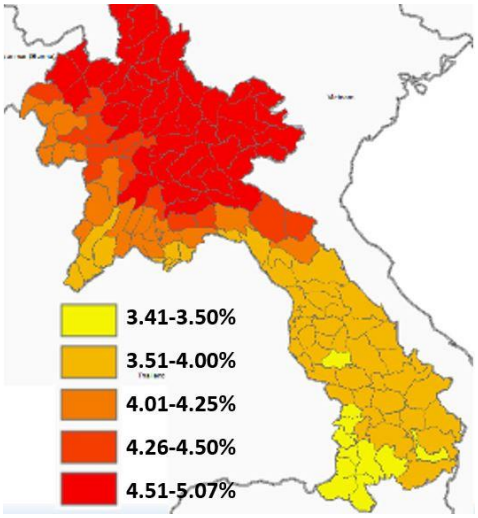


Figure 37. *Projected % change in average annual maximum temperatures to 2050 province in Lao PDR (RCP 4.5* from 1986-2015 baseline, using CRU TS high resolution gridded datasets v4.01)*[91]*



Precipitation

71. The same model projections suggest that all target provinces will experience an increase in average annual precipitation by 2040 (RCP 4.5) as compared to the baseline period 1981 to 2010. These increases vary according to city and province, with greater average annual rainfall

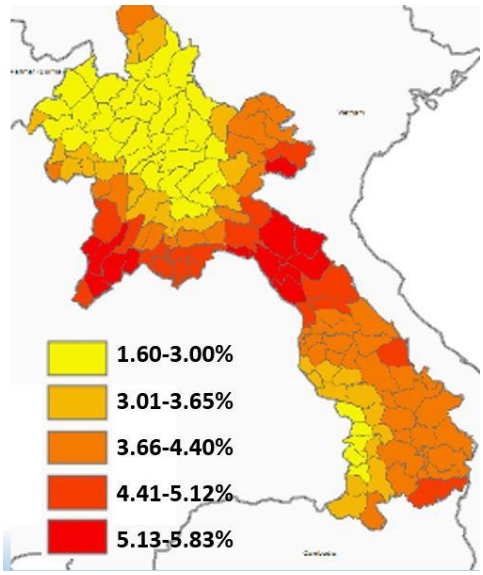
89 Climate Information. Site specific reports. Available here.

90 MONRE Department of Climate Change Management. Presentation on National Climate Change Vulnerability Assessment, 2021. Not publicly available.

91 Ibid

expected in Xekong city (Sekong) and Salavan city (Salavane) and the lowest in Phongsaly city (Phongsaly) (see Table 3). Average annual rainfall across districts within the selected provinces is likely to increase by 1.65 to 5.12%. Most districts across Luang Prabang and Luang Namtha will experience increases of 1.6 -3%, whereas most districts across Salavane, Khammouane and Sekong will experience increases between 3.66-5.12% (see Figure 38). Gnommalat district in Khammouane province is likely to experience the greatest average increase (4.41-5.12%).

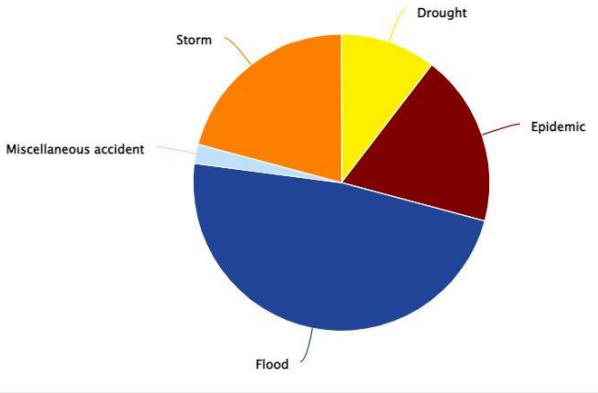
Figure 38. Projected % change in average annual precipitation across Lao PDR according to province (RCP 4.5)[92]



Lao PDR's exposure to Climate Change Impacts

72. Flooding, epidemics, tropical storms, and droughts are the main natural hazards that impact Lao PDR (see Figure 39). From 1970-2010, Lao PDR experienced 33 floods, droughts, and other natural hazard events that affected approximately 9 million people and caused over USD 400 million in damages. In the last two decades alone, tropical storms, cyclones, and the impacts from monsoon rains have affected more than 1.5 million people and caused damages of over USD 400,000.[93]

Figure 39. Overview of natural hazard frequency from 1980 to 2020 for Lao PDR[94]



Flooding and Water Impacts

73. According to the CORDEX South Asia Ensemble Model, for the RCP 4.5 emissions scenario (relative to a baseline of 1981 to 2010),[95] the impacts of flooding, variable precipitation, and extreme heat are likely to intensify by 2040. In particular, the changes in precipitation and rainfall

92 Ibid
93 World Bank Climate Change and Knowledge Portal. Vulnerability data on Lao PDR. Available here.
94 Ibid
95 Climate Information. Site specific reports. Available here.

intensity described above are expected to increase water runoff (Figures 40 and 41) and water discharge (Figures 42 and 43) across the country.

Figure 40. % change in annual mean water runoff across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[96]

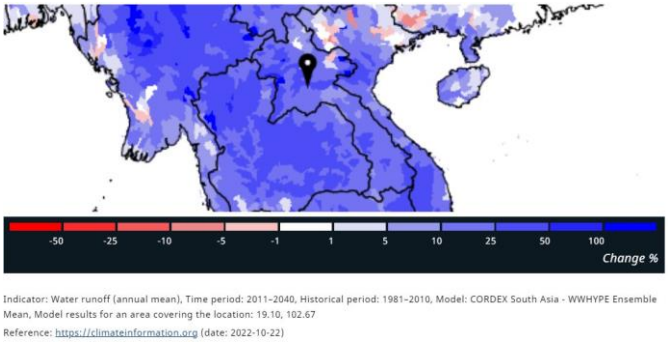


Figure 41. % change in annual mean water runoff across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[97]

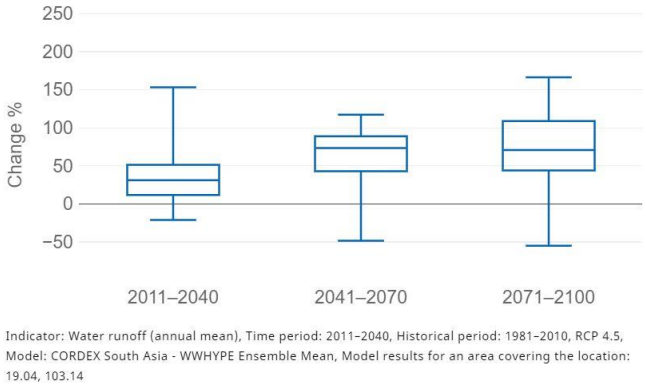


Figure 42. % change in annual mean water discharge across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[98]

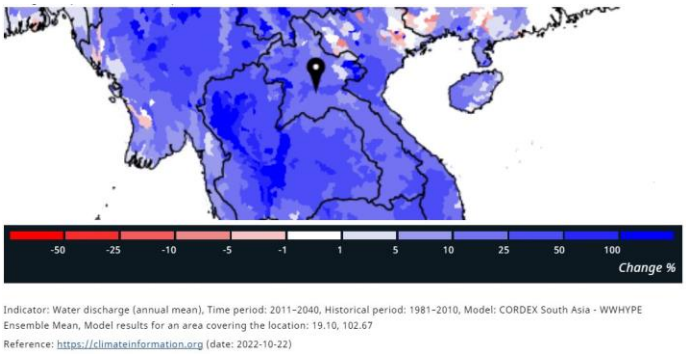
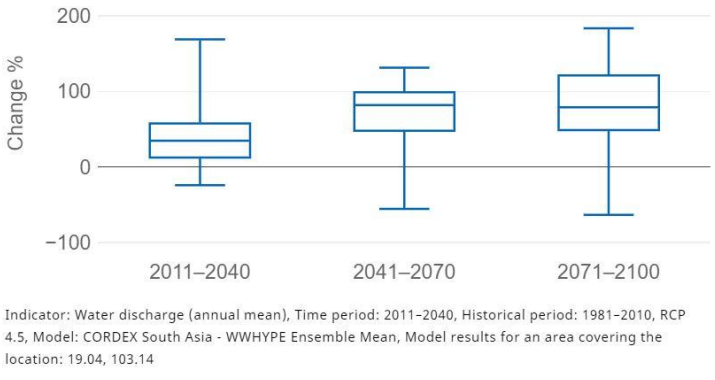


Figure 43. % change in annual mean water discharge across Lao PDR from 2011 to 2100 (RCP 4.5, baseline 1981 to 2010)[99]



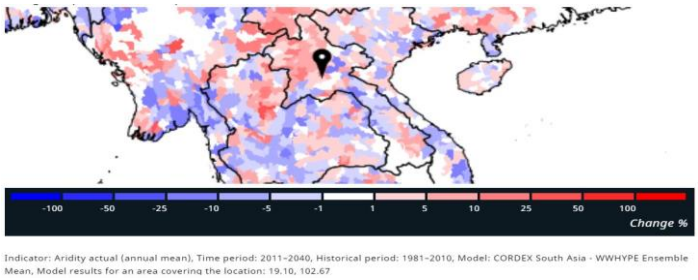
96 Climate Information. Site-Specific Reports. Report for 19.10, 102.67. Available here.
97 Climate Information. Site-Specific Reports. Report for 19.04, 103.14. Available here.
98 Climate Information. Site-Specific Reports. Report for 19.10, 102.67. Available here.
99 Climate Information. Site-Specific Reports. Report for 19.04, 103.14. Available here.

74. The increases in water discharge and runoff are also expected to result in increased soil moisture across Lao PDR (see Table 4). The mean annual values of the ratio between actual evapotranspiration and precipitation over 30 years indicate that aridity across the country will decrease by 2040, except for in the northern regions, where it is likely to increase (see Figure 44).

Table 4. Mean annual change in climate-related impacts across Lao PDR by 2040[100]

Climate change-related impacts (annual mean)	***Median change***
Actual aridity	-14%
Soil moisture	5.5%
Water runoff	14%
Water discharge	16%

Figure 44. Percentage change in annual mean aridity across Lao PDR from 2011 to 2040 (RCP 4.5, baseline 1981 to 2010)[101]



75. Numerous provinces are considered at risk for cyclones, landslides and flooding and all provinces except Phongsaly and Sekong are at high risk of urban flooding (See Figures 45 and 46). Without adaptation measures, it is estimated that by 2030 the population exposed to annual river flooding could increase to over 80,000.[102] In the country's northern regions, climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature, making landslides more prevalent following flood and storm events.[103] Modelled projections indicate these expected events are likely to cause extensive damage to infrastructure by 2032.

Figure 45. Hazard risk (cyclone – left; landslide – right), by province in Lao PDR[104]

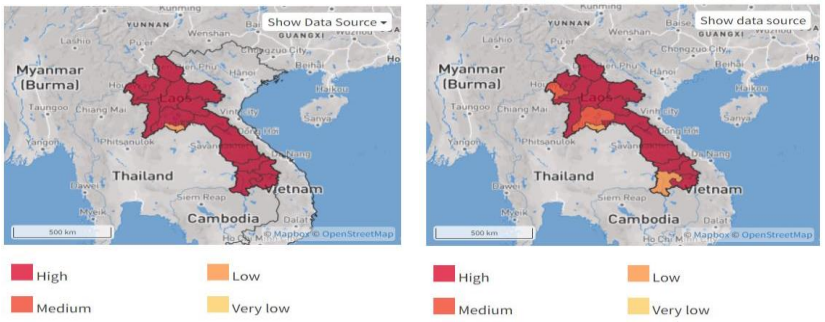
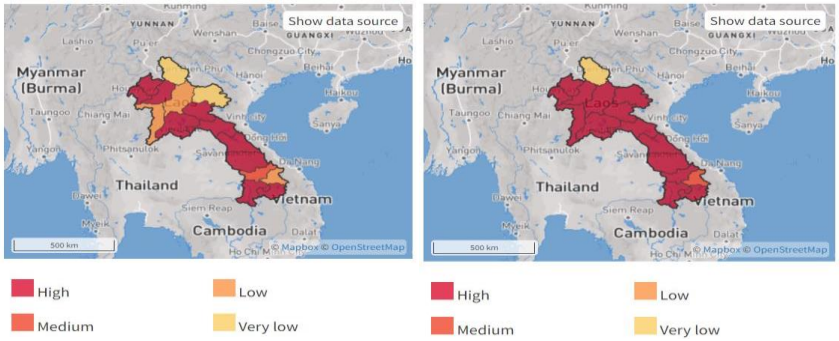


Figure 46. Hazard risk (river flooding – left; urban flooding – right), by province in Lao PDR[105]



