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Annex 2

Feasibility Study

For the GCF-FAO Project “Enhancing the resilience of Serbian forests to ensure energy security of the most vulnerable while contributing to their livelihoods and carbon sequestration (FOREST Invest)”

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1. PROJECT SUMMARY

Overview

1. The project 'Enhancing the resilience of Serbian forests to ensure energy security of the most vulnerable while contributing to their livelihood and carbon sequestration (FOREST Invest)' aims to support the Republic of Serbia in enabling its forest sector to contribute to the country's goals with respect to climate change adaptation and mitigation and support the most vulnerable households. It will do so by upgrading management capacities of key institutions and communities, expanding ecosystems services to reduce poverty among communities, incentivizing private companies to decarbonize their processes while contributing to forest's restoration and better management and stabilizing and increasing carbon removals. The project aims to directly enhance the resilience of 729,064 people (371,823 women) while increasing carbon removals from the forestry sector (7.6 MtCO_{2eq} [27Y] and reducing net emissions by the private sector by 0.8 MtCO_{2eq} [27y]). Indirectly the project will positively impact 2.8 million (1.45 million women) persons. Main co-benefits of the project will be biodiversity conservation, gender empowerment and poverty reduction.
2. The initiative will achieve its target using a cross-cutting mitigation and adaptation approach by (a) ensuring climate adaptive forest management on 500,000 ha of forests; (b) enhancing the resilience of rural communities and supporting the energy security of over 759,665 persons, (c) increasing forest cover by 7,000 ha; (d) supporting the conversion of about 51,000 ha of public and private degraded coppice stands into high forest; and (e) assisting private companies (i.e. agrifood companies) in addressing climate change issues. Additional positive impacts of the project include: (I) private sector engagement in climate adaptive forest management; (II) greening wood-based biomass value chains; (III) increased protection of rural communities from disasters; and (IV) socio-economic benefits for the rural poor due to higher quality fuelwood and enhanced availability of NWFPs and other ecosystem services.
3. The project will address bottlenecks to climate change adaptation and mitigation through three specific components: Component 1 - National level upscaling of sustainable and climate adaptive silviculture and carbon finance framework; Component 2 – Improving energy security and livelihood from climate resilient forest ecosystem and GHG emissions reductions from increased carbon sinks and decarbonization opportunities; and Component 3 - Engaging Private sector in climate adaptive silviculture and decarbonization investments. Taken together, these actions will enable Serbia to reduce the vulnerability of its forestry sector and enhance incomes and energy security of the poorest households while increasing total CO₂ removals and biodiversity. Given the ownership and management structure of forests in Serbia, the project will operate at the national level while taking into account regional specificities.
4. The project will benefit approximately 3.6 million people. The direct beneficiaries are fuelwood users, communities that will receive technical assistance, training and financial support to strengthen forest management, poor communities that will secure energy access from forests, modernize the biomass value chain and decarbonize the agri-food sector. The direct beneficiaries will also include a wide range of private sector actors: (i) Forests' owners and their associations; (ii) Private landowners. The households are largely concentrated in rural areas and make up the poorest segments of the population. The total investment will be of USD 83,811,581, including USD 25 million of GCF grant funding. The rest of the investment will be co-financed from four additional entities: Ministry of Agriculture, Forestry and Water Management (MOAFWM) (in-kind), Serbia Shume (in-kind), Vojvodina Shume (in-kind) and FAO (grant).
5. There are several areas in which the project is expected to facilitate a paradigm shift in the country. First, the low carbon development strategy of Serbia is strictly connected to the health of forests and their capacity to: (a) remove CO₂ emissions, (b) provide energy and (c) guarantee offsetting opportunities. Therefore, the adaptation of the forestry sector, the expansion of forest areas and the reduction/removal of the negative impacts of drivers of forest's degradation (Components 1 and 2) are preconditions for climate change adaptation, poverty alleviation and decarbonisation in Serbia (Component 3). Second, the governance of forests as well as of ecosystem services (i.e. carbon removals, biodiversity, non-wooded forest products, protection and fuel biomass) can no longer be delegated to central institutions only

(Component 1). It requires new paradigms where communities, local authorities and the private sector could participate and invest. Therefore, the project will provide the forestry sector with additional tools and mechanisms to lessen its structural dependency on national budget or external donors (Components 1 and 3). Third, transparency and evidence-based forest monitoring and reporting are paramount to secure the trust of national and international stakeholders and to assure that reported data about forests and emissions are verified (Component 1).

Adaptation Benefits

6. The adaptation investments will support Serbia in addressing the main climate stressors identified and in planning / executing new forestry investments considering the climate change projection identified in the national communications, the national adaptation plan and other scientific documents.

Table 1: Adaptation benefits

Project objective	Results	Beneficiaries
Adaptation investments will help modernize the forestry sector to reduce its vulnerability to climate change and prepare forests to withstand forecasted changes, without compromising key ecosystem services, including those that are critical to poverty alleviation (i.e., energy, NWFP). By addressing the forest-energy-decarbonization nexus, the project will reduce the vulnerability of rural communities and the poor and reduce their overall exposure to energy price shocks while guaranteeing forests' growth and health. Finally, the proposal will reduce the exposure and vulnerability of private forests smallholders as well as small and medium sized agrifood enterprises by reducing their overall climate risks and allowing them to use forests for additional income as well as to contribute to the decarbonization efforts of the country.	<p>By the end of the project:</p> <p>558,000 hectares of forests will have been brought under climate-resilient management practices.</p> <p>Public and Private Nurseries are able to provide the forestry sector with at least 24 different species of tree compared to the current 4.</p> <p>2,500 Public and Private Stakeholders are trained and engaged in Climate Adaptive Silviculture (CAS).</p> <p>8 national curricula related to forestry-energy-decarbonization nexus are upgraded to include introduced technologies and practices.</p>	<p>The project will benefit 3.6 million people.</p> <p>The beneficiaries include: (i) the number of persons in communities living in and in proximity of forest areas that the project will address (ii) the number of people currently using fuelwood as their primary source of energy for heating; and (iii) smallholders and forest owners that dispose of increased value of the forest due to increased climate resilience of their properties; (iv) the rural population that will increase its resilience due to enhanced forest ecosystem services (more details in Annex 25).</p>

Mitigation Benefits

7. Project activities will contribute significantly to achieving Serbia's national climate commitments and targets (established in particular within the NDCs and the Low Carbon Development Strategy).

Table 2: Mitigation benefits

Project objective	Results	Beneficiaries

The project will increase the capacity of public and private forests to remove CO ₂ , it will reduce the negative impact of drivers of forest degradation, and it will support Serbian agribusiness companies to decarbonize their processes and increase their resilience.	It is estimated that -8.4 million tonnes of CO _{2eq} will be avoided over 27 Years (equivalent to project duration and capitalization phase).	The entire population will benefit from mitigation activities.
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Other Expected Co-Benefits

8. The project will have additional beneficial impacts on the environmental, economic, and social spheres – including gender. These can be summarized as follows:

Table 3: Additional co-benefits

Environment	<ul style="list-style-type: none"> - Reduced air pollution (particulate matter) through cleaner biomass combustion - Conservation of biodiversity - Enhanced ecosystem services with benefits for soil quality, water availability, evapotranspiration and soil erosion
Social	<ul style="list-style-type: none"> - Improved quality of life of the poorer and most vulnerable communities due to protection of rural communities and infrastructures from natural disasters like flash floods, floods and landslides and due to reduction of poverty (lower expenses for energy and new economic opportunities) - Mitigation of rural urban migration phenomena through increased development opportunities in particular for the younger generation
Economic	<ul style="list-style-type: none"> - Contribute to reducing poverty through: (i) increased access to fuelwood with improved quality (ii) greater transparency of the solid biofuel value chain, and (iii) enhanced economic opportunities through the sector's modernization. - Enhanced availability and opportunities for the valorisation of non-wood forest products (e.g. honey production) - Creation of Eco-tourism opportunities
Gender	<ul style="list-style-type: none"> - Enhanced participation of women in local and national decision making and planning

2. METHODOLOGY AND APPROACH

I. Literature Review

9. As mandated by the NDA¹, FAO as Accredited Entity approached the preparation of the proposed climate investment project by analysing results deriving – among other - from the following main sources:
- Comprehensive literature review including ongoing and past projects and national communications/policy papers. Of these, priority was given to: (i) National Communications to UNFCCC, UNCCD, CBD and others; (ii) national action/adaptation plans and strategies; (iii) national legal frameworks, (iv) UN assessments and reports; (v) publications from national institutions, academia (national and international) and CSO; and (vi) bilateral donors' reports / projects.
 - Data review with the MOAFWM;

¹ Until 21 November 2024, the Ministry of Agriculture, Forestry and Water Management served as National Designated Authority. The role then transferred to the Ministry of Environmental Protection.

- c. Data collected both at national and local levels to determine current exposure of communities and to understand vulnerability to climate change.