100 Climate Information. Site-Specific Reports. Available here.
101 Climate Information. Site-Specific Reports. Report for 19.10, 102.67. Available here.
102 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR, 2021. Available here.
103 GFDRR. Think Hazard Lao PDR. Available here.
104 Ibid
105 Ibid

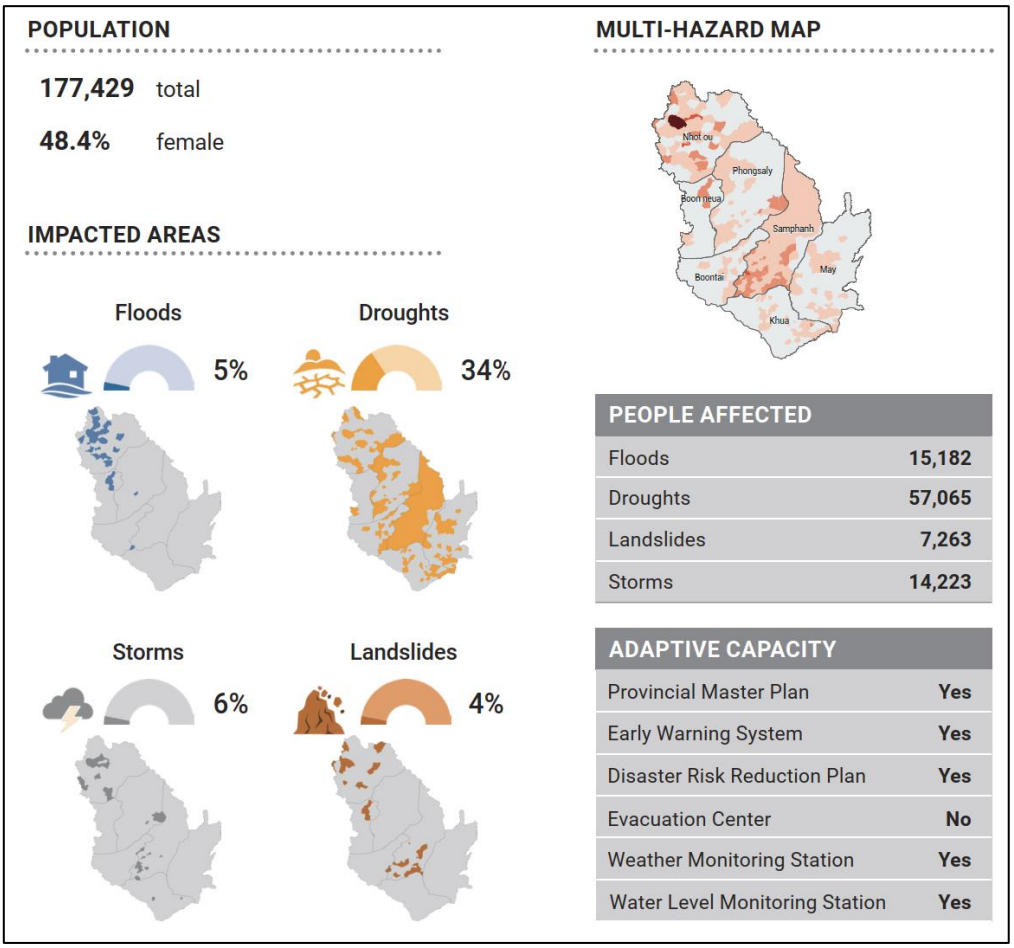
Observed Climate Change Impacts and Risks - Province Level

76. Over the last few decades, droughts, landslides, and flooding have intensified in the project's target provinces of Sekong, Salavane, Oudomxay, Luang Prabang, Luangnamtha, Khammouane and Phonsaly, with specific hazards varying by province. Below, we include summary vulnerability profiles for each target province, as described in UN-Habitat's 2019 National Climate Change Vulnerability Assessment.[106] Unless otherwise indicated, the profiles are presented verbatim without adaptation. This includes the demographic and hazard summary graphics for each province.

Phongsaly

77. Phongsaly province is in the northmost of Lao PDR, bordering Vietnam to the east and China to the north. Predominantly mountainous, the province has an area of 15,513 square kilometers, which is divided into seven districts, with a total [2019] population of 177,429 people. UN-Habitat's assessment shows that the province is impacted by climate change related hazards, especially by droughts that affect 34% of the villages (see Figure 47). Nhot ou is the most vulnerable district as it is exposed to a greater number of threats (especially Karng village, in the northwest of the district, which is highly affected by all types of hazards), while villages in Sampanh district are widely affected by droughts. Storms and droughts also hit some areas of Phongsaly district, and both floods and landslides coincidentally affect villages of Boon Neua district. Adaptive capacity levels are high, since most primary disaster risk reduction (DRR) resources, except for an evacuation center, are in place.

Figure 47. UN-Habitat demographic and hazard summary for Phongsaly Province



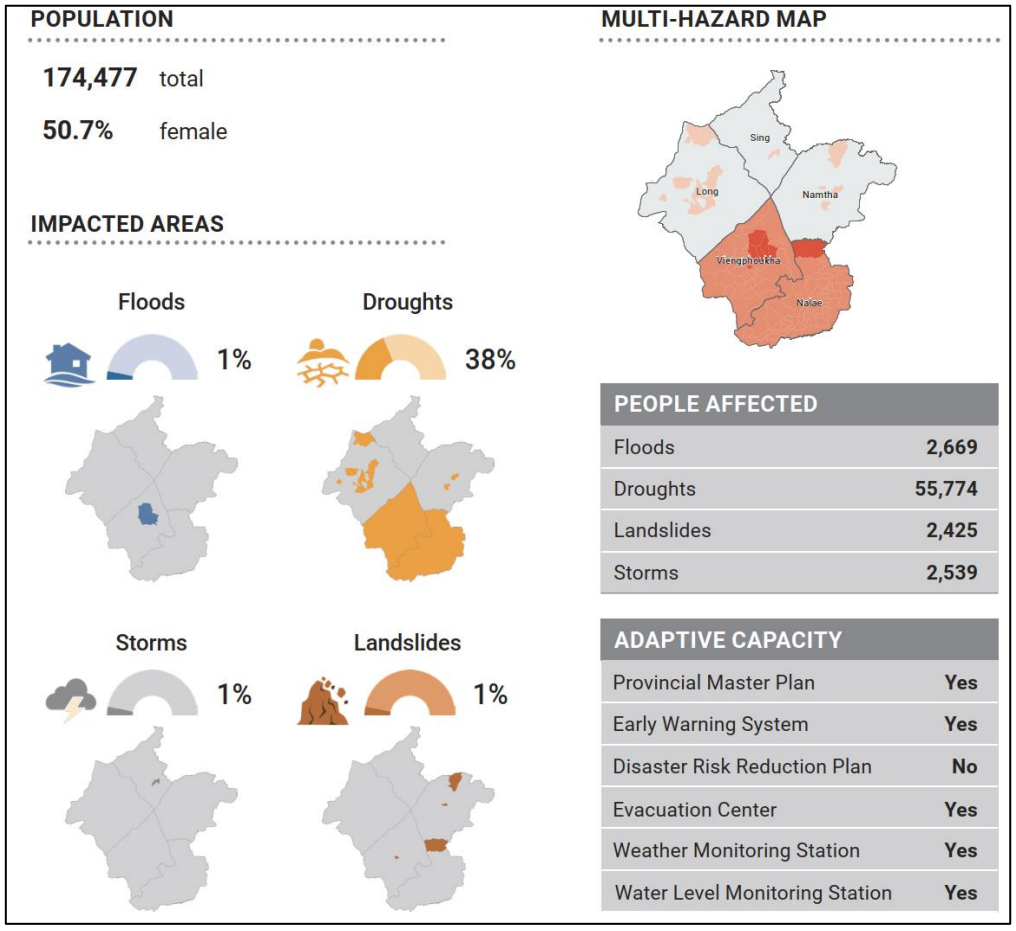
78. In 2018, extensive flooding resulted in an estimated 100 billion Lao Kip (USD 5.8 million) in damage and losses across Phongsaly province. The estimated damage to the health and nutrition sector was 0.3 billion Lao Kip (USD 17,000) and one health center was destroyed. Damage to rural water and sanitation infrastructure was also estimated at 0.3 billion Lao Kip (USD 17,000).

106 UN-Habitat. Lao PDR National Climate Change Vulnerability Assessment – Preliminary Results, 2019. Available here.

Luangnamtha

79. Luangnamtha province is in northern Lao PDR, bordering Myanmar to the northwest and China to the northeast. The province has an area of 9,498 square kilometers, which is divided into five districts, with a total population of 174,477 people. UN-Habitat's assessment shows that the province is moderately impacted by climate change related hazards, with four out of five districts (38% of the villages) reportedly experiencing droughts and two out of five districts (32% of the villages) experiencing earthquakes (see Figure 48). The highest number of villages impacted by earthquakes within Lao PDR are in Luangnamtha, totaling 116 villages. Nalae and Viengpoukha district are greatly affected by both droughts and earthquakes, while Long and Namtha districts are affected to a lesser extent. Viengpoukha is the only district affected by floods, while landslides are also reported in a few villages of Nalae, Namtha districts. Adaptive capacity levels are moderate, since no DRR plan has been developed for this province.

Figure 48. UN-Habitat demographic and hazard summary for Luangnamtha Province



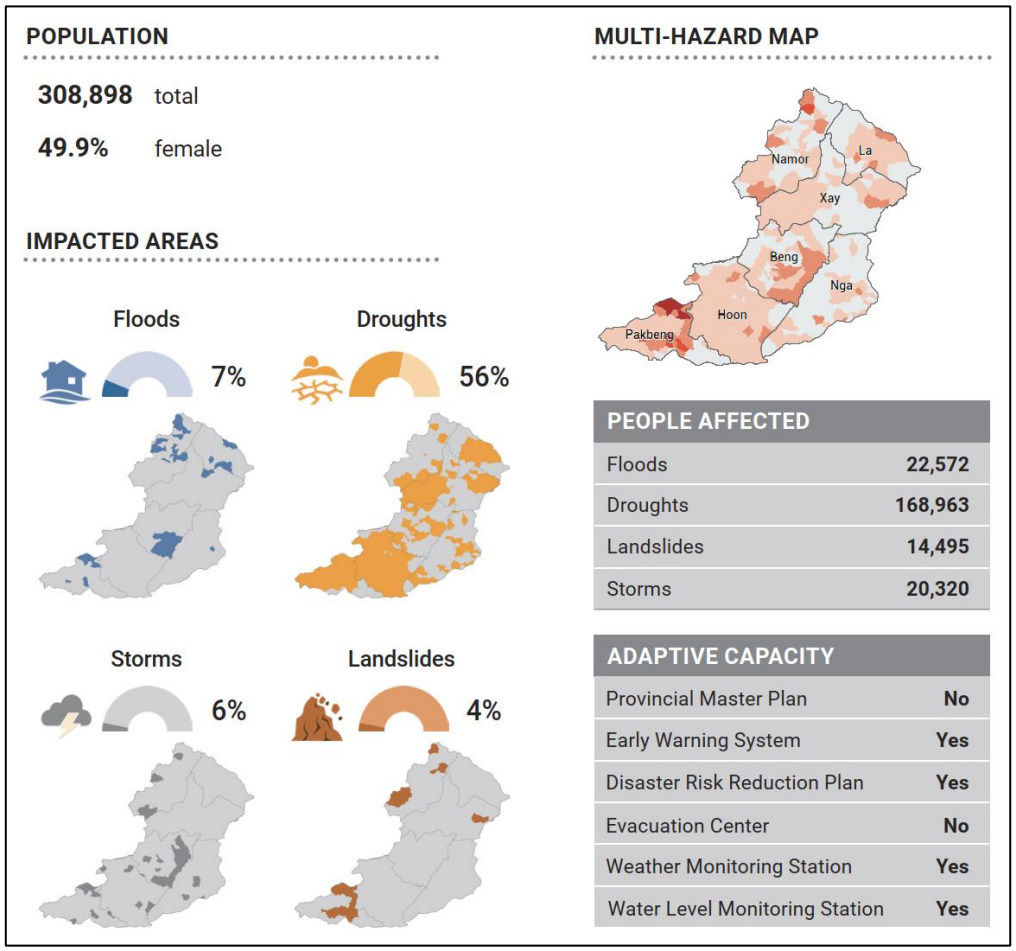
80. Landslides due to flooding have resulted in considerable damage to water, sanitation, health services, and transport infrastructure in Luangnamtha province. Drought conditions have also intensified across some districts in the last decade, resulting in adverse impacts on water, sanitation, and disease prevalence. In 2018, extensive flooding resulted in an estimated 70 billion Lao Kip (USD 4 million) of losses and damages across the province. The estimated damage to the province's health and nutrition sector was 0.3 billion Lao Kip (US$ 17,000) and damage to urban water and sanitation infrastructure was estimated at 1.5 billion Lao Kip (USD 87,000).[107]

107 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced, 2019. Available here.

Oudomxay

81. Oudomxay province is in northern Lao PDR, bordering China to the north. The province has an area of 12,079 square kilometers, which is divided into seven districts. With a total population of 308,898 people, Oudomxay is highly exposed to climate change hazards, as over half of its population was reportedly affected by droughts in 2019 (see Figure 49). While all districts in Oudomxay are vulnerable to this hazard, the highest number of affected villages are concentrated in Hoon district. Villages in northern Namor and southern Pakbeng districts are exposed to a greater number of threats, including floods, storms, and landslides. The mountainous southeast of Beng district, in the center of the province, is also highly vulnerable to floods and storms. Adaptive capacity levels are moderate since the province lacks a master plan and evacuation centers.

Figure 49. UN-Habitat demographic and hazard summary for Oudomxay Province



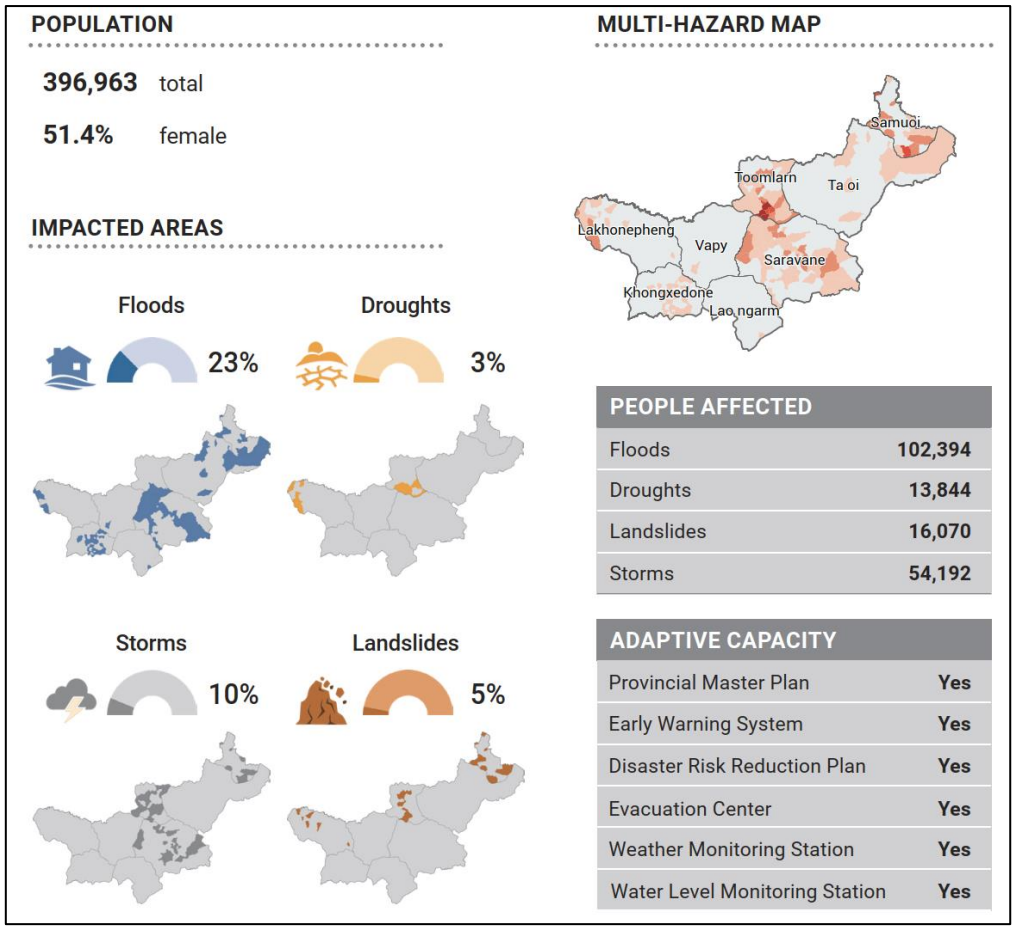
82. Landslides due to flooding have resulted in damage to water, sanitation, health services, and transport infrastructure across the province. Drought conditions have intensified across regions of Oudomxay in the last decade, which has led to adverse impacts on water, sanitation, and disease prevalence. In 2018, wide-scale flooding resulted in damages estimated 160 billion Lao Kip (USD 9.2 million), with damage to the health and nutrition sector estimated at 0.5 billion Lao Kip (USD 29,000). Damage to urban water and sanitation infrastructure amounted to approximately 4.3 billion Lao Kip (USD 249,000).[108]

108 World Bank GFDRR. Post-Disaster Needs Assessment 2018 Floods, Lao PDR. Available here.

Salavane

83. Salavane province is in southern Lao PDR, bordering Vietnam to the east and Thailand to the west. The province has an area of 10,108 square kilometers, which is divided into eight districts, and a total population of 396,963 people. UN-Habitat's assessment shows that the province is moderately impacted by climate change related hazards, with nearly a quarter of its population affected by floods (see Figure 50). While all hazards affected villages in Toomlarn district, at the north of the province, Samuoi and Salavane districts are also exposed to floods and storms. Floods, due to topographical characteristics of the area, affected more than half of villages in Khongxedone district, which is a quite flat watershed that receives water from higher land. Landslides and droughts are rare across this province. Adaptive capacity levels are high, since primary DRR resources are in place.

Figure 50. UN-Habitat demographic and hazard summary for Saravane Province



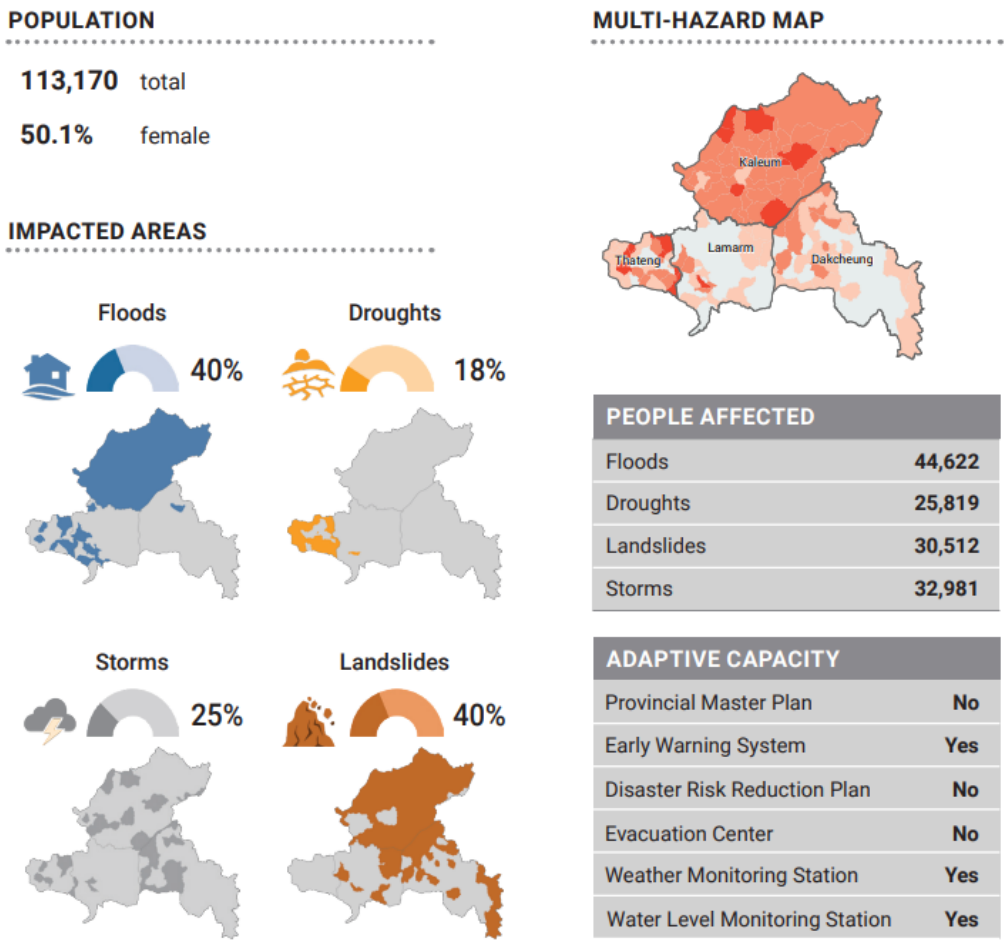
84. The prevalence of flooding in Salavane has increased in the last decade, resulting in damage to health services, water and sanitation, and road infrastructure. In 2018, floods caused damages estimated at 10 billion Lao Kip (USD 580,000), including 0.6 billion Lao Kip (USD 34,800) in damages to water and sanitation infrastructure.[109]

109 Ibid

Sekong

85. Sekong province is in southern Lao PDR, bordering Vietnam to the east. The province has an area of 8,285 square kilometers, which is divided into four districts. A total population of 113,170 people makes Sekong the second least populated province in Lao PDR. UN-Habitat's assessment shows that the province is highly impacted by climate change related hazards, with floods and landslides being the main threat registered within the province (see Figure 51). While droughts mostly affect villages in Thateng district, this area is also vulnerable to floods and storms. Villages in Kaleum district, in the north, and Dakcheung, in the southeast, are highly affected by floods, storms and landslides. Lamarm district only registers floods on its western area. Adaptive capacity levels are low, since primary DRR resources, such as a DRR plan, evacuation centers and a provincial Master Plan, are not in place.

Figure 51. UN-Habitat demographic and hazard summary for Sekong Province



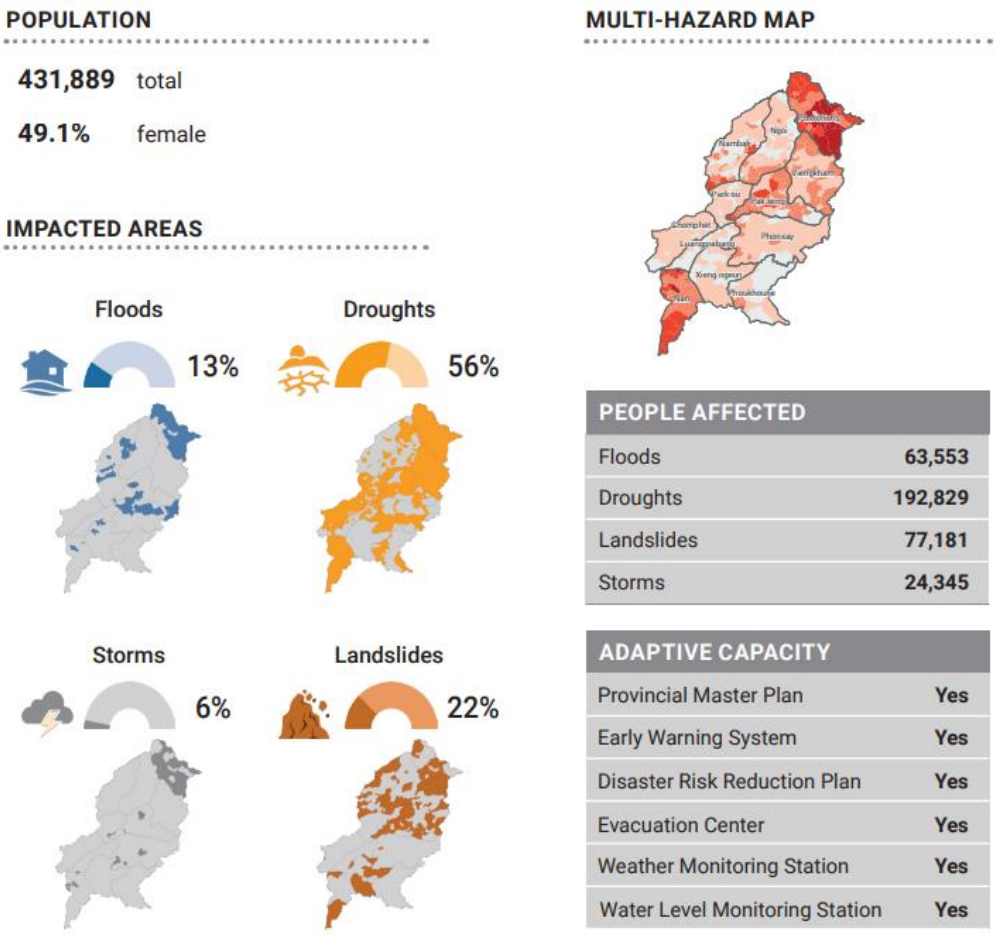
86. Over the past decade, flooding and landslides have caused extensive damage to health services and water and sanitation infrastructure in Sekong. In 2018, large-scale flooding resulted in an estimated 50 billion Lao Kip (USD 2.9 million) in damages, including an estimated 1.1 billion Lao Kip (USD 64,000) in damage to urban water and sanitation infrastructure.[110] In 2020, flooding across Sekong province resulted in further infrastructure damage and loss of lives. One person died and three were reported missing after flooding in the Kaleum district. Approximately 250 people from 50 households were affected by widescale flooding and landslides.[111] In 2022, tropical storm Noru caused extensive damage to homes and infrastructure across Sekong province. Twenty-eight villages were affected by flooding from Sekong River, two roads became impassable, and landslides were reported on nine other roads. Electricity and water infrastructure in several villages was also damaged or destroyed.[112]

110 Ibid
111 Floodlist. Laos, Cambodia and Vietnam – Floods Leave Over 40 Dead, Dozens Missing as Storm Nangka Approaches, 2020. Available here.
112 Business Standard. Thousands of people in Laos affected by floods from tropical storm Nor, 2023. Available here.