10. The next chapters will highlight and summarize the main findings at national, local and target areas level.

II. The selection of beneficiaries, targeted areas and activities methodology

- 11. Beneficiary selection criteria include prioritizing areas and sectors with the higher vulnerability, assessing willingness and commitment to participate, considering geographic proximity to project areas, promoting gender inclusivity, involving diverse stakeholders, and aligning with project objectives to promote sustainable forest management practices.
- 12. FAO and the Government of Serbia have already preliminarily identified and mapped the potential forest restoration and new afforestation sites that are considered suitable for afforestation investment and discussed with stakeholders the potential investment areas (Annex 16). The selection criteria for potential activities targeted areas include ecological significance; accessibility and logistics, socio-economic considerations; clear land ownership, absence of land tenure conflict, and absence of land cultivation or pasture use. Criteria are reported in the full funding proposal together with the description of activities. The selection criteria for project activities include alignment with project objectives, effectiveness, scalability, stakeholder engagement, cost-effectiveness, and sustainability.
- 13. These criteria will be reviewed and refined, and specific considerations will be given during the selection of individual afforestation plots, among other criteria explained below.

III. Economic and Financial analysis methodology

- 14. Traditional financial models are useful but insufficient for measuring the achievement of the project's objective of mobilizing investments for afforestation, coppice conversion, and land restoration. Additional models were developed to quantify the financial and economic benefits, guide cost structures and co-financing requirements, determine investment-specific concessionally levels, and identify success factors and complementary actions.
- 15. The model parameters were based on information collected during the project design phase, including interviews, market analyses, data from relevant agencies and databases, and estimates from the design team. Conservative assumptions were made for inputs and outputs, considering potential risks and scenarios. A list of prices used in the analysis is available in the spreadsheet of the EFA document (Annex 3).
- 16. The models calculate aggregated benefit cash flows, taking into account variable adoption rates and success rates for firms. Conservative projections are made to include the financial and economic benefits, including carbon emissions.

II. Climate change analysis methodology

a. GeoSpatial Analysis:

- 17. Most of the FAO climate analyses use local weather data provided by the Serbia National Adaptation Plan (NAP) project (Advancing Medium And Long-Term Adaptation Planning In The Republic Of Serbia (United Nations Development Programme (UNDP) et al., January-1-2022)). Additionally, the project used a number of geospatial tools and sources to fine tune the analysis and look at those variables where no ground data was made available. Details are available in Appendix 6.
- 18. Terra Net Evapotranspiration: This product provides the Evapotranspiration and potential evapotranspiration data for our analysis. The algorithm used is based on the logic of the Penman-Monteith equation, which includes inputs of daily meteorological reanalysis data along with MODIS

remotely sensed data products such as vegetation property dynamics, albedo, and land cover (Running et al., 2021).

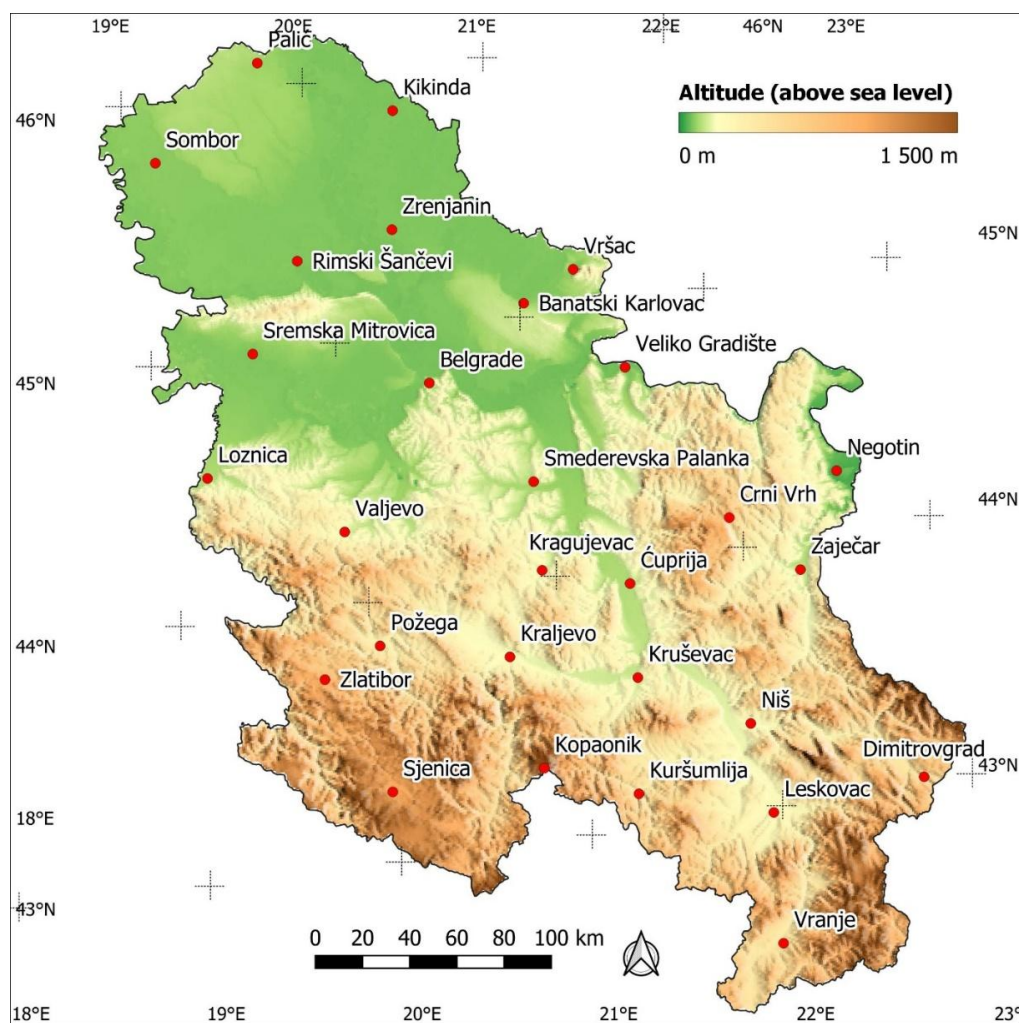
19. GLDAS: Global Land Data Assimilation System (GLDAS) will be used to provide snowfall and snow depth data for our analysis. This product ingests satellite and ground-based observational data products. Using advanced land surface modelling and data assimilation techniques, it generates optimal fields of land surface states and fluxes (Rodell et al., 2004).
20. MODIS: MODIS database will be used to provide Leaf Area Index (LAI), Normalize Difference Vegetation Index (NDVI) data for our analysis. These variables are derived from MODIS products (Didan, 2015; Myneni et al., 2015)
21. ERA5: For the analysis of winds direction and speeds, this analysis will use the modelled data provided by ERA5 database. ERA5 is the fifth generation ECMWF (European Centre for Medium-Range Weather Forecasts) atmospheric reanalysis of the global climate. The reanalysis combines model data with observations from across the world into a globally complete and consistent dataset (Muñoz Sabater, 2019).

b. Analysis of data from existing meteorological stations

22. To characterize historical temperatures and precipitation in Serbia we will use local weather stations data. These data were measured by local weather stations and published in the meteorological yearbooks of the Republic Hydrometeorological Service of Serbia, Hidmet (Republic Hydrometeorological Service of Serbia, 2020). The database comprises 29 weather stations throughout Serbia: Banatski Karlovac, Belgrade, Crni Vrh, Čuprija, Dimitrovgrad, Kikinda, Kopaonik, Kragujevac, Kraljevo, Kruševac, Kuršumlija, Leskovac, Loznica, Negotin, Niš, Palić, Požega, Rimski Šančevi, Sjenica, Smederevska Palanka, Sombor, Sremska Mitrovica, Valjevo, Veliko Gradište, Vranje, Vršac, Zaječar, Zlatibor and Zrenjanin (see local weather data provided by the Serbia National Adaptation Plan (NAP) project (Advancing Medium And Long-Term Adaptation Planning In The Republic Of Serbia (United Nations Development Programme (UNDP) et al., January-1-2022))).

Figure 1: Location of the 29 Weather stations considered in the analysis²

^{2 2} The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



Overlaid on a topographical map. Data source: Hidmet (Republic Hydrometeorological Service of Serbia, 2020) and NASA / USGS / JPL-Caltech (Farr et al., 2007).

23. The analysis of future climatic conditions in Serbia was achieved using the NASA (National Aeronautics and Space Administration) Earth Exchange - Global Daily Downscaled Climate Projections (NEX – GDDP) dataset, comprising of 20 downscaled climate models for the globe that are derived from the General Circulation Model runs conducted under the Coupled Model Intercomparison Project Phase 5 (CMIP5 (Taylor et al., 2012)). These models are: BNU-ESM, CCSM4, CESM1-BGC, CNRM-CM5, CSIRO-Mk3-6-0, CanESM2, GFDL-CM3, GFDL-ESM2G, GFDL-ESM2M, IPSL-CM5A-LR, IPSL-CM5A-MR, MIROC-ESM-CHEM, MIROC-ESM, MIROC5, MPI-ESM-LR, MPI-ESM-MR, MRI-CGCM3, NorESM1-M, bcc-csm1-1 and inmcm4 (Thrasher et al., 2012). Both RCP 4.5 and RCP 8.5 scenarios were considered for each model.