Luang Prabang

87. Luang Prabang province is in northern Lao PDR, bordering Vietnam to the northeast. Predominantly mountainous, the province has an area of 19,949 square kilometers, which is divided into 12 districts. With a total population of 431,889 people, Luangp Pabang is the second largest and fourth most populated province in Lao PDR. UN-Habitat's assessment shows that the province is highly impacted by climate change related hazards, with 11 out of 12 districts (56% of the villages, nearly 193 thousand people) experiencing droughts (see Figure 52). Phontong district, northeast of the province, is the most exposed area, experiencing floods, droughts, storms and, to a lesser extent, landslides. The southern tip is also highly exposed, with all 51 villages in Nan district experiencing both droughts and earthquakes, a high number of which are also affected by landslides. While Viengkham and Pak xeng districts are highly vulnerable to droughts and landslides, Phonxay district is mostly affected by droughts and floods. Adaptive capacity levels are high, since primary DRR resources are in place.

Figure 52. UN-Habitat demographic and hazard summary for Luang Prabang Province



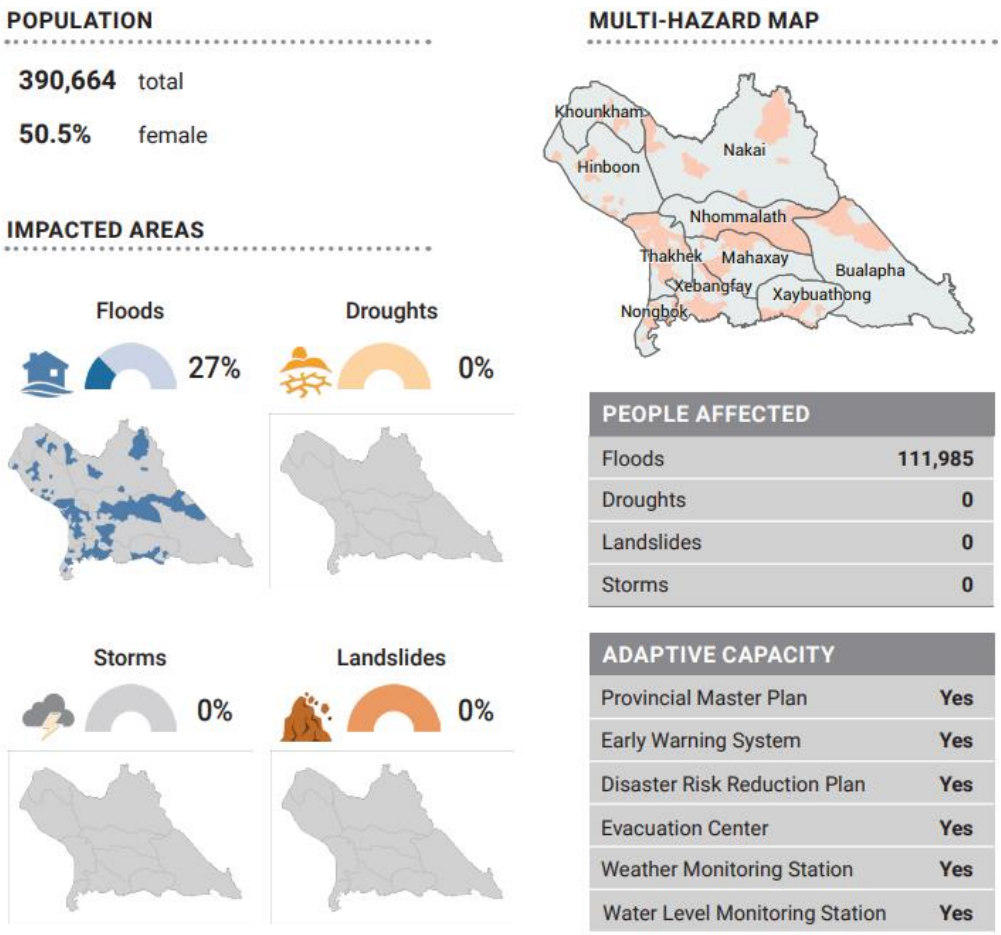
88. Drought conditions have intensified across Luang Prabang province in the last decade, resulting in adverse impacts on water and sanitation and increasing disease prevalence. Landslides due to flooding have resulted in considerable damage to water, sanitation, health services, and transport infrastructure. In 2018, wide-scale flooding resulted an estimated at 250 billion Lao Kip (USD 14.5 million) in damages, including an estimated 1 billion Lao Kip (USD 58,000) to the urban water and sanitation infrastructure.[113]

113 World Bank GFDRR. Post-Disaster Needs Assessment 2018 Floods, Lao PDR. Available here.

Khammouane

89. Khammouane province is in central Lao PDR, bordering Vietnam to the east and Thailand to the west. The province has an area of 16,735 square kilometers, which is divided into 10 districts with a total population of 390,664 people. UN-Habitat's assessment shows that the province is slightly affected by climate change related hazards, with about 27% of the villages (over 100,000 inhabitants) within the province reportedly affected by floods, mainly in the lowlands (see Figure 53). Villages in the central districts of Nhommalath and Thakhek and southern Xebangfay are exposed to a greater extent, while Bualapha, Hinboon, and Kounkham districts are less exposed. Adaptive capacity levels are high, since primary DRR resources are in place.

Figure 53. UN-Habitat demographic and hazard summary for Khammouane Province



90. In 2018, extensive flooding resulted in losses and damages across Khammouane province estimated at 310 billion Lao Kip (USD 18 million). Damages to the health and nutrition sectors were estimated at 1 billion Lao Kip (USD 58,000), which included impacts to 12 health centers. Damage to rural water and sanitation infrastructure was estimated at 10 billion Lao Kip (USD 640,000).[114]

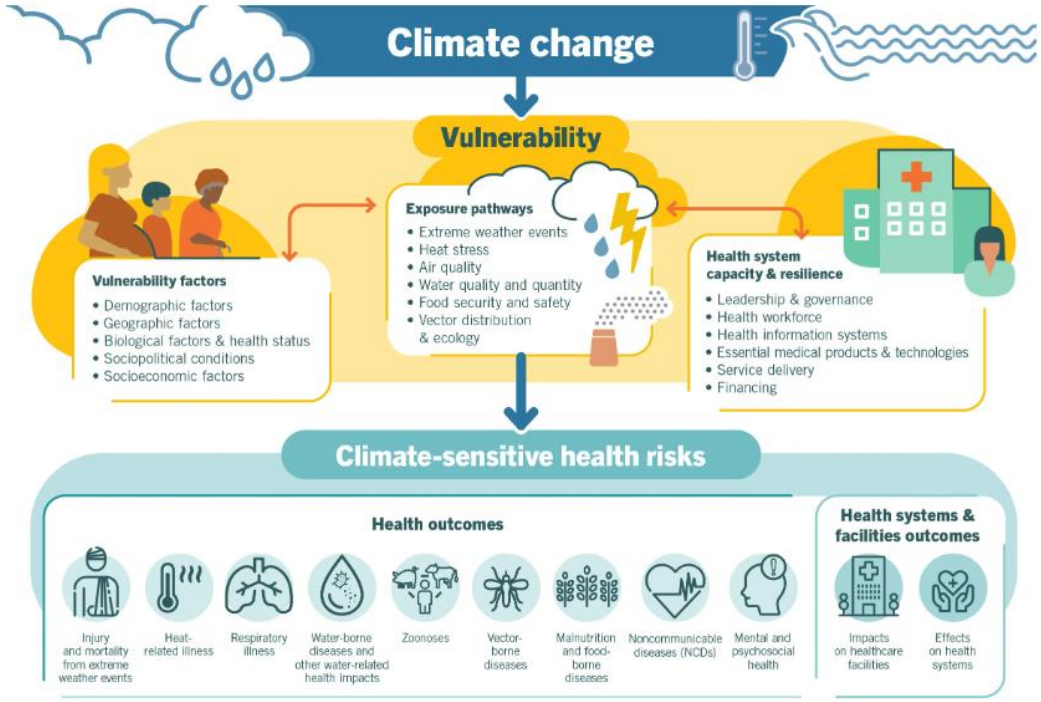
114 Ibid

Section 4 - Direct and Indirect Impacts of Climate Change on Health and the Health System in Lao PDR

91. The changing profile of temperature and precipitation in Lao PDR is expected to impact the health system directly (through more frequent and intense extreme weather events EWEs that damage health facility infrastructure) and indirectly (by creating conditions that increase the incidence of certain diseases, including dengue and diarrheal disease, which will place new demands on the health system).

92. These direct and indirect impacts of climate change on health are further influenced by external factors, including the interactions between socioeconomic conditions, exposure pathways, and the capacity of the health system (see Figure 54). Ultimately, the risks to health posed by climate change are a product of the type of hazard (e.g., extreme heat, drought, floods, etc.), the extent of the exposure to the hazard, and the population's underlying sensitivity and vulnerability.[115] People experiencing poverty, those who already have the greatest challenges in accessing health services (e.g., rural populations), those with poor access to improved drinking water sources, and people with existing health conditions (e.g., children experiencing stunting and wasting) are likely to be most impacted.[116,117,118,119]

Figure 54. Overview of climate sensitive health risks, exposure pathways, and vulnerability factors[120]



Projected Health Impacts of Climate Change in Lao PDR

93. WHO's 2015 Health and Climate Change Country Profile for Lao PDR linked key findings of climate projections to climate and health outcomes, finding that:

- *Incidence of dengue is expected to increase* – The mean relative vectorial capacity for dengue transmission is projected to increase under a high emissions scenario from the baseline of 0.55 to about 0.62 towards 2070. This is likely due to climactic changes that will favor vector abundance.
- *Incidence of diarrheal disease is expected to increase* – Diarrheal diseases, such as leptospirosis and cholera, are likely to become more prevalent following flood events due to

115 The Intergovernmental Panel on Climate Change. Field, Christopher B., et al. "Summary for policymakers." Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the IPCC. Cambridge University Press.
116 Lao Statistics Bureau Poverty in Lao PDR: Key findings from the Lao Expenditure and Consumption Survey 2018-2019. Available here.
117 Lao Statistics Bureau. Lao PDR Lao Social Indicator Survey 2011 – 12. Available here.
118 Ibid
119 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR. 2017. Available here.
120 WHO. Climate Change and Health, 2021. Available here.

high population density, inadequate health services, and damage to water and sanitation infrastructure resulting from storm and flood-related damage.

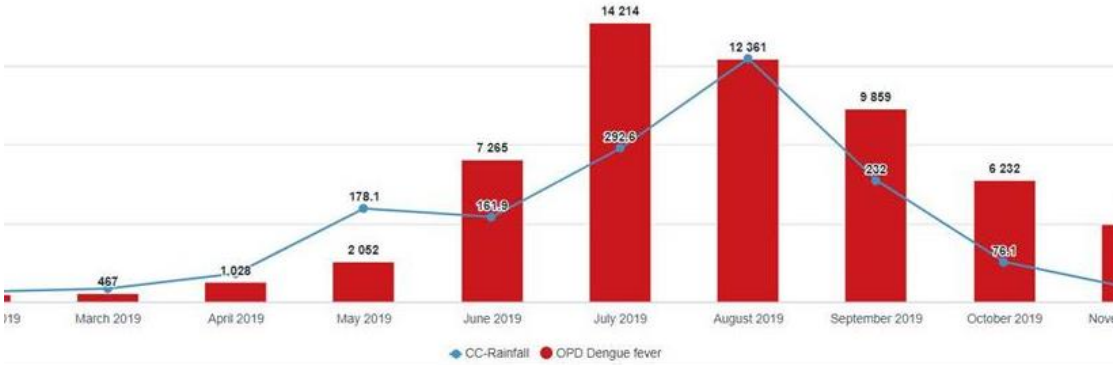
- *Heat-related deaths are expected to increase* – Under a high emissions scenario, heat-related deaths in people aged 65 and older are projected to increase to about 72 deaths per 100,000 by 2080, as compared to the estimated baseline of about 3 deaths per 100,000 annually between 1961 and 1990. A rapid reduction in emissions could limit heat related deaths in the elderly to about 15 deaths per 100,000 in 2080. While numbers are not available, this increased risk also applies to outdoor workers and children.
- *Malaria is projected to decline* – While malaria still presents a major health risk in Lao PDR, the population at risk of malaria is projected to decline by 2070. This is part due to existing malaria control and eradication programs and strategies, but climate change is also contributing factor. It is estimated that a low emissions scenario will lead to a greater decline in the population at risk than a high emissions scenario.

94. Further details on key climate-related health risks and their projected impacts on Lao PDR's population are described below.

Dengue

95. A major health problem in Lao PDR, dengue has caused serious epidemics in recent years. Dengue incidence is significantly associated with mean temperature, rainfall, and humidity and transmission follows a seasonal pattern (see Figure 55). Epidemics occur during the wet season with lower incidence during dry and cooler months.

Figure 55. Seasonal variation of dengue prevalence in Lao PDR[121]



96. Because of this pattern, climate change-related increases in temperature and precipitation are expected to increase dengue transmission. Temperature increases are associated with faster rates of reproduction of the virus within the vector as well as shorter virus incubation periods, allowing faster transmission to another host. Higher precipitation has also been associated with an increase in the population of *Aedes aegypti*, one of the main mosquito species responsible for dengue transmission. While dengue tends to be found in urban areas because the mosquito vector, *Aedes aegypti*, thrives in the built environment (ex: stored water containers), an increase in dengue-transmitting mosquitos in rural areas demonstrates that the mosquito is adapting to rural environments, possibly due to changes in human behavior, which could further increase the population impacted. Highly vulnerable groups include infants, children, pregnant women, people living in poverty, and migrants.

97. With numbers of dengue cases rising annually, the health sector needs to prepare for an increase in cases of dengue during the mid-part of the year when it is generally more wet. Dengue is treated by managing symptoms, which requires access to safe drinking water to keep patients hydrated, and for severe cases, medical equipment, supplies, and facility-based care to manage symptoms of shock, vomiting, bleeding, and pain. Tools to prevent dengue include developing or enhancing early warnings of outbreaks. Early warnings are based on linking data on dengue cases and related climate variables. Early warnings can equip health workers and communities in these areas with the knowledge and resources to take dengue prevention and risk reduction measures during high-risk periods.

121 Lao PDR Ministry of Health. Draft Health National Adaptation Plan for Lao PDR. Not publicly available.

Diarrheal Disease

98. Recent data suggests that diarrheal disease accounts for 11% of deaths in children under 5 in Lao PDR.[122] While poor hygiene and sanitation practices contribute to outbreaks, diarrhea cases also follow seasonal variations, with greater incidence in the dry season (see Figures 56 and 57). Data already shows a growing incidence of diarrhea cases in Lao PDR between 2014 and 2018 commensurate with an increase in the mean number of dry days per year during this period. Similarly, a 2019 vulnerability assessment conducted by Lao Health Science University found climate change was likely to result in increased incidence of severe diarrhea and dysentery through more frequent cycles of rainfall and drought, longer dry seasons, and inadequate access to safe water, a conclusion the forthcoming HNAP also confirms.

Figure 56. Seasonal variation in the number of diarrhea cases presenting to health care facilities in Lao PDR[123]

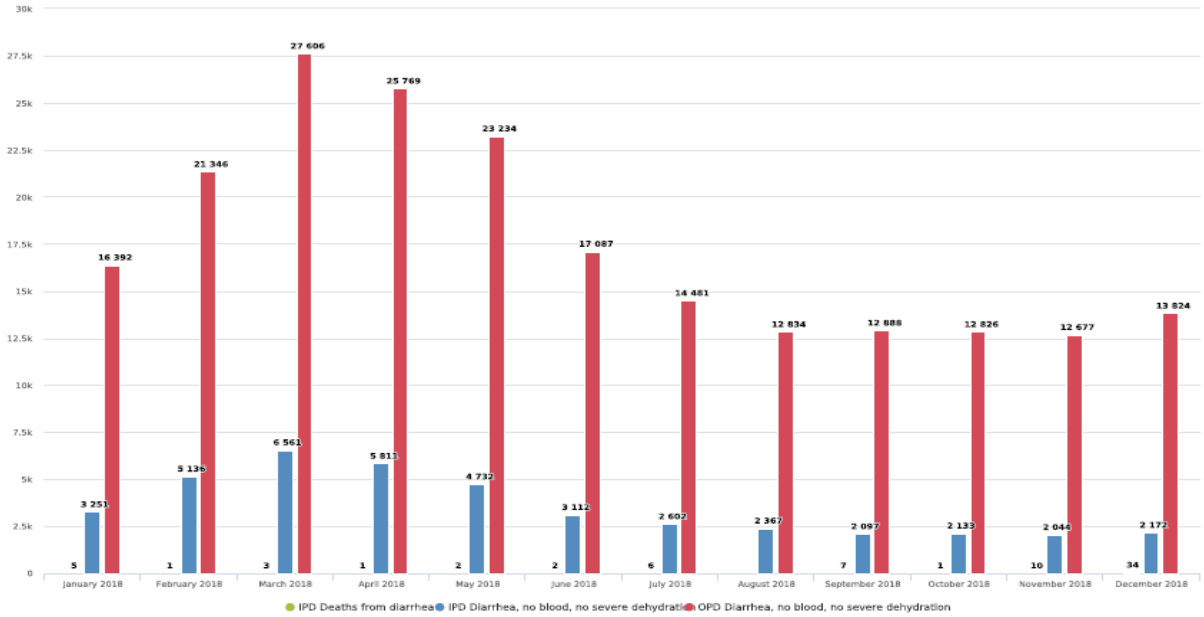
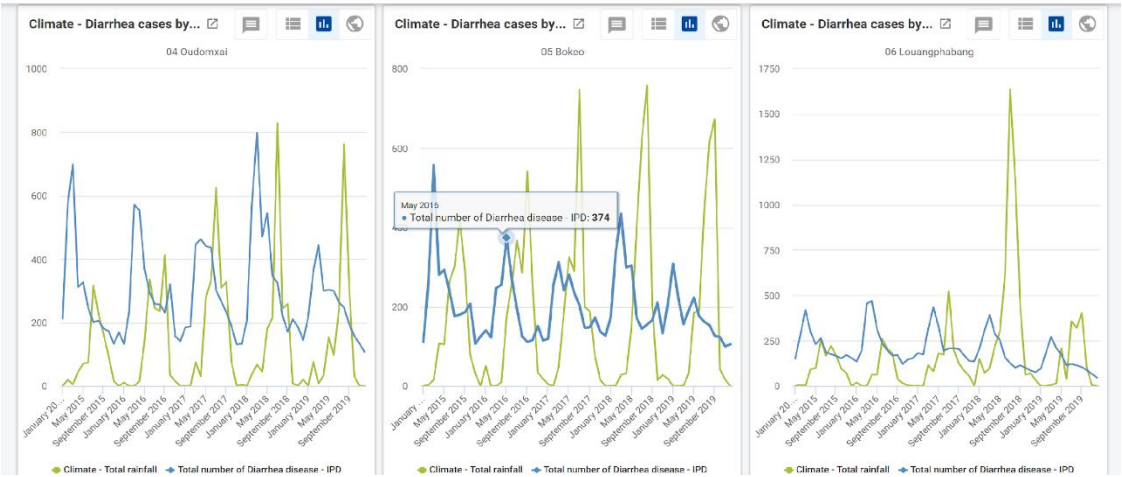


Figure 57. Relationships between rainfall and diarrheal disease in Lao PDR, 2016-2019



99. While cholera outbreaks have become less common in Lao PDR in recent years due to improved WASH practices and vaccination campaigns, the disease remains endemic. In rural areas, more frequent and intense flooding and tropical storms resulting from climate change could lead to increased cholera risk due to contamination of poorly managed water sources/sanitation sites.[124]

100. Treatment for diarrheal disease includes oral rehydration, which can occur at home or in health facilities depending on the severity of symptoms. Tools to prevent diarrheal disease include

122 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR, 2021. Available here.
123 Lao PDR Ministry of Health. Draft Health National Adaptation Plan for Lao PDR. Not publicly available.
124 UNICEF. Lao PDR's First Ever Cholera Vaccination Campaign Launched in Flood-hit Sanamxay District, 2018. Available here.

providing access to safe and climate-resilient water and sanitation services and developing an early warning system that includes climate information so health workers and communities are equipped with knowledge and resources to take prevention measures during high-risk periods.

Heat-Related Illness

101. Periods of extreme heat also threaten health, due to heat-related illness and exacerbations of chronic medical problems. Children, the elderly, outdoor workers, and people with underlying medical problems are among those most at risk during periods of extreme heat. The most vulnerable workers in LDCs such as Lao PDR (e.g., the self-employed in agriculture or migrant workers in the construction sector) are often the hardest hit by heat stress. This also raises questions of social equity and justice. Research indicates that should adaptation measures not be in place, annual heat-related deaths in the Southeast Asia region could increase 295% by 2030 and 691% by 2050 (under an A1B emissions scenario from CMIP3 — most comparable to RCP6.0).[125] In Lao PDR under a high emissions scenario, heat-related deaths among elderly people are expected to increase to approximately 72 per 100,000 by 2080, compared with 3 per 100,000 worldwide during the baseline period from 1961 to 1990.[126]

102. Methods to treat and prevent heat-related illness include establishing cooling centers during extreme heat events, training health workers on the management of heat-related conditions, increasing capacity to forecast heatwaves, and public awareness-raising.

Acute Malnutrition

103. The Laotian population's heavy reliance on subsistence agriculture means EWEs that reduce local food production and supply are likely to lead to food insecurity and malnutrition, particularly among the one-fifth of the population that already consumes less than the minimum dietary energy requirements. Livelihoods vulnerable to climate change impacts, such as those which depend on manufacturing and agriculture, are also likely to be adversely impacted by EWEs, which could contribute to increased poverty and reduced access to nutritious foods.

Climate Change Impacts on Health System Infrastructure

104. Health facilities in Lao PDR have already begun to experience the impacts of climate change. In the 2021 WHO and MoH-led survey of health facilities described above, more than of facilities 50% reported experiencing severe damage from EWEs in the past 20 years, and of those, 70% also sustained significant losses to non-structural commodities (e.g., medical equipment, medicines). Despite this, most health facilities in Lao PDR do not have climate-resilient infrastructure or disaster risk mitigation plans in place. Results of the same survey showed that no health facilities had staff trained on climate-related health outcomes, adaptation measures, or response protocols; only 1% had measures in place to reduce vulnerability to EWEs; and only 5% had developed electrical supply and water disruption plans.

105. The damage EWEs cause to health facilities can be costly. For example, a tropical storm and flooding event in 2018 damaged 35 healthcare centers and two hospitals, which required repairs. Extensive costs were also incurred for temporary health service points and to address disease outbreaks. Total costs were estimated at 27.3 billion Lao Kip (USD 2.73 million; see Figure 58).[127]

125 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR. 2021. Available here.
126 World Health Organization. Climate and Country Health Profile 2015. Available here.
127 World Bank and Asian Development Bank. Climate Risk Country Profile, Lao PDR. 2021. Available here.

Figure 58. Summary of reconstruction and recovery costs in the health sector post 2018 flooding in Lao PDR[128]

SUB-SECTOR	PROGRAM OF ACTIVITY	BILLION LAO KIP
Reconstruction/repair of damaged health facilities and associated losses	• Reconstruction of destroyed health centers • Repair of damaged health centers and district hospitals • Replacement of office and medical equipment	11.89
Relocation of health facilities	• Assessment of site location Acquisition of the land Preparation of the land	6.7
Nutrition	• Increased cost for enhanced screening of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM), as part of an integrated outreach health service package • Cost of supplies and treatment, including RUTF • Contingency referral system • Additional operational cost associated with treatment, staffing, and capacity building • Nutrition promotion, including prevention of thiamine deficiency	2.571
Disease surveillance and outbreak response	• Reestablishment of routine services Support for rapid response team Health promotion Vector control	0.997
Chronic diseases (TB, HIV, diabetes)	• Reestablishment of routine services Contingency referral system Health promotion	1.22
Mental health	• Reestablishment of routine services Contingency referral system Health promotion	0.97
Mother and child health, including pregnancy, delivery, immunization, and referral	• Reestablishment of routine services Contingency referral system Health promotion	2.52
Vector-borne diseases	• Distribution of bed nets • Fogging in the affected areas • Continuation of larval surveys • Procurement of equipment to conduct activities and of chemicals for destruction of mosquito breeding sites	0.44
TOTAL		**27.32**

106. As a result of flooding, drinking water was either unavailable or contaminated, which became a burden for households that had to buy bottled water for drinking. The assessment estimated that approximately USD 350,000 was spent on bottled water. In some parts of the country, sanitation facilities were entirely destroyed by the floods.