24. Data review with Institutional stakeholders

25. Data were gathered from the Ministry of Agriculture Forestry and Water Management (MOAFWM) and Ministry of Environmental Protection (MEP), and Republic Hydrometeorological Service of Serbia. Data and analysis produced by FAO experts have been verified with the MOAFWM (NDA), as well as relevant ministries, academia and research centres who participated in the design process (Annex 7, Appendix 3).

III. Ground-truthing

26. To ensure that the project design is responsive, relevant, as well as gender sensitive, number of consultations were held in the country. These consultations are part of the national engagement process (Annex 7) and national ownership and given the importance of local community participation in the project. In the stage of preparing the Concept Note and the full funding proposal of this project, consultations were organized with various stakeholders representing the Government, donors, private

sector as well as civil society organizations, including entities involved in rural development, forestry and environmental sectors.

3. BACKGROUND INFORMATION

I. Socio-economic and demographic background

27. In 2019, Serbia's GDP was approximately USD 51 billion, with varying annual growth rates ranging from -1.54 percent to 4.87 percent. The country is classified as an upper middle-income economy, with a GDP per capita of USD 7,402 in 2019.
28. Serbia's economy experienced steady growth before the COVID-19 pandemic, with GDP growth averaging 3.20 percent between 2015 and 2019, recovering from the impact of the 2008 Global Financial Crisis³. The strong pre-pandemic growth, coupled with robust fiscal and monetary policy support, helped mitigate the economic effects of the pandemic. In 2020, GDP growth declined by 0.95 percent but is projected to rebound to 2.3 percent in 2023⁴. Inflation, however, has been on the rise, with core inflation reaching 9.5 percent in October 2022.
29. The external sector plays a significant role in Serbia's economy, although both investment and trade declined during the pandemic. Export and import volumes as a percentage of GDP had been increasing steadily since 2015. In 2019, exports accounted for 51 percent of GDP, while imports represented 60.9 percent⁵. However, both exports and imports experienced a sharp contraction in 2020 due to the pandemic. Over time, Serbia has managed to attract increasing foreign direct investment, with inflows rising from 5.9 percent of GDP in 2015 to 8.3 percent in 2019.⁶
30. Serbia has witnessed strong domestic investment and a decline in public debt. First, overall investment, as a share of the GDP, rose sharply from 18.7% in 2015 to 25.1% in 2019. It declined marginally to 23.2% in 2020.⁷ Second, public debt as a share of GDP has been declining steadily between 2015 and 2019, from 71.2% to 52.8%. Pandemic related borrowing has led to an increase in indebtedness to 58.4% in 2020.⁸
31. The demographic characteristics of Serbia present unfavourable trends, including a decline in birth rates, an increase in mortality rates, and a negative natural increase rate. The population is disproportionately distributed between urban and rural areas. The average life expectancy is 77.1 years for women and 72.0 years for men, with the average age of the population being 41.4 years. The working-age population constitutes 65.5% of the total population. Rural areas face higher risks of poverty and social exclusion⁹, and women in rural areas tend to be older due to migration patterns¹⁰. The depopulation of rural areas poses challenges to sustainable resource management and increases pressure on urban areas. However, the decline in population also creates opportunities for afforestation on abandoned land, which can contribute to socio-economic activities, prevent erosion and flooding, and benefit rural communities. Serbia is confronting demographic challenges such as emigration, rural depopulation, and demographic aging. The unfavourable demographic trends in rural areas involve population decline, an increase in average age, falling fertility rates, migration to urban areas and other countries, with women being more affected due to various factors. Improving living conditions and access to employment, education, and services in rural areas can help address these challenges and retain population.¹¹

³ World Bank, World Development Indicators database. GDP growth (%): 2020: -9.45%, 2019: 4.3%, 2018: 4.5%, 2017: 2.1%, 2016: 3.3%, 2015: 1.8%.

⁴ IMF, 2022. Republic of Serbia: Third Review Under the Policy Coordination Instrument, Staff Report.

⁵ World Bank, World Development Indicators database. Exports of Goods and Services (as a % of GDP) and Imports of Goods and Services (as a % of GDP)

⁶ World Bank, World Development Indicators database. FDI inflows, as a % of GDP.

⁷ International Monetary Fund, World Economic Outlook Database, October 2021

⁸ Gross government debt as a percentage of GDP. Source: World Economic Outlook 2021, IMF.

⁹ FAO. 2021. National gender profile of agriculture and rural livelihoods – Serbia. Budapest. <https://doi.org/10.4060/cb7068en>

¹⁰ Strategy for Gender Equality for the period 2021-2030 year

¹¹ FAO. 2021. National gender profile of agriculture and rural livelihoods – Serbia. Budapest. <https://doi.org/10.4060/cb7068en>

32. The unemployment rate has also been declining over the last five years, from 18.2% in 2015 to 10.9% in 2019. The declining trend has continued into the pandemic. The unemployment rate was 9.4% in 2020. As a caveat, this could also reflect a decline in the labor force or people dropping out of the workforce during the pandemic.
33. Agriculture is the largest employer and represents 20 percent of the total employment in Serbia). Agriculture, forestry and fisheries sector represent a share of 6.3 percent in total GDP (2018) (compared to 19.7 percent in 1995). Forestry and timber industry account for 5.7 percent of the total exports¹². Forestry enterprises employ around 4,957 people¹³ (average annual in 2017). The GDP's share of forestry, without the participation of the processing timber is 0.3 percent. Tourism is also a relevant activity in Serbian forests and contributes to about 1.4 percent.
34. At first glance in the public sphere, men and women are formally equal. With more than 30% of women in the national parliament and woman in the position of Prime Minister, Serbia has recently scored a very good results in the EU Gender Equality Index¹⁴ (in the domain of power). Education is one of the key emancipation strategies for women and in 2021 (i.e. more female than male graduated students). However, inequalities are visible in many aspects for the reason listed below:
- The private sphere, family, parenthood, or unpaid work, which spills over into the field of paid work.
 - Segregation in the education system and the labour market, where dominantly female jobs are paid less and discrimination of young women in the labour market, mostly due to expected motherhood. Women are in general less active in the labour market and less employed, regardless of education.
 - Prevalence of gender stereotypes visible in the private and public sphere, at the discursive and practical level, and
 - Violence against women.

Macroeconomic environment

35. The macroeconomic conditions in Serbia have shown steady growth in GDP, with a temporary decline due to the COVID-19 pandemic. Prior to the pandemic, Serbia experienced consistent GDP growth between 2015 and 2019, reversing the effects of the 2008 global financial crisis. Although the pandemic led to a 0.95% decline in GDP growth in 2020, it is projected to rebound and reach 2.3% in 2023. Inflation has been increasing, following global trends, with core inflation reaching 9.5% in October 2022.
36. The external sector plays a significant role in Serbia's economy, with exports and imports of goods and services accounting for a growing share of GDP. However, both exports and imports contracted in 2020 due to the pandemic. Serbia has attracted increasing foreign direct investment, with inflows rising from 5.9% in 2015 to 8.3% in 2019. Domestic investment has also been strong, accompanied by a decline in public debt.
37. Unemployment has been on a downward trend, decreasing from 18.2% in 2015 to 9.4% in 2020. However, this decline may be influenced by changes in the labor force during the pandemic. Serbia has made progress in economic reforms, particularly in privatizing state-owned banks and reforming the tax administration, driven by the EU accession process. Further reforms are needed in areas such as fiscal policy, privatization of state-owned enterprises, competition rules, and public administration.
38. Serbia's financial landscape includes a robust banking sector, which provides lending opportunities despite global macroeconomic risks. The country's banking sector is dominated by foreign banks, accounting for 84% of total banking assets. Banks offer various interest rates and repayment periods, with tailored energy efficiency and sustainability products available, often funded through donor credit lines.

¹² See <http://www.china-ceecforestry.org/country/serbia/>

¹³ Source: Bulletin Forestry 2017, - Statistical Office of the Republic of Serbia

¹⁴ According to the latest Gender Equality Index 2018, Serbia was still a country of pronounced gender inequalities in all domains. These inequalities were significantly more pronounced than the EU average (55.8 vs. 66.2), and progress that has been made (compared to 2016), was very small (3.4)¹⁴. One of the main axes of inequality noted by the Index refers to gender segregation, which is established during education and continues later in the labour market.

However, there are challenges in disbursing loans for decarbonization, including limited information and awareness among firms, knowledge gaps within financial institutions, and regulatory uncertainties. Despite these challenges, banks express interest in expanding their credit for decarbonization and sustainability to comply with European regulations and meet their goals.