107. This event also had a major effect on urban and rural WASH services. The post-disaster needs assessment estimated the total damage and losses to the sector at 69.9 billion Lao kip (USD 7.5 million). Funding requirements to meet short-, medium-, and long-term recovery needs are estimated at 68.2 billion Lao kip (7.3 million USD).

Health Sector Vulnerability by Province

108. Lao PDR's Ministry of Natural Resources and Environment recently undertook a detailed, province-level assessment of climate risk exposure and adaptive capacity for the health sector in Lao PDR, which was used to inform selection of the project's target provinces. Climate change resilience across the target provinces ranges from medium to low (see Figure 59). The provinces also rank high on the Sensitivity and Exposure Index (SEI) and low on the Adaptive Capacity Index (ACI). The SEI and ACI are aggregating indices used to assess vulnerability to climate change and adaptive capacity at village and district levels that were included in Lao PDR's second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC). SEI scores in the target provinces range from 0.6 to 1.0 (out of 1.0, with higher scores being worse; see Figure 60). ACI scores across the target provinces range from 0.2 to 0.6 (out of 1.0, with lower scores being worse; see Figure 61).

128 World Bank GFDRR. Post-Disaster Needs Assessment 2018 Floods, Lao PDR. Available here.

Figure 59. Lao PDR's climate change resilience score according to regions[129]

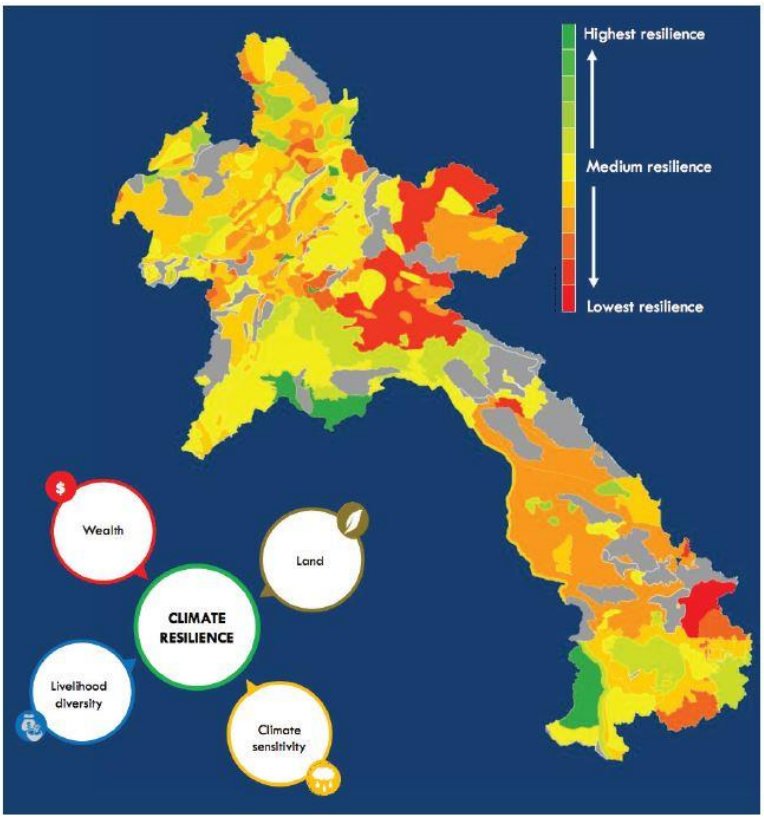
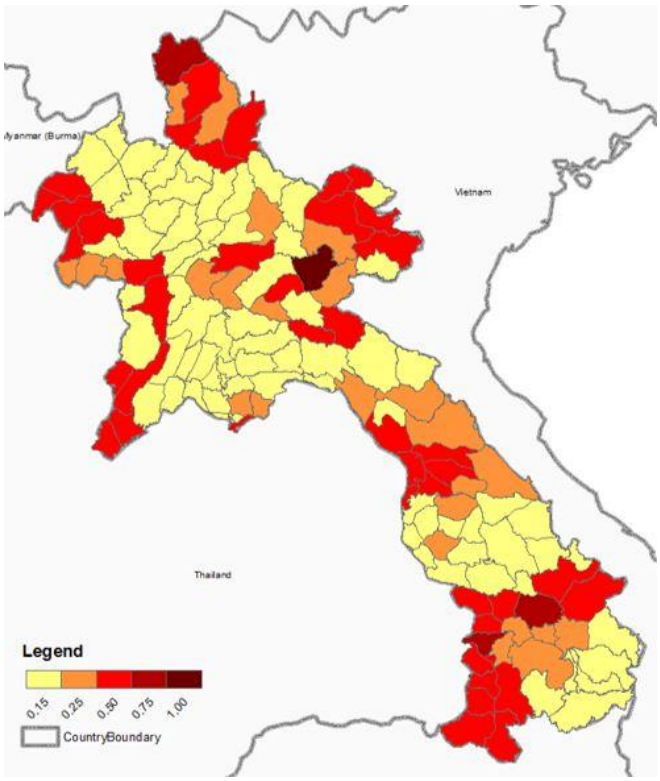
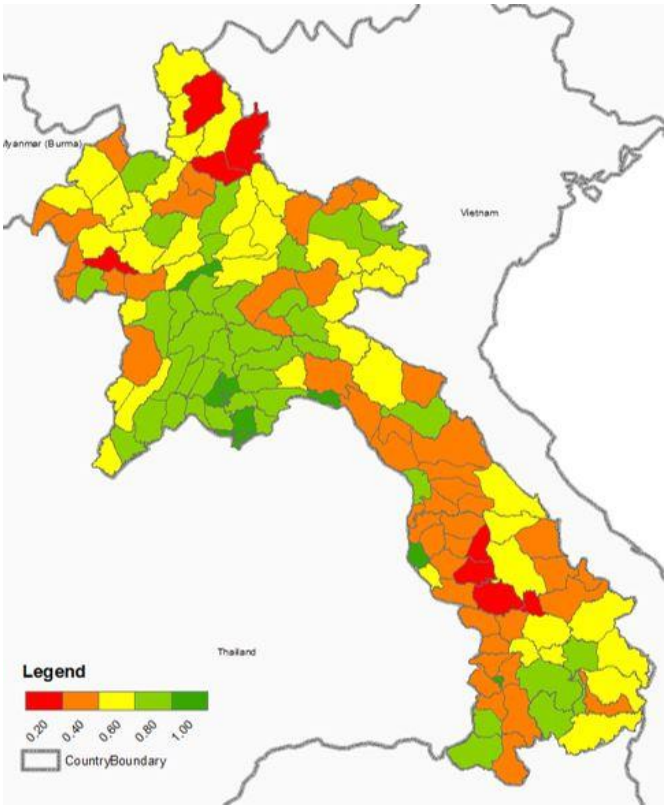


Figure 60. SEI Scores across Lao PDR according to districts[130]



129 UNDRR. Disaster Risk Reduction in Lao PDR: Status Report 2019. Available here.
130 MONRE Department of Climate Change Management. Presentation on National Climate Change Vulnerability Assessment. MONRE. Not publicly available.

Figure 61. ACI scores across Lao PDR according to districts[131]



109. Findings from the assessment are presented by province below.

Sekong

110. Between 70% and 100% of villages across Sekong have an SEI of greater than 0.5 and ACI of less than 0.25, indicating the high vulnerability of this province to climate change impacts. Primary disaster monitoring and risk reduction resources such as a DRR plan, evacuation centres, and a provincial Master Plan are not in place.[132] Persistent poverty is a contributing factor, with the poverty rate in the province estimated at 25-30%. As the second least populated province in Lao PDR, Sekong has the least number of health facilities (30 in total), compared to the other target provinces. Reduced access to health facilities greatly reduces the resilience of this province's health sector to climate change impacts. Health indicators remain low in Sekong. In 2015, the province's infant and maternal mortality rates were estimated at 70 per 1,000 and 357 per 1,000, respectively;[133] the estimated prevalence of pneumonia among children was 11%, the highest among all provinces; and the prevalence of wasting and stunting among children was 9% and more than 40%, respectively[134]. Health facilities such as Sekong Provincial Hospital are less vulnerable to climate change impacts compared to Dakcheung District Hospital and Xiengluang health centre, which are are categorized as moderate to highly vulnerable to climate change impacts, considering the moderate adaptive capacity of the region where these facilities are located.[135] These health facilities are moderately vulnerable to urban flooding and landslides.[136]

Salavane

111. Between 25 and 50% of villages across Salavane have an SEI of greater than 0.5 and up to 75% of villages have an ACI of less than 0.25, indicating the vulnerability of this province to

131 Ibid
132 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced. 2019. Available here.
133 World Bank In Lao PDR's Sekong Province, Over 50 Percent of the Population Get Free Access to Healthcare, 2016. Available here.
134 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
135 MONRE Department of Climate Change Management. Presentation on National Climate Change Vulnerability Assessment. MONRE. Not publicly available.
136 GFDRR. Think Hazard Lao PDR. Available here.

climate change impacts.[137] Persistent poverty across the province reduces the adaptive capacity of its health system to climate change. Poverty rates in Salavane are high; in 2019, an estimated 8% of the country's poor population resided in the province.[138] Health indicators in Salavane remain poor. In 2015, the prevalence of wasting and stunting among children was more than 15% and 40%, respectively.[139] The health sector in this province is also strained by factors such as poor access to improved drinking water sources; in 2012, it was estimated that only 59% of the province's population had access to improved water sources.[140]

Oudomxay

112. Districts across Oudomxay have a low climate change exposure; however, sensitivity and vulnerability to climate change across many districts are moderate to high. The average adaptive capacity to climate change for this province is moderate, considering that a DRR and Master Plan is not in place. Adaptive capacity is also decreased because of poor access to evacuation centers across Oudomxay.[141] Large-scale deforestation in the province has greatly hampered the adaptive capacity of the agriculture sector to climate change impacts such as flooding and drought, which increase the vulnerability of this province to malnutrition and food insecurity.[142] Data collected in 2015 indicate that the prevalence of wasting and stunting among children was as much as 9% and more than 40%, respectively.[143] In 2019, an estimated 8.9% of Lao PDR's poor population resided in Oudomxay[144] and an estimated that 20-30% of all households in the province experienced poverty, suggesting a highly unequal distribution of income.

Luang Prabang

113. Despite adaptive capacity being moderate to high for this province and primary DRR resources being in place, Luang Prabang still remains highly vulnerable to climate change impacts such as drought and flooding.[145] This mountainous province is positioned in the Mekong floodplain, making the region vulnerable to landslides and flooding. Luang Prabang has a population of approximately 431,889 people and is the second largest and fourth-most populated province in Lao PDR. These factors place considerable strain on the province's health and water and sanitation infrastructure and enhance the vulnerability of the province's healthcare system to climate change impacts. Persistent poverty across the province also reduces the adaptive capacity of populations and the health systems to climate change. In 2019, an estimated 7.7% of the country's poor population resided in Luang Prabang.[146] Health facilities such as Luang Prabang Provincial Hospital and Phongxay District Hospital are categorized as moderately vulnerable to climate change impacts considering the moderate adaptive capacity and low climate change impact exposure of their locations.[147]

Luangnamtha

114. Adaptive capacity levels for Luangnamtha are moderate, and since no DRR plan has been developed for the province, it remains vulnerable to climate change impacts.[148] Districts across the province have a moderate to high vulnerability and sensitivity to climate change. Climate change exposure is low and adaptive capacity is low to moderate across districts. However, variations in adaptive capacity and climate change sensitivity are evident. Long district has a higher climate change sensitivity and adaptive capacity compared to Sing district. Poor access to hospitals and health facilities contributes to and reduces the climate change resilience of the province's health sector. High levels of malnutrition also place considerable strain on the province's healthcare sector, reducing its adaptive capacity to climate change impacts. The prevalence of wasting is especially high in this province, where one in five children is either

137 Lao PDR. National Communication 2. Available here.
138 Lao Statistics Bureau. Poverty in Lao PDR: Key findings from the Lao Expenditure and Consumption Survey 2018-2019. Available here.
139 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
140 Lao Statistics Bureau. Lao PDR Lao Social Indicator Survey 2011 – 12. Available here.
141 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced, 2019. Available here.
142 Wong et al. Economic Valuation of Land Uses in Oudomxay Province, Lao PDR: Can REDD+ be Effective in Maintaining Forests? In *Land* 3(3). 2014. Available here.
143 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
144 Lao Statistics Bureau Poverty in Lao PDR: Key findings from the Lao Expenditure and Consumption Survey 2018-2019. Available here.
145 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced, 2019. Available here.
146 Lao Statistics Bureau. Lao PDR Lao Social Indicator Survey 2011 – 12. Available here.
147 GFDRR. Think Hazard Lao PDR. Available here.
148 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced. 2019. Available here.

moderately or severely wasted. In 2015, the prevalence of wasting and stunting among children was as much as 4% and 39%, respectively.[149]

Khammouane

115. Some districts in Khammouane province, such as Mahaxai, Nongbok, Gnommalat, Xebangfai and Xaibouathong, have a high vulnerability and sensitivity to climate change, while others, such as Mahaxai, Nongbok, Gnommalat, Xebangfai and Xaibouathong, have a low to moderate adaptive capacity to deal with climate change impacts. Exposure to climate change impacts across these districts is moderate. Despite primary DRR resources being in place, key factors still contribute to making the province vulnerable to climate change impacts such as flooding.[150] The lowland regions of Khammouane are vulnerable EWEs due to their flat terrain. Persistent poverty also reduces the adaptive capacity of the province to climate change impacts. Access to health services in Khammouane remains low compared to other regions, and in 2012, Khammuane had one of Lao PDR's highest infant mortality rates with 138 deaths per 1,000 live births.[151] In 2015, the prevalence of wasting and stunting among children was as much as 14% and 39%, respectively.[152] Health facilities such as Khammouane Provincial Hospital, Sadeu healthcare center and Nongbok District Hospital are categorized as moderate to highly vulnerable to climate change impacts due to their low adaptive capacity and the moderate climate change impact exposure of the region where they are located. These health facilities are particularly vulnerable to river and urban flooding and climate change impacts such as landslides and cyclones.[153]

Phongsaly

116. Despite primary DRR resources being in place across Phongsaly, districts in the province have a moderate to high vulnerability, sensitivity, and exposure to climate change and the province's health sector remains vulnerable to impacts such as flooding. Adaptive capacity is primarily low across districts; however, variations are evident. Despite Samphan district having a higher climate change exposure compared to the other districts in Phongsaly, Samphan also has a higher adaptive capacity than Phongsaly, Khoa, and Mai districts. Improved access to evacuation centers could enhance climate change resilience across Phongsaly.[154] Also, the province is vulnerable to flooding and landslides due to the characteristic high rainfall of the region. Malnutrition and reduced access to health facilities further reduce the climate change resilience of the province's health sector. In 2015, the prevalence of wasting and stunting among children was as much as 9% and more than 40%, respectively.[155] In 2012, Phongsaly had one of the highest infant mortality rates in Lao PDR with 151 and 138 deaths per 1,000 live births.[156]

149 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
150 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced, 2019. Available here.
151 Ibid
152 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
153 GFDRR. Think Hazard Lao PDR. Available here.
154 Floodlist. Thailand and Laos – Floods Leave 33 Dead, Thousands Displaced. 2019, Available here.
155 Lao People's Democratic Republic and World Food Programme. Fill the Nutrient Gap Lao PDR, 2017. Available here.
156 Lao Statistics Bureau. Lao PDR Lao Social Indicator Survey 2011 – 12. Available here.

Section 5 - Relevant Current and Recent Health and Climate Change Programs in Lao PDR

117. The Table 5 below presents relevant current and recent programs being implemented in Lao PDR with health and climate change objectives, which were used to inform the design of the proposed project.

Table 5. Relevant current and recent heath and climate change programs in Lao PDR

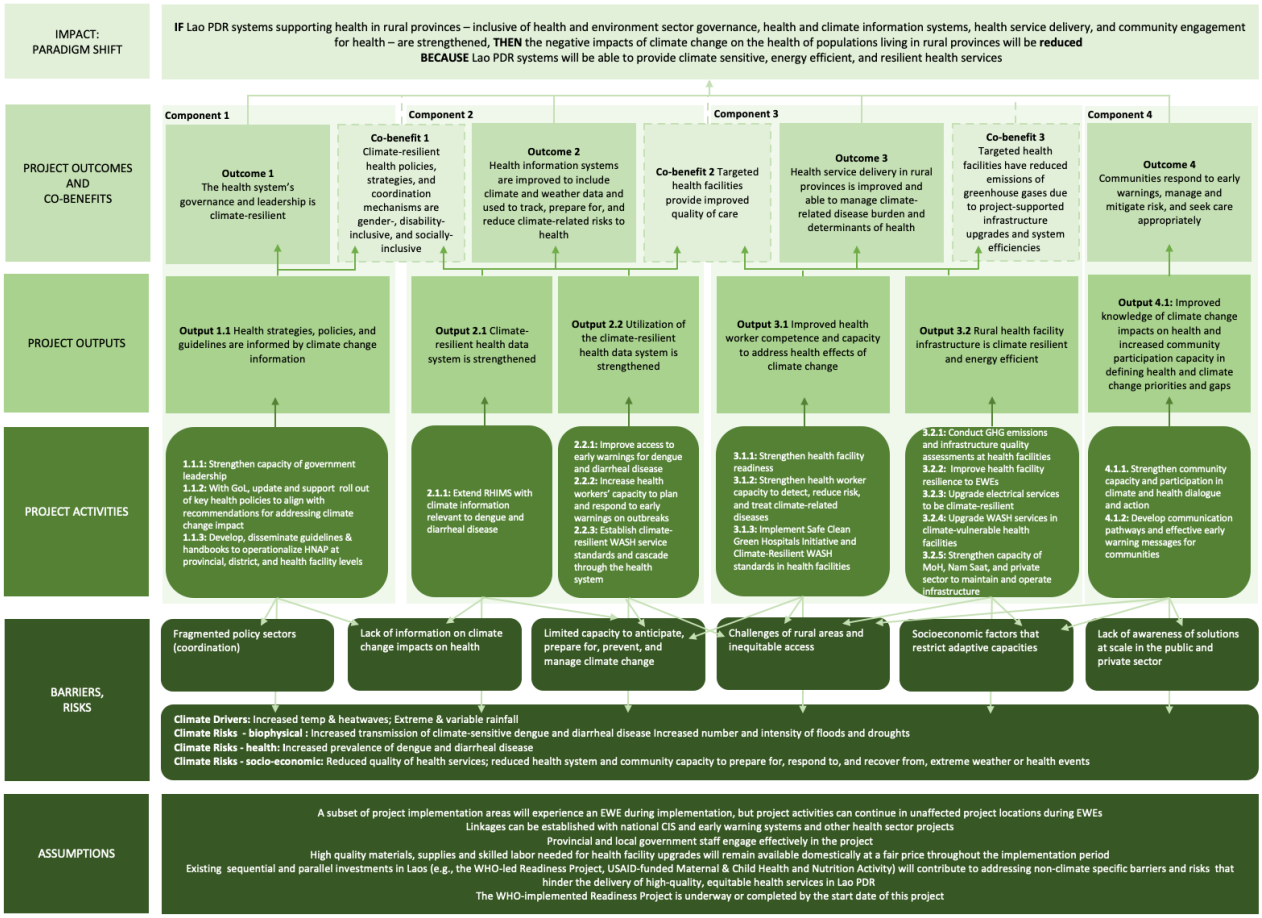
Relevant Program	Description
Enhancing Early Warning Systems in Cambodia and Lao PDR 2021-2025 USD 3.5 million Funded by the Climate Risk Early Warning System and Supported by the World Bank and United Nations Office for Disaster Risk Reduction	Led by National Meteorological and Hydrological Services (NMHS) and National Disaster Management Offices (NMDOs) in Lao PDR and Cambodia, this project is working to strengthen both countries' capacities to provide hydrometeorological information, early action, and response services to vulnerable populations. The project focuses on strengthening institutions, operations, and legal frameworks; improving the capacities of NMHS to provide more timely and precise forecasts and warnings; disseminating warning information to the populations and institutions that need them most using ICT services; and enhancing preparedness and response capacity.
Scaling Up Water Supply, Sanitation, and Hygiene Project 2019-2024 USD 25 million Funded by the World Bank	This project aims to provide access to improved water supply, sanitation, and hygiene services in 450 villages with poor nutrition indicators while also strengthening the capacity of community, district, and provincial institutions for improved service delivery. Within each supported village, the project will focus on reaching schools and health facilities with improved water supply, sanitation, and hygiene services. To do this, the project is working through and strengthening the capacity of water supply and sanitation committees formed under village development committees to manage and operate water systems. At district and provincial levels, it is forming sustainability units, including within Nam Saat, that will support village development committees with their responsibilities. Lao PDR's MoH is responsible for implementation.
Building resilience of health systems in Asian LDCs to climate change 2019-2023 USD 9 million (GEF LDCF) with USD 27 million in co-finance across 6 countries Funded by the Global Environment Facility (GEF) and implemented by UNDP and WHO	This project is working in Lao PDR, Bangladesh, Cambodia, Myanmar, Nepal, and Timor-Leste to strengthen the capacity of the health systems in each country to adapt to the impacts of climate change, with an emphasis on protecting the health of vulnerable communities actively facing drought and floods throughout seasons. The project has four goals: 1) strengthened institutional capacity to effectively integrate climate risks and adaptation options in health sector planning and implementation, which has included support to develop Lao PDR's Nationally Determined Contribution and enhance communication mechanisms to facilitate collaboration; 2) effective decision-making for health interventions through the generation of information and improved surveillance and early warning systems, which in Lao DPR has included developing an RHIMS-based data visualizer that can support decision-making on climate-sensitive health risks; 3) climate-resilient health service delivery, which in Lao PDR has included piloting activities to develop Climate Resilient Water Safety Plans and implementing the WASH-FIT tool in two provinces; and 4) improved regional cooperation and knowledge exchange and the integration of a Health National Adaptation Plan into the National Adaptation Planning Process.
Greater Mekong Region Health Security Project 2017-2023 USD 132 million (USD 12 million in Lao PDR) Funded by the ADB	Economic growth and health security in the greater Mekong region is highly vulnerable to outbreaks of emerging diseases. This project assists the Governments of Cambodia, Lao PDR, Myanmar, and Vietnam to enhance responses to emerging infectious diseases and to manage other major public health threats, in line with the Sustainable Development Goals. The project focuses on improved regional cooperation and communicable disease control in border areas, strengthening national outbreak response systems, and improving laboratory services and hospital infection prevention and control.
Strengthening Resilience to Climate Change in the Greater Mekong Subregion 2015-2021	This project provided regional academic and research institutions and public health and environmental authorities in Lao PDR, Cambodia, and Vietnam with technical assistance to strengthen their capacities in climate change adaptation. The project worked with these stakeholders to build the scientific knowledge needed to address the

USD 4.3 million Funded by ADB	health impacts of climate change and quantify the additional burden of climate change on health outcomes. In Lao PDR, the project was implemented by the MoH's Department of Hygiene and Health Promotion. It focused on producing vulnerability and adaptation assessments in all three countries, including detailed assessments for high-risk provinces, and aligning those assessments with national strategies and plans; training 1,322 health sector staff on climate change adaptation through a training-of-trainers model; producing country-specific training modules addressing national plans and priorities, including a Fundamentals of Climate Change and Health knowledge product; and holding regional, national, and provincial workshops on climate change and human health adaptation strategies.
Health Sector Governance Program 2015-2016 USD 30 million Funded by ADB	This project supported reforms to improve access to basic health services in Lao PDR, with a focus on improving governmental health sector reform processes, improving delivery of free health services for maternal, newborn, and child health and the poor, strengthening human resources for health capacity; and strengthening health sector financial management capacity. The project established a functioning national commission on health sector reform, supported the government to endorse the Health Sector Reform Framework and the Health Sector Reform Implementation Plan, developed detailed road maps for key reforms that the MoH approved, and strengthened the delivery of free health services.
Health Services Improvement Project 2006-2015 USD 27.4 million Funded by the World Bank	This project aimed to support the GoL to improve the health status of the Laotian population with an emphasis on those in the lowest wealth quintile and living in rural areas. It worked in nine provinces, focusing on improved health service infrastructure, training, service delivery and improving health information systems, and increasing the utilization of health services by women and children.