II. Natural resources

39. Serbia, located on the Balkan Peninsula, is a landlocked country with hilly terrain and mountains dominating the southern portion. The total surface area of Serbia is 88,361 km². Over time, the forest area in Serbia has significantly decreased due to demographic factors and land conversions, with forests now covering only about 15 percent of the territory.
40. Serbia can be divided into three main geographical regions: the northern plains, known as the Pannonian plain; the central regions with hills; and the south-central regions, which encompass both lowlands and mountainous areas. The country is traversed by three major rivers—Danube, Sava, and Tisa—which flow into the basins of the Black, Adriatic, and Aegean Seas, respectively. Approximately 32 percent of Serbia's territory is lowland, while mountain areas account for 11 percent ([FAO, 2019](#)).
41. Serbia is recognized as one of the six European and 153 global centers of biological diversity according to the International Union for Conservation of Nature. Its exceptional biodiversity is attributed to its geographical position and the presence of diverse ecological habitats. The country is particularly rich in genetic, species, and ecosystem diversity, with significant centers of ecosystem diversity found in its major mountain massifs and canyon spaces, harboring numerous endemic and relict communities.
42. Nearly 40% of Serbia is covered by forests, primarily located south of the Sava-Danube axis and on highlands away from the three Morava valleys. Broad-leaved forests cover 28% of the country's area, while transitional woodland-shrub covers 6.5%. Mixed forest and coniferous forest make up only 3% of the country's area. The landscape to the north of the Sava-Danube axis is dominated by agriculture, except for the Fruška Gora Mountain range to the west and the Deliblato Sands to the east. The forest composition is mainly broad-leaved forest and transitional woodland-shrub in the southeast, and a mixture of broad-leaved forest, transitional woodland-shrub, coniferous forest, and mixed forest in the Dinarides mountains to the southwest.
43. Serbia experienced a notable decrease in total canopy cover between 2000 and 2015, with an approximate rate of -24 kha per decade, which continued during the 2015-2019 period. The Bor District in the east, near the border with Romania, saw the most significant forest loss. While the forest typology did not undergo significant changes in the past five years, the canopy cover area of deciduous broadleaf forests decreased, while that of evergreen needle leaf forests slightly increased.
44. Soil characteristics - Serbia has 8 main soil types: Cambisols, Phaeozems, Leptosols, Fluvisols, Vertisols, Gleysols, Luvisols, and Planosols, which cover more than 97% of the country's surface area. Cambisols and Phaeozems are the most common soils and are found almost exclusively south of the Sava-Danube axis. Fluvisols are present throughout the country, while Leptosols are found at high altitudes. Luvisols are concentrated in the Balkan Mountains and south of the Sava valley, Gleysols in the northeast, and Planosols mainly in the west. Vertisols are found around the three Morava valleys and close to the Timok and Nišava rivers. Sand, loam, and clay are almost equally distributed throughout most of the country, with some exceptions where sand content is higher. Water capacity is also evenly distributed throughout Serbia, with lower values found in the north and in valleys, and extremely high or low values found in specific areas.
45. Surface water - The North of Serbia has a dense free-flowing surface water network with large discharge ratio, including the Danube, Tisa, and Sava rivers, and multiple canals of the Danube-Tisa-Danube network. In contrast, the South of Serbia has a more scattered network with smaller discharge ratio, including the Morava, Ibar, Lim, and Timok rivers. There are also more large lakes and reservoirs in the South, such as the Iron Gate dam, Vlasina Lake, Perućac lake, and Gruža Lake. The North has easier access to surface water due to the flat topography and dense network, while the South may face difficulties and higher costs due to the hilly topography and scattered network.

III. Climate change and climate change scenarios

46. The climate of Serbia can be defined, using the Köppen-Geiger climate classification (Beck et al., 2018), as a warm-summer humid continental climate (Dfb). Temperatures reach their minimum in January (average temperature around 0°C) and their maximum in July (average temperature around 21°C). Rain is relatively constant (40 to 55 mm of monthly accumulated precipitation), with a small rainy season from May to June, with about 70 mm of accumulated precipitation monthly. Snowfall starts in October, and gradually increases until January when it reaches on average slightly more than 30 mm of water equivalent per month.
47. Climate Change has affected Serbia during the 1980-2019 period. Average temperature increased (+0.6°C/decade), while annually accumulated frost days and ice days decreased (-8 days/decade and -3 days/decade respectively) and tropical nights and summer days increased (+1 day/decade and +8 days/decade respectively). Snowfall, snow depth, wind directions and speed for their part did not present any significant changes. This has led to negative impacts such as heat waves, floods, forest fires, and disruptions in food production and ecosystems.
48. In terms of precipitation, a very large year to year variation (from 413 mm to 986 mm) prevented the observation of any clear trends for annually and monthly accumulated precipitation (669 mm/year on average), accumulated wet days (102 days/year on average), precipitation intensity (7 mm/wet days on average) and the duration of the longest dry spell (annually 27 days on average).
49. The annually accumulated water deficit, Ellenberg's Quotient and Forest Aridity Index presented large year to year variations but not overall statistically significant trends. The absence of trends is confirmed at the district level too.
50. To assess the variation and describe the changes of the climate in Serbia for the future (2020-2060), this analysis used 20 downscaled General Circulation Models under 2 Radiative Pathways Scenarios (4.5 and 8.5)¹⁵. Monthly and annual time series were produced for each model under each scenario, and a median model over all models was calculated for each scenario. Using only statistically significant regressions of annual and monthly time series of each median model, this analysis then established the projected variation trends of 13 climatic indices, over a 40-year period (2020-2060) under both RCP 4.5 and RCP 8.5 scenario, in order to assess their trends of variation and describe the projected changes that the climate of Serbia will undergo.
51. Climate Change is expected to intensify its impact in Serbia during the next 40 years under both scenarios. Average temperature is expected to continue its increase (+0.3 or +0.5°C/decade depending on the scenario) together with minimum and maximum temperature. Annually accumulated frost days and ice days are expected to continue their decrease (frost days: -3 or -6 days/decade depending on the scenario, and ice days: -0.9 or -1.3 days/decade depending on the scenario), and tropical nights and summer days increased (tropical nights: +3 or +7 day/decade depending on the scenario, and summer days +5 or +7 days/decade depending on the scenario).
52. In term of precipitation, the large year to year variation is projected to continue, while annually accumulated precipitation is expected to decrease (-15 mm/decade) but only under the RCP 8.5 scenario. Annually accumulated wet days is expected to decrease (-2.7 days/year/decade) and the duration of the longest dry spell of the year is expected to increase (+0.6 days/decade) under the same RCP 8.5 scenario.
53. Ellenberg's Quotient and Forest Aridity Index are expected to increase under both scenario (Ellenberg's Quotient: +0.5 or +1.2°C/mm/decade depending on the scenario, and Forest Aridity Index: +0.2 or +0.3°C/mm/decade depending on the scenario). These trends are confirmed at the district level.
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Table 4: Historical trends (1980-2019) and projected trends at national level (2020-2060)

Variable	Climate change historical trends (1980-2019) and Projected trends (2020-2060) under RCP 4.5 and 8.5 scenarios, <u>per decade</u>	
	National	Detailed information Paragraph in Climate Brief (Appendix 6)
Mean T °C	Historical: +0.6°C Projected: RCP4.5: +0.29°C RCP8.5: + 0.48°	Historical: figure 3, paragraph 28 Projected: figure 4
Min T °C	Historical: Projected: RCP4.5: +0.29°C RCP8.5: +0.44°C	Historical: figure 3, paragraph 28 Projected: figure 4
Max T °C	Historical: Projected: RCP4.5: +0.45°C RCP8.5: +0.44°C	Historical: figure 3, paragraph 28 Projected: figure 4
Average Annual Accumulated Precipitations	Historical: Trend is not statistically significant (average value 669mm) Projected: RCP4.5: Trend is not statistically significant; average value: 731mm RCP8.5: Trend -15mm	Historical: figure 3, paragraph 28 Projected: figure 4
Annual Potential Evapotranspiration (PET)	NA	The Climate brief mentions that: ET and PET were not available in the NAP dataset
Wet Days	Historical: Trend is not statistically significant (average value 102 days) Projected: RCP4.5: Trend not statistically significant, average value: 129.65 days RCP8.5: -2.74 days	Historical: figure 14 Projected: figure 15
Longest Dry Spell	Historical: Trend is not statistically significant (average value 27 days) Projected: RCP4.5: trend not statistically significant, average value: 21.89 days RCP8.5: +0.57 days	Historical: figure 14 Projected: figure 15
Precipitation Intensity	Historical: Trend is not statistically significant (average value 7mm/wet day) Projected: RCP4.5: + 0.08mm/ wet day/decade RCP8.5: trend not statistically significant, average value: 5.53mm/wet day	Historical: figure 14 Projected: figure 15
Ice Days	Historical (1980-2019): -3.03 days Projected: RCP4.5: -0.89 days RCP8.5: -1.34 days	Historical: figure 23 Projected: figure 24
Frost Days	Historical (1980-2019): -8.34 days Projected: RCP4.5: -3.02 days RCP8.5: -6.00 days	Historical: figure 23 Projected: figure 24
Summer Days	Historical (1980-2019): + 8.40 days Projected: RCP4.5: +5.11 days RCP8.5: +7.43 days	Historical: figure 23 Projected: figure 24
Tropical Nights	Historical (1980-2019): +0.82 days	Historical: figure 23

	Projected: RCP4.5: +2.79 days RCP8.5: +6.61 days	Projected: figure 24
Snowfall	Historical: Trend is not statistically significant (average value: 99mm)	Historical: figure 34
Snow depth	Historical (2000-2019): Trend is not statistically significant (average value: 22mm)	Historical: figure 34
Wind direction	Historical (1990-2019): Trend is not statistically significant	Historical: figure 38
Average wind speed	Historical (1990-2019): Trend is not statistically significant (average value 20km/h)	Historical: figure 38
Maximum wind speed	Historical (1990-2019): -5km/h	Historical: figure 38
Water deficit	Historical (2001-2019): Trend is not statistically significant (average value 676mm)	Historical: figure 43
Ellenberg's Quotient	Historical (1980-2019): Trend is not statistically significant (average value 33.99°C/mm) Projected: RCP4.5: +0.75°C/mm RCP8.5: +1.88°C/mm	Historical: figure 45 Projected: figure 46
Forest Aridity Index	Historical (1980-2019): Trend is not statistically significant (average value 7.71°C/mm) Projected: RCP4.5: Trend is not statistically significant (average value 7.30°C/mm) RCP8.5: +0.42°C/mm	Historical: figure 45 Projected: figure 46

Institutional set-up and policy framework of the climate change sector

54. Serbia's climate change sector has established institutions, policies, and strategies to address climate challenges, aligning with EU directives and aiming for emission reductions, forest conservation, and increased resilience.
55. The Ministry of Environmental Protection is responsible for national-level adaptation planning and the development of the Low Carbon Development Strategy and its Action plan. The Republic Hydrometeorological Service of Serbia collects and analyzes meteorological data and climate projections. A Climate Change Committee, established in 2014, oversees and monitors relevant policies with representatives from ministries, governmental institutions, universities, and scientific institutions.
56. The recent adoption of the Law on climate change in March 2021 provides a legal framework for more efficient climate change adaptation and GHG emissions reduction. It aligns Serbia's regulations with the EU's green agenda and aims to achieve decarbonization and sustainable development in line with the EU Green Deal by 2050.
57. The Third National Communication draft identifies adaptation measures, including afforestation, climate-smart forestry approaches, and close-to-nature forest management practices. Estimated investment needs are EUR 92 million per year until 2030, mainly for afforestation targets. Private sector financing through decarbonization initiatives, such as afforestation activities, is crucial to meet the more ambitious 2050 targets.
58. Serbia's implementation of mitigation scenarios and compliance with EU Emission Trading Schemes (EU-ETS) requirements are expected to achieve carbon neutrality by 2070. Strengthening institutional capacity, establishing national offsetting/insetting mechanisms, and implementing a robust monitoring system are necessary.
59. The revised National Determined Contributions (NDCs) aim for a 33.3% reduction in GHG emissions by 2030 compared to 2010 levels. Mitigation measures include increasing the carbon sink, afforestation, energy efficiency, renewable energy sources, and addressing emissions in the industry, transport, and agricultural sectors.
60. Renewable energy expansion, in line with EU directives, plays a significant role in Serbia's efforts to mitigate climate change. Biomass, including forest resources and agricultural residues, represents the largest potential for renewable energy. Utilizing other biomass sources and improving wood biomass consumption efficiency are important steps.
61. The Low Carbon Development Strategy outlines five specific objectives, including reducing GHG emissions in EU-ETS and non-EU-ETS sectors, increasing the forest sink, enhancing climate resilience in priority sectors, and promoting a climate-neutral and climate-resilient economy and society. Industrial emissions, particularly from the energy industry, are a major concern, and emission reduction targets are set for different sectors through investments in energy efficiency and renewable energy.

Greenhouse Gas Emissions and related mitigation strategies

62. Serbia's greenhouse gas (GHG) emissions in 2018 totalled 62,683 kt CO_{2eq}, with the energy sector being the largest emitter at 78% of total emissions. The Agriculture, Forestry, and Land Use (AFOLU) sector accounted for around 7% of emissions. GHG emissions increased by 9% between 2000 and 2018 due to higher fuel consumption in road transport. If no action is taken, GHG emissions are projected to rise by 3.2% by 2030 and 10.7% by 2050 compared to 2010 levels. The industrial sector is responsible for 69% of the country's emissions, with the energy industry contributing the most. Sectoral policies aim to reduce emissions through investments in energy efficiency and renewable energy, aligning with the EU Climate Action 2050 and the EU Green Deal.

63. To address climate change challenges, Serbia needs to adapt its forestry sector, increase forest cover, improve forest management sustainability, and enhance carbon removal from forests. These measures would have broad societal co-benefits, including emission offsets for the private sector and agricultural benefits from forestry investments. Forests are also crucial for socio-economic reasons, serving as a vital energy source for rural and impoverished populations. Achieving low carbon development and renewable energy goals requires a robust and climate-adaptive forestry sector.

65. Table 5 presents a selection of important projects in the Climate Change sector. For Climate change projects related to forestry and energy refer to the corresponding chapters below.

Project / programme	Brief description	Time period	Implementing agency / Funding source / National Partner(s)	Links
EU for Green Agenda in Serbia	<p>The objective is to contribute to the efficient, inclusive and sustainable implementation of the Green Agenda in Serbia by:</p> <ul style="list-style-type: none"> improving the strategic and legislative framework, co-financing implementation of innovative pilot projects and mobilizing additional financing for scale-up investments. <p>In this way, the project will contribute to the green transformation of economy and society in Serbia.</p>	2022-2024	UNDP / EU / Ministry for Environmental Protection	https://www.undp.org/serbia/projects/eu-green-agenda-serbia
Climate Smart Urban Development	<p>The objective of the project is to promote climate-smart urban development. By a challenge prize approach it seeks to actively engage the civil society, public and business communities to come up with new and innovative ideas on how to contribute to this in practice and to jointly develop, finance and implement these ideas further. Broader and more effective use of new information and communication technologies (ICT) to enable and spearhead innovation and productivity gains, optimization of the resource use (e.g. by improved energy efficiency and resource sharing), reduction of physical mobility needs, more attractive public and non-motorized transport, increased use of renewable energy sources, climate smart waste management (improved recycling schemes and waste to energy) and other measures contributing to climate change mitigation are among the topics to be considered in this context.</p>	2016-2022	UNDP / GEF / Ministry for Environmental Protection	https://www.rs.undp.org/content/serbia/en/home/projects/climate-smart-urban-development-project.html
Serbian National Disaster Risk Management Program	<p>The objective of the National Disaster Risk Management Program (NDRMP) was to support the Government of Serbia to build a</p>	Completed 2016 – 2018	World Bank /	https://documents1.worldbank.org/cu

	comprehensive program for disaster resilience. This program was used as an umbrella framework to coordinate, channel funds, and implement activities related to reducing and managing risks in Serbia.		Public Investment Management Office of Serbia	rated/en/266831614666100180/pdf/Serbian-National-Disaster-Risk-Management-Program.pdf
Climate Change Adaptation in Western Balkan	Advisory services and purchase of equipment related to the (i) Establishment of a flood early warning system; (ii) drafting of national climate change adaptation strategies formulation and implementation of flood or drought management plans on the communal level; (iii) regional cooperation in integrated water resources management (IWRM); (iv) integrating climate change adaptation strategies in urban planning	Completed 2012-2018	GIZ / Germany / Ministry of Energy, Development and Environmental Protection	https://wocapedia.net/images/2/22/Factsheet_Climate_Change_Adaptation_in_the_Western_Balkan_2012.pdf

Table 6 Key lessons learned from previous projects in climate change sector

Key lesson learnt	Brief summary
Coordination	Forestry is at the core of all sectoral strategies, however, coordination among sectors to fully integrate this aspect is not in place yet.
Disaster Risk Reduction	Serbia is facing significant losses in the last 2 decades because of Climate Change related Disasters (6.8 bln USD from 2000 – 2020), Forestry can play an important role to mitigate these aspects.
Alignment with EU decarbonization strategy	Serbia is an EU candidate and therefore works to align its regulations to those of the EU. There has been significant application of laws and strategies related to EU decarbonization, however the pathway is not yet complete.

SWOT Analysis of the Sector

66. Strengths, Weaknesses, Opportunities and Threats (SWOT) were developed based on the review of national documents and strategies related to environment and climate change. The climate sector in Serbia has several strengths, including the presence of high-quality research institutions and a commitment from the government to adaptation and decarbonization processes. The country's harmonization with EU laws and regulations and participation in regional exchange programs further enhance its climate efforts. Serbia also benefits from its rich biodiversity and natural resources, as well as access to a diaspora with expertise and financial resources. However, there are weaknesses to address, such as the lack of approved key documents, limited examples of decarbonization, and inadequate knowledge on climate change in education curricula. Insufficient coordination, low public awareness and trust, and a limited involvement of the private sector pose additional challenges.

67. Opportunities lie in the interest and potential investments from the donor community, access to EU funds and programs, and the ability to view decarbonization to improve the competitiveness of the private sector. Serbia can also explore the production and export of innovative technologies, capitalize on its energy-intensive economies for efficiency improvements, and engage the diaspora in development processes. Additionally, there is an increasing interest in implementing public-private partnerships (PPP). However, threats exist, including the risk of unsuccessful decarbonization efforts negatively impacting visibility, economic crises diverting government attention and investments, and the presence of a "brain drain" phenomenon. Unclear political will, unfavourable demographic trends, and limited public awareness pose additional threats to the climate sector in Serbia.

IV. Forests of Serbia

68. Serbia's forest cover has experienced significant changes over time. Before the 18th and 19th centuries, approximately 75% of the country's territory was covered by forests. However, due to demographic

factors and land conversions for agriculture, especially grasslands, the forest area decreased to around 15% before the Second World War.

69. Afforestation campaigns in the 1960s and 70s, supported by the establishment of a financial source for the "Protection and Improvement of Forests," reversed the declining trend. The 2008 National Forest Inventory (NFI) results indicate that Serbia's forest cover amounted to 2,252,400 hectares, or 29.1% of the total land area. Central Serbia has a forest cover of 37.6%, while the Vojvodina region has 7.1%. Natural high stands occupy 27.5%, coppice stands 64.7%, artificially established stands 6.1%, and plantations (poplar and willow clones) 1.7% of the total forest area.
70. The overall status of both state and private forests is considered unsatisfactory. The NFI results reveal a low standing volume, low annual increment, and an unfavourable structure. State-owned forests under active management show higher average volume and increment compared to private forests.
71. Forests in Serbia contribute approximately 2.3% of the national GDP. However, their contribution to the GDP has declined in recent years, down to 1.4% in 2021.¹⁶ Forestry is an important activity in rural areas, but the full potential of forests, including the value of marketable forest ecosystem services, remains underutilized.
72. Forest degradation is a significant environmental problem, leading to habitat loss, fragmentation, and the loss of forest carbon, biodiversity, and ecosystem services. Causes include illegal timber extraction, overexploitation of wood biomass for energy, rural area abandonment, financial and knowledge limitations of landowners, forest fires, and pressures from agriculture, energy, and construction sectors.
73. Non-Wood-Forest-Products (NWFP) commercial collection is possible in Serbia, with commercial collection regulated by the Law on Forests and Nature Protection. Non-commercial collection is free, depending on volumes, and project activities do not impact NWFP access.
74. Woody biomass extraction, primarily for fuelwood, remains the main driver of forest degradation. Approximately 2.5 million Serbian households¹⁷, particularly in poor rural areas, rely on fuelwood for energy. Forest degradation is estimated to affect 6.47% of the total territory of Serbia, with an annual cost of USD 254 million, which is equal to 7.6 percent of the country's agricultural GDP.
75. **Vulnerability:** The vulnerability of Serbian forests arises from a combination of climatic and anthropogenic factors, as well as from the lack of preparedness among public and private stakeholders, and inadequate integration of the forest-energy-climate nexus across sectors. Temperature increases and precipitation variabilities have already led to increased periods of droughts and a faster expansion of forest fires [SNC, 2017], as well as to increased pest outbreaks, decreased forest vitality and decreased soil water content [TNC, 2020]. Reportedly [Djurdjevic, 2020; NAP 2021], the increasing number of climate related outbreaks of herbivorous insects like *Corythucha arcuate* and *Pytiogenes chalcographus* have led to extensive mortality of *P. abies* causing severe ecological and economic losses [Stojanovich, 2021]. Research shows that changes in abiotic factors, such as temperatures and precipitation, change vegetation patterns and the provision of ecosystem services [Laco, 2021]. Recent studies highlight furthermore that globally climate change has significantly decreased the resilience of temperate forests globally, such as the one present in Serbiaⁱ [Forzieri, 2022]. This is confirmed by data from the MOAFWM showing that the adverse impacts from pests,ⁱⁱ diseases, fires and climatic hazard on Serbian forests continue to increase (+268% of m³ of wood lost between 1966 and 2019). This compounds the fact that Serbia's current total growing stock of forests is unsatisfactory. Forests have in fact a low standing volume of about 161 m³·ha⁻¹ with a low annual increment of about 4.0 m³·ha⁻¹. It also has an unfavorable production capacity due to inadequate management in recent decades (high stands represent 27.5% and coppice regenerate stands 64.7%) [Georgieva et al., 2021]). Further, the current scenario is reducing the diversity of species and favoring less desirable forest structures, thus impacting habitats and migration

¹⁶ <https://ras.gov.rs/uploads/2021/12/ras-forest-based-industries-small-1.pdf>

¹⁷ <https://publikacije.stat.gov.rs/G2021/Pdf/G202113048.pdf>

routes of wildlife reducing the overall resilience of forest ecosystems while increasing exposure to climate change. The RCP8.5 scenario highlights that climate change is placing prevalent forest species under drastic stress. Projections indicate that by the end of the century, between three-fourths and all Norway spruce, Silver fir, European beech and pine habitats will be found outside their current climate space [Stojanovic, 2021]. Forest stands will be less diverse and even more exposed to climate change with immediate adverse impacts on the livelihood and energy security of the rural population and the poor, as well as on biodiversity and ecosystem resilience.

76. Forests represent for Serbia a source of livelihood, employment, energy and protection from extreme events among others. Nonetheless, the largely uncontrolled extraction of fuelwood (>7 mcm yearly) and outdated forest management processes are worsening adverse climate change impacts on forests. Therefore, forests' vulnerability is exacerbated by the local overexploitationⁱⁱⁱ of wood biomass, poor management of fuelwood – depending on the region up to 60%^{iv} of consumers burn it with an elevated moisture (>23%^v) and hence lower energy content - and by the forestry sector's high adaptation deficit. Finally, forest operators are still applying approaches and techniques that do not factor in climate change trends and projections and that continue to privilege monoculture without investing in increasing the biodiversity and diversifying forest composition. In addition, the high number of individual forest owners estimated to be at least 900,000 with an average size of the forest holding of about 1.27 ha and an average size of the individual forest parcel of about 0.3 ha [Dragan et al., 2015] further contributes to the vulnerability of Serbian Forests. Only a small proportion of individual owners (0.2%) is organized in 18 active Private Forest Owners associations (PFOAs) and the private forests can be characterized as "unmanaged" in the absence of short or long-term of forest management planning despite tireless efforts by the Department of Forests (DoF) through making subsidies available for a variety of forest management measures.

Institutional set-up and policy frameworks

77. The forest sector in Serbia is governed by a legal framework and policies that aim to promote sustainable forest management and conservation. Serbia has signed and ratified various international environmental agreements and conventions related to forests, which are integrated into the legal system and have supremacy over national laws. The main components of the institutional set-up and policy framework are as follows:

Table 7: Laws, policies and strategies in the forest sector

Name	Adoption year	Highlights
Forestry Development Strategy of Serbia (FDS)	2006	<ul style="list-style-type: none"> - Main strategic document for the forest sector - Addresses conservation, improvement, and development of forests - Emphasizes multifunctional role of forests - Aims to increase forest cover and improve forest resources - Supports research, international cooperation, and support for private forest owners
Law on Agricultural Land (LoAL):	2006	<ul style="list-style-type: none"> - Regulates planning, protection, and use of agricultural land - Prohibits felling of forests above endangered agricultural parcels - Allows establishment of meadows, pastures, and forests on arable agricultural land with consent - Cooperation between forestry and cadastre sectors encouraged
Law on Nature Protection	2009	<ul style="list-style-type: none"> - Requires implementation of sustainable forest management - Preservation of forest clearings and edges - Authorization for commercial collection of non-wood forest products - Institutional setup and governance in the forestry sector
Law on Forests (LoF)	2010	<ul style="list-style-type: none"> - Regulates preservation, protection, planning, and use of forests - Prohibits permanent reduction of forest areas - Supports afforestation, conversion of coppice forests, and forest protection - Recognizes economic functions of forests and their contribution to climate change mitigation

		- Regulates grazing and collection of other forest products
Law on Fees for the Use of Public Goods	2018	- Establishes fees for the use of forests and agricultural land - Exempts fee for afforestation of agricultural land and establishing shelterbelts
Law on Use of Renewable Energy Sources	2021	- Regulates the use of energy from renewable sources - Considers forest and agricultural biomass as renewable energy sources - Defines sustainability criteria for biomass-derived fuels

78. Institutional setup and governance: The MOAFWM is the main government body responsible for forestry. The Directorate of Forests within MOAFWM performs state administration and professional tasks related to forest policy, conservation, promotion, use of forests, and wildlife. It consists of sections and departments dedicated to different aspects of forestry and hunting.

79. Please refer to the working Paper Forest Sector (Appendix 7) for more comprehensive information on the national and municipality management of the forest sector in Serbia.

Forest's sector performance and state support

80. The forest sector in Serbia plays a vital role in the economy, providing employment, contributing to the Gross Value Added (GVA), and supporting industries such as wood processing and furniture production. Efforts are made to manage both state-owned and private-owned forests sustainably while providing professional support to forest owners.

81. The forest sector in Serbia can be divided into two main categories: the management of state-owned forests and the management of private-owned forests. State-owned forests, which account for 53% of Serbian forests, are managed by Public Enterprises (PE) such as Serbia Shume and Vojvodina Shume as well as special public enterprises responsible for managing national parks. These entities perform strategic, development, and coordination activities, supervise forest sections, and engage in various forest-related activities such as silviculture, forest protection, seed and nursery production, hunting and game breeding, and tourism.

82. PE Serbia Shume in Belgrade, which manages state-owned forests on a vast area of 893,203.50 hectares, plays a significant role in the forest sector. The company employs over 3,200 full-time employees and is responsible for the overall management and coordination of forest activities. Similarly, PE Vojvodina Shume in Petrovaradin manages state-owned forests in Vojvodina and employs 1,448 full-time employees. This organization also holds FSC certification for sustainable forest management.

83. The Public Water Company further supports the Forest Sector in Vojvodina "Vode Vojvodine," which manages forests in the protection zone of watercourses. Additionally, the Institute for Lowland Forestry and Environment provides essential services to other forest users and manages a small portion of Vojvodina's forests. Two military institutions, Karađorđevo and Morović, also engage in forestry activities.

84. Regarding private-owned forests, professional and technical support is provided by the aforementioned PEs and the PEs for national parks. There are also two Private Forest Owner Associations (PFOAs) that offer support to their members. In recent years, there has been a significant change in the ownership structure due to the restitution process, with a considerable area of state-owned forests being returned to churches. Churches that become private owners of forests are required to organize professional forest management.

85. The overall performance of the forest sector in Serbia shows an increasing trend in annual felling, except for the year 2020 affected by the Covid-19 pandemic. The largest share of production is fuel wood, followed by industrial and technical wood. The Gross Value Added (GVA) for forestry, including logging, accounted for 4.0% of the GVA in the "Agriculture, Forestry, and Fishing" section, amounting to EUR 108.1 million in 2018.

86. The wood processing, furniture, and paper industries in Serbia achieved a GVA of EUR 592.5 million, contributing to 1.7% of the total realized GVA in 2018. The manufacture of paper and paper products recorded the largest share, followed by the manufacture of wood and products of wood and cork, and furniture production. The wood industry, together with the forest sector, employs approximately 53,000 people and has significant export potential.
87. The forest sector provides livelihoods for rural communities, employing around 9,090 individuals engaged in various forestry activities. Industrial production in the wood processing sector remained stable in 2020 compared to 2019, while furniture production experienced growth. The sector is characterized by a large number of micro and small companies, with over 95% of registered companies employing less than 50 workers. The majority of these enterprises are privately owned and located in central Serbia.
88. The state has provided support to the forest sector through various initiatives. Starting in the mid-20th century, afforestation efforts were undertaken to combat overexploitation and degradation of forest lands. Over the years, an average of 9,006 hectares per year were afforested, with the primary goal of preventing erosion and increasing overall forest cover. In 2010, the establishment of the Budget Fund for Forests (BFF) allowed for renewed investments in forestry, including afforestation. However, the annual area of newly established forests showed a declining trend from 2015 to 2019, ranging from 992 to 614 hectares.
89. In addition to afforestation, the BFF supported forest restoration interventions, such as planting on bare lands and soil amelioration. These interventions covered an average area of 1,300 hectares per year from 2015 to 2019. The Autonomous Province of Vojvodina also has its own regional BFF, administered by the Provincial Secretariat for Agriculture, Water Management, and Forestry. Furthermore, other provincial secretariats, such as those for Urbanism and Environmental Protection, as well as Regional Development, Interregional Cooperation, and Local Government, provide support to environmental projects that may intersect with forestry-related issues. The Provincial Secretariat for Finance co-finances projects funded by the EU, offering additional support to the forest sector in AP Vojvodina.
90. Further information regarding the forest sector in Serbia and its role in the economy, as well as the overall state support to this sector, can be found in the working paper on the Forest Sector – Serbia: Assessment and Recommendations (Appendix 7).

SWOT Analysis of the Sector

91. The forest sector in Serbia has several strengths, including the recognition of the importance of forest goods and services, a long forestry tradition, and a core budget for forestry investments. The market for wood and non-wood forest products is stable and growing, and Serbia has highly productive alluvial forests. The sector benefits from a qualified professional workforce and maintains rich biodiversity in its forests. However, there are weaknesses such as outdated strategies and plans, incomplete implementation of forest management plans, and inadequate data on private forests.
92. Despite these weaknesses, there are opportunities for the Serbian forest sector. Forestry is recognized as a key sector for climate change mitigation and the green economy, and there is potential to increase the resilience and productivity of forests. The implementation of a Forest Information System and the establishment of a Chamber of Forestry Engineers provide avenues for informed decision-making and professional development. Increased public awareness of forest importance and the introduction of a new forest planning system that considers biodiversity and climate change are positive opportunities. Nevertheless, threats such as climate change impacts, lack of skilled workforce, inadequate fire intervention capacities, and pressure on forest lands from construction activities should be addressed to ensure the sector's sustainable development.

Relevant Projects (past and ongoing) in forest sector

93. Table 7 highlights past and ongoing development projects/programs in the forest sector. This comprehensive overview allows for a better understanding of the various initiatives and collaborations within the forest sector in Serbia.

Table 8: Past and Ongoing Development Projects / Programmes related to the funding proposal

Project / programme	Brief description	Time period	Implementing agency / Funding source / National Partner(s)	Links
National Capacity Self-Assessment for the Environmental Protection Management in Serbia	At the request of the Ministry competent for Environment, the GEF approved in 2003 the means for the realization of the project "National Capacity Self-Assessment for the Environmental Protection Management in Serbia" and the project started in 2005. Finalization of the project "National Capacity Self-Assessment for the Environmental Protection Management in Serbia" is again initialized by the Ministry of Environment, Mining and Spatial planning in 2010 and financed by GEF. The main goal of the NCSA is to identify national priorities for capacity building, aiming to enhance environmental protection management nationally.	Completed 2004 – 2012	UNDP/ GEF/ Ministry of Environment, Mining and Spatial planning	https://www.rs.undp.org/content/serbia/en/home/library/environment_energy/national-capacity-self-assessment-for-environmental-protection-m.html
Dinaric Arc Parks	WWF started the project Dinaric Arc Parks in early 2012, with the aim to create an association of nature and national parks in the territory of Albania, Bosnia and Herzegovina, Croatia, Kosovo*, North Macedonia, Montenegro, Serbia and Slovenia. The first and main objective of this project was to create a network of protected areas by connecting all parks in the Dinaric Arc region. *) "All references to Kosovo should be understood to be in the context of United Nations Security Council resolution 1244 (1999)."	Completed 2012-2015	WWF/ Norwegian Ministry of Foreign Affairs/ The MAVA Foundation	http://awsassets.panda.org/downloads/fs2012_dinaric_arc_parks_web_1.pdf http://awsassets.panda.org/downloads/fs2012_dinaric_arc_parks_web_1.pdf
Development of a sustainable bioenergy market in Serbia	The objective of this project was to improve the general conditions, expertise and resources required to promote the sustainable use of bioenergy; this contributed also to rural development and to greenhouse gas mitigation. The programme advised ministries and authorities on eliminating regulatory barriers and on adapting to EU-compliant regulations on the sustainable use of biomass. Training courses and networking events helped to improve the expertise of political decision-makers. Cooperation agreements for developing sustainable biomass supply chains have been concluded with 13 district heating companies. The recommendations on cost-efficient use of fuelwood and energy-saving stoves have reached more than 7,500 households since the awareness-raising campaign was launched. These recommendations can help to reduce air pollution in living quarters and conserve forest resources.	Completed Phase I 2013 – 2017 Phase II 2018 – 2020	GIZ/ German Federal Ministry for Economic Cooperation and Development (BMZ)/European Union/ Ministry of Agriculture and Environmental Protection	https://www.giz.de/en/worldwide/26153.html http://www.bioenergy-serbia.rs/index.php/en/

Reducing Barriers to Accelerate the Development of Biomass Markets in Serbia	The project aims to reduce barriers to accelerate the development of biomass markets in Serbia. The objective of the Biomass Project is to increase the share of energy from renewable sources in the energy mix of Serbia, namely the share of biomass in power generation. The Project started with US\$ 3.1 million from the GEF and UNDP, the Biomass Project will have a total budget of US\$ 30 million. Co-financing will be provided by Serbian institutions and private investors	Completed 01 October 2013 - 31 December 2019	UNDP/ GEF / Ministry of Mining and Energy/ Ministry of Agriculture/ Environmental Protection	https://www.rs.undp.org/content/serbia/en/home/projects/reducing-barriers-to-accelerate-the-development-of-biomass-markets.html https://open.undp.org/projects/00074238
Innovative Forest Management Planning	This project was implemented in order to reinforce and strengthen forest functions and services. There was the need to develop an improved planning and monitoring methodology for Serbia's forest management. This methodology pronounced close-to-nature forest management as a guiding principle.	Completed 2015 – 2017	Unique land use GmbH in consortium with Hessen-Forst/ Bundesministerium für Ernährung und Landwirtschaft (BMEL) of Germany/ Ministry of Agriculture and Environment.	https://www.unique-landuse.de/en/projects/1540-innovative-forest-management-planning/
Vocational and Postgraduate Training in the Forestry Sector	Due to political changes in the region, the Serbian forestry sector required updating to facilitate the implementation of modern forest management. This cooperation project addresses the lack of practical orientation in vocational training and the missing practical postgraduate training programs. UNIQUE and HessenForst supported the Serbian forestry sector in implementing the previously developed and improved forest management planning and monitoring methodology for vocational training and practical training.	Completed 2017 - 2019	Unique land use GmbH and HessenForst/ Bundesministerium für Ernährung und Landwirtschaft (BMEL) of Germany/ MOAFWM	https://www.unique-landuse.de/en/projects/1762-vocational-and-postgraduate-training-in-the-forestry-sector/
Enhanced Cross-Sectoral Land Management through Land Use Pressure Reduction and Planning GEF Project ID 5822	The objective of this project was the development of instruments and mechanisms for integrated land use management, remediation, and capacity development to reduce pressures on land as a natural resource from competing land uses in the wider landscape and to support reversal of land degradation.	Completed 7 October 2015 - 30 September 2021	GEF/UNEP/ Ministry of Energy, Development and Environmental Protection	https://www.thegef.org/projects-operations/projects/5822
GEF Support to UNCCD 2018 national reporting process – Umbrella II – Serbia GEF Project ID 9980	The Project Objective is to enable country Parties to collect necessary biophysical, socioeconomic data, establish sound reporting and monitoring systems at national level and report against the UNCCD Strategy.	Probably completed by now Approved in 2018	UNEP/GEF/Ministry of Agriculture/ Ministry Environmental Protection	https://www.thegef.org/projects-operations/projects/9980

Prevent The Effects of Urban Disasters In South East European Countries	The expected outcome of the project was to enable Southeast European countries to reduce the likelihood of conflict and to lower the risk of natural disasters, including from climate change.	Completed 1 Jan 2017 – 31 Dec 2019	UNDP/European Civil Protection & Humanitarian Aid Operations	https://open.undp.org/projects/00100674
Enhancing Access to Climate Finance In The ECIS Region	The main objective of this project was to enhance access to climate finance and to support knowledge exchange across the country on leveraging and management of the climate finance in the Republic of Serbia. The project was part of a regional project Enhancing Access to Climate Finance in the ECIS region. The project was focusing on climate finance access and project's activities were clustered into two components: - Support to feasibility analysis, economic and cost benefit analysis, project scoping and design aimed at leveraging new and additional climate finance investments in the country; - Exchange knowledge across the ECIS countries on leveraging and management of the climate finance.	Completed 1 Jan 2017 – 31 Dec 2021	UNDP/Russia	https://open.undp.org/projects/00104887 https://info.undp.org/docs/pdc/Documents/SVK/104887-ProDoc_Climate-Finance_signed.pdf
Capacity Development for Improved Implementation of Multilateral Environmental Agreements	The objective of the project is to improve implementation of MEAs in Serbia by strengthening consultative processes and integrating MEA provisions into high-priority policies and programs at national and municipal levels. The project focused on strengthen participation in MEAs through targeted research, a comprehensive overview of MEA issues and activities, and ongoing input from civil society. It will also enable national and local government units to include global environmental considerations in selected reports and strategies. Finally, it will develop capacity in key target groups (Members of Parliament, youth, and university and mid-career students) to understand and participate in activities that benefit the global environment.	Completed 1 Jan 2017 – 31 Dec 2021	UNDP/GEF/Ministry of Agriculture/ Ministry of Environmental Protection	https://open.undp.org/projects/00087663
Third National Communication UNFCCC	The project aims to enabling the Republic of Serbia to prepare, produce and disseminate its 2nd Biennial Update Report and 3rd National Communication to the UN Convention on Climate Change. These will update and strengthen information provided regarding national circumstances, GHG inventories, climate change mitigation, vulnerability to climate change, and steps taken to adapt to climate change, as well as identify gaps, constraints, and financial, technological and capacity building needs.	Completed 1 June 2017 – 12 Jan 2022	UNDP/GEF/Ministry of Environmental Protection	https://open.undp.org/projects/00099636
Climate Pact for Impact	The project has been designed to connect various parts of society, sectors, knowledge platforms and know-hows. This project was focusing on education, raising public awareness and capacity building about climate change, and the importance of considering both mitigation and adaptation in decision-making for the long-term sustainable development of the society. Key issue to address	Completed November 2019 – December 2021	WWF/Sweden	https://www.wwfadria.org/what_we_do/all_initiatives/climate_pact_for_impact/

	was to increase understanding and enable the public to participate in initiatives and activities aimed at adapting to climate change.			
Building Resilience of Agricultural Sector to Natural Disasters and Climate Change Impacts	Capacities of local governments for management of natural disasters and implementation of resilient prevention and recovery measures were strengthened, and manuals and training material developed in of advisory in DRR/CSA approach and practice.	Completed 01-Jan-2020 - 31-Dec-2021	FAO/MOAFWM; Public Investment Management Office	
Protected Areas for Nature and People I and II	This regional project is to be implemented from 2019 to 2022 in Serbia, Bosnia and Herzegovina, Albania, Montenegro, Northern Macedonia, and Kosovo*. It is a continuation of the project under the same name that lasted from 2016 till 2019. The goal of the project is the efficient and financially sustainable management of protected areas, through improving national policies for Protected Area management and biodiversity conservation and increasing the participation of local communities in the management of protected areas. (*) "All references to Kosovo should be understood to be in the context of United Nations Security Council resolution 1244 (1999)."	Phase I completed 2016 - 2019 Phase II ongoing 2019 - 2022	WWF/SIDA	https://www.wwfadria.org/what-we-do/all-initiatives/protected-areas-for-nature-and-people/
Contribution of Sustainable Forest Management to a Low Emission and Resilient Development GCP/SRB/002/GFF / GEF Project ID 9089	The project will address the four barriers of mainstreaming a sustainable forest management in Serbia to contribute to the conservation of biodiversity and climate change mitigation through the promotion of multifunctional sustainable forest management in productive forest landscapes.	Ongoing 19-Feb-2018 - 30-Jun-2023	FAO/GEF/MOAFWM - Directorate of Forests	https://www.thegef.org/projects-operations/projects/9089
Adaptation Planning Serbia NAP	The goal of this project is to improve Serbia's legal framework for addressing climate change vulnerabilities and strengthen institutional capacities for integrating climate change adaptation (CCA) measures into decision making and investment planning.	Ongoing Sept 2018 – Jan 2023	UNDP/GCF	https://www.rs.undp.org/content/serbia/en/home/projects/adaptation-planning-serbia-nap.html https://open.undp.org/projects/00105424
Establishing Transparency Framework for the Republic of Serbia	The project will finalize and launch a monitoring, reporting, and verification (MRV) system that will allow Serbia to define and implement climate change-related policies and measures as expressed in its Nationally Determined Contribution (NDC) effectively and will allow the country to undertake more ambitious commitments in its NDCs over time.	Ongoing March 2019 – June 2022	UNDP/GEF/Austria/ Ministry of Environmental Protection	https://www.rs.undp.org/content/serbia/en/home/projects/establishing-transparency-framework-for-the-republic-of-serbia.html
ANKLIWA-DS Adaptive forest management – Germany – Serbia	This project aims to find adaptive and sustainable management strategies to climate change for the forests in Serbia. This project will also be a testbed for German forests to develop sustainable forest management strategies under climate change because future climate conditions may be similar to the comparatively drier climate found currently in Serbia. The innovative forest	Ongoing 1 November 2019 - 31 October 2022	UNIQUE and University of Freiburg /Bundesministerium für Ernährung und	https://www.researchgate.net/project/ANKLIWA-DS-bilateral-cooperation-between-Serbia-and-Germany-to-develop-and-implement-

	planning approach is based on sound scientific findings encompassing site-specific mapping, climate sensitive forest growth simulations, evaluation of the suitability of tree species and their productivity under climate change and development of policy strategies for adaptation measures.		Landwirtschaft (BMEL) of Germany/ MOAFWM	adaptation-strategies-to-climate-change-in-forest-management
FEM4FOREST Forests in Women's hands	The main objective of this project is to strengthen the forest sector at local, regional and interregional level through increased involvement and ability of women actors by supporting their equal presence and competences at the market in Danube Region. The overall Project concept follows an interactive innovation model where innovation occurs as a result of multi-actor interactions driven by needs of society and market, state of the art of science and technology, and organizational capabilities. The planned activities are demand-driven and target three most crucial components: social inclusion, gender equality and economic independency.	Ongoing 1 July 2020 - 31 December 2022	Slovenian Forestry Institute and others / Interreg Danube Transnational Programme/ MOAFWM – Directorate of Forests	Project website: https://www.interreg-danube.eu/approved-projects/fem4forest Project reports: https://www.interreg-danube.eu/approved-projects/fem4forest/outputs
Strengthening Serbia's AFOLU sector capacities to access climate finance for priority investments GCP/SRB/004/GCR	This project is focusing on increasing national capacities to accelerate climate related investments, with focus on engagement of private sector. The project works on strengthening Serbia's capacities to access climate finance for climate investments, with the objectives to: a) raise awareness in the public; b) engage with private sector and facilitate direct access to the climate investments; c) implement priority investments in the forest energy, agriculture, water resources, and hydrology sectors.	Ongoing 14-Oct-2020 - 14-Sep-2022	FAO/GCF/MOAFWM	
Twinning project: Improvement of forest management in Serbia as a contribution to climate change adaptation and mitigation	The overall objective of this project is to improve forest governance in Serbia in line with EU standards and requirements and to introduce comprehensive sectoral policy to ensure the reduction of illegal activities and resilience of forests to climate change. Specific objective is to strengthen capacities of forestry sector in Serbia to be able to implement obligations stemming from EU standards and regulations in the field of forestry and forestry related fields, including timber market, Forest Information System, subsidies, NATURA 2000 and bio economy. The project will contribute to climate change adaptation and mitigation in forestry, entirely in accordance with the European Green Deal. This Twinning