Section 6 - Theory of Change Diagram and Narrative

118. The project's Theory of Change (ToC), outlined in Figure 62 below, details the causal links and pathways from activities to outputs and programmatic-level outcomes. Together, these activities, outputs, and programmatic-level outcomes are designed to generate measurable adaptation results for the health system and communities in Lao PDR, so the Laotian people can remain "healthy and strong" despite unstable and changing climate conditions, in line with the vision the GoL has articulated in its Strategy on Climate Change and Health Adaptation and Action Plan. The project will contribute to a paradigm shift to facilitate climate-informed advisory and risk management services and community action, particularly for some of the rural Laotian communities most vulnerable to the health impacts of climate change. The project will work directly with the Laotian health system and these communities to address knowledge, capacity, and resource barriers so Laotians can transform their own health and work toward climate-resilient development.

Figure 62. Strengthening Climate Resilience of the Lao PR Health System ToC Diagram



119. The ToC is premised on the principle that equitably improving health outcomes, including for the most vulnerable communities in Lao PDR, requires addressing climate and health challenges together and that communities and health systems that have the knowledge and capacities needed to adapt to a changing environment will experience better health outcomes in the long term. Understanding the links between climate change and health impacts, monitoring key performance indicators and implementing anticipatory actions, establishing climate-resilient health facilities, and ensuring the health workforce and broader population are climate-informed are key actions that will enhance health system and community resilience to health-related climate change impacts and will contribute to a healthier, more economically prosperous Lao PDR.

120. The ToC hypothesizes that:

> **IF** the Lao PDR systems supporting health in rural provinces—inclusive of health and environment sector governance, health and climate information systems, health service delivery, and community engagement for health—are strengthened

THEN the negative impacts of climate change on the health of populations living in rural provinces will be reduced

BECAUSE Lao PDR systems will be able to provide climate sensitive, energy efficient, and resilient health services.

121. The project aims to achieve impact via four interlinked outcomes, each representing one project component, with mitigation, health, and gender co-benefits anticipated. The outcomes correspond to the three infrastructure levels of resilient health systems: institutional, built, and social infrastructure[157] and align with key components of the WHO's Operational Framework for Building Climate Resilient Health Systems and GoL priorities. Each outcome is summarized below.

- ***Outcome 1: The health system's governance and leadership is climate resilient –*** To strengthen governance and leadership of climate-resilient health systems, the project will work with GoL to develop health strategies and policies that incorporate the threats presented by climate change and increase climate resilience, along with training materials, guidelines, and handbooks to operationalize them. The strategies and policies will be aligned between central and subnational levels. As the country's updated HNAP is finalized, the project will also support subnational level rollout.
- ***Outcome 2: Health Information Systems are improved to include climate and weather data and used to track, prepare for, and reduce climate-related risks to health –*** Building on and leveraging WHO and GoL-led efforts, the project will use data from the country's meteorological system, key WASH indicators, and reported health outcomes to enable the health system to use climate data in conjunction with health data for planning and decision-making. This will enable the health system to use early warning system information for planning in the near-term and, over time, to develop a clearer picture of the direct impacts of climate change on WASH sustainability and the health system more broadly. These efforts will contribute to improved prevention, diagnosis, and management of some climate-sensitive diseases and their associated risk factors.
- ***Outcome 3: Health service delivery in rural provinces is improved and able to manage climate-related disease burden and determinants of health –*** The project will use relevant WHO guidance on vulnerability assessment and building resilience of health systems to strengthen health service delivery, so it effectively contributes to reducing the health impacts of climate change on the population. This component will include strengthening the capacity of health workers from 100 health facilities to plan for, monitor, detect, and treat some climate-related diseases. It will also include conducting small-scale upgrades to the infrastructure in 79 of those facilities, including their WASH infrastructure, so it is climate resilient and energy efficient. This will enable staff at the targeted facilities to provide high-quality and uninterrupted health services despite climate stressors, including EWEs.
- ***Outcome 4: Communities respond to early warnings, manage and mitigate risk, and seek care appropriately –*** The project will introduce risk communication and community engagement activities that will increase community knowledge on the impacts of climate change on health; guide community stakeholders in developing and implementing community health and climate resilience action plans; and provide 50 target communities located within the five districts classified as highly vulnerable to climate change with resources to implement approved priority activities from their plans (see Section 7).
- ***Co-benefits –*** The project is expected to achieve mitigation, health, and gender co-benefits. Health facility infrastructure upgrades will reduce GHG emissions from target facilities, resulting in mitigation co-benefits. Health worker capacity strengthening activities and health facility infrastructure upgrades are expected to improve the quality of care health facilities and health workers provide, resulting in health co-benefits. Increasing the inclusiveness of climate-related health policies, strategies, and coordination mechanisms will result in gender co-benefits.

122. The outcomes are designed to contribute to specific health system building blocks, which provide a framework for supporting and strengthening a health system. Developed by WHO, the building blocks are mutually reinforcing and widely recognized as a catalyst for achieving global

157 Curtis et al. "Impact of extreme weather events and climate change for health and social care systems", Environmental Health 2017, 16(Suppl 1):128. DOI 10.1186/s12940-017-0324-3

health targets such as the Sustainable Development Goals.[158] Project outcomes align with relevant building blocks as described below. The project outcomes and their associated activities collectively are required to improve access to responsive, climate-related healthcare and prevention services at facility and community levels.

- Outcome 1 activities will contribute to strengthening the Health System Leadership and Governance building block through strengthened national policies, strategies, government capacity, and coordination mechanisms. This building block is foundational and required to strengthen the other building blocks.
- Outcomes 2, 3, and 4 contribute to enhanced access to and use of Information, another key health system building block. Outcome 2 enhances climate and health information systems that can be applied to improve strategic decision-making and resourcing allocation at all levels of the health system. Outcome 3 will generate information about the energy efficiency and climate adaptation capacity of the health system to inform efficiency and resilience improvements. Outcome 4 strengthens community and individual capacity to access and use climate and health information to prevent climate-related diseases, seek more timely treatment and adapt to the impacts of climate that affect human health.
- Outcome 3 activities also strengthen the Service Delivery and Medical Products and Technologies building blocks by providing the supplies, equipment, and infrastructure that are prerequisites for the health workforce to provide high-quality health services. As with the Leadership and Governance building block, Service Delivery and Medical Products and equipment are essential for a functional health system but independently are insufficient to improve access to health services and their quality and use.
- The quality of service delivery is also dependent on the Capacity of the Health Workforce, which Outcomes 2 and 3 also address through improved training, coaching, and monitoring activities that will be delivered alongside MoH officials. These activities will equip health workers at provincial and health facility levels with the skills and knowledge to apply the information, products, technologies, and infrastructure made available through the project's other components effectively.

123. Collectively, these mutually reinforcing and interlinking components provide the basis to sustain climate-resilient health services beyond the life of the project.

124. Activities that reduce people's vulnerability to current health-related climate change impacts, such as strengthening health worker and community capacity to understand and respond to climate-related health challenges, will lead to immediate benefits. The project will achieve medium-term impact by working with government, health facilities, and communities to improve their access to and ability to use climate information for decision-making while simultaneously strengthening health facility resilience to anticipated climate change impacts and enabling community-designed and led actions. These activities are expected to result in measurable outcomes within the project period and continued impact beyond implementation. The project will achieve long-term impacts by working at district, provincial, and national levels to establish a strong policy framework and roadmap for action that will use data and evidence to guide the health system's current and future response to climate change.

158 Manyazewal T. (2017). Using the World Health Organization health system building blocks through survey of healthcare professionals to determine the performance of public healthcare facilities. Arch Public Health. 2017;75(1):50.

Section 7 – Community Health and Climate Resilience Action Plans – Menu of Activity Options

125. With community stakeholder input, the project will develop a community climate resilience action planning guide to enable communities to prepare for and respond to climate-related weather and health events, including EWEs. Training for community leaders and community-based health workers (see Funding Proposal - Activity 3.1.2) will enable them to engage on the development of climate resilience action plans in target communities. Trainees will be comprised of men, women, youth, and people with disabilities. Once planning is complete, a subset of 95 target communities located within the five districts classified as highly vulnerable to climate change will be supported to implement approved activities over two a two-year period. Table 6 below presents the full list of activity options that will be available to communities. The project will work to connect the 155 target communities not prioritized for direct support to other donors and partners that may be positioned to fund their community health and climate resilience action plans. SC will also continue to seek co-financing to support these communities to implement their plans.

126. The project will establish district-level community health and climate resilience action plan review committees composed of reviewers from SC, the District Offices of Natural Resources and Environment, and DHOs. The committees will review and provide input into community plans, approve activities from the menu of options for funding, and monitor progress as the plans are implemented. The project will also facilitate annual coordination meetings on climate change risks and resilience with community leaders, the District Office of Natural Resources and Environment, DHOs, and the Department of Agriculture and Forestry (see Table 7).

Table 6. Illustrative Menu of Community Health and Climate Resilience Fund Options

****Unit Cost and Total Cost columns from Table 6 have been redacted in accordance with the GCF Information Disclosure Policy, as the portion is confidential under the disclosure policy of the Accredited Entity.****

Activity	Unit	Unit Cost	# units	Total Cost
Village early warning communication system				
Loudspeaker	each		4	
Information board	each		1	
Amplifier	each		1	
Electric wire	set		1	
Solar panel	each		1	
Total				
Community rainwater/ harvesting drinking water system				
Water piping	meter		10	
Large storage unit	each		1	
Miscellaneous materials, supplies, equipment for installation and supply (e.g., saws, drills, tape, adhesive, nails, screws, paint)	set		1	
Water quality testing materials, supplies for bacteriological, chemical and physical water quality testing	each		6	
Rainwater measurement equipment	each		1	
Foreman	day		2	
Specialized Labor	day		2	
Unspecialized Labor	day		2	
Total				
Household rainwater storage system (for govt. designated vulnerable households)				
Water piping	meter		5	
Household rainwater storage unit	each		1	
Miscellaneous materials, supplies, equipment for installation and supply (e.g., saws, drills, tape, adhesive, nails, screws, paint)	set		1	

Activity	Unit	Unit Cost	# units	Total Cost
Foreman	day		1	
Specialized Labor	day		1	
Total				
Household water treatment systems				
Household water filter	each		60	
Total				
Distribute water-conserving household handwashing stations				
Handwashing unit	each		60	
Total				
Upgrade community buildings and sanitation facilities to be climate-resilient				
Roofing materials	set		1	
Miscellaneous materials, supplies, equipment for installation and supply (e.g., saws, drills, tape, adhesive, nails, screws, paint, sand, gravel)	set		1	
Cement	per bag		10	
Total				
Reduce standing water from community vicinity				
Shovels	each		10	
Sand, dirt, gravel	per kilo		10	
Per diem and gas for GoL representatives to oversee activity	per session		3	
Total				
Conduct extreme weather and health event simulation exercises with communities				
Incentives for joining activity (village lunch costs, snacks)	per time		4	
Per die and gas for GoL representatives to oversee activity	per session		4	
Total				
Health & safety education sessions on dengue & diarrheal disease prevention and disaster preparedness				
Per diem and gas for GoL representatives to oversee activity	per session		4	
Total				
Installation of mosquito screens in public buildings				
Wood	set		1	
Miscellaneous materials, supplies, equipment for installation and supply (e.g. saws, drills, tape, adhesive, nails, screws, paint)	set		1	
Window screens	roll		1	
Total				
Distribution of mosquito nets to households				
Mosquito nets	each		150	
Total				

Table 7. Training, workshops, and conferences

**** Cost and Total Cost columns from Table 7 have been redacted in accordance with the GCF Information Disclosure Policy, as the portion is confidential under the disclosure policy of the Accredited Entity.****

	Cost	Unit	Qty	Total

Activity	Unit	Unit Cost	# units	Total Cost
Annual community meetings in Years 1 and 2 to gather stakeholder input on community disaster risk reduction action planning 25 districts *15 people per district * 2 years. Costs include participant travel costs and community meals		/district	25	
Train community leaders to implement community-led disaster risk reduction planning and implement community-led disaster risk reduction planning. There will be 250 trainings for 4 people per community. Costs include participant transport and follow-up monitoring		event	250	
Facilitate annual coordination meetings on climate change risks and resilience with village leadership and DONRE, DHO, DAF. Meetings will be held in each of the 250 communities annually in Years 2-4 (250 meetings * 3 years). Costs include venue rental, lunch, and transportation		event	750	

Section 8 – Maps

127. ****Section 8 – Maps have been redacted in accordance with the GCF Information Disclosure Policy, as the portion is confidential under the disclosure policy of the Accredited Entity.****

Section 9 – Logical Framework

128. The Logical Framework is included as Feasibility Study Annex 2a.

Section 10 – Implementation Timetable

129. The Implementation Timetable is included as Feasibility Study Annex 2b.

Section 11 - Gender Assessment and Action Plan

130. The Gender Assessment and Action Plan is included as Annex 4.

Section 12 - Stakeholder Consultations Report

131. The Stakeholder Consultations Report is included as Annex 13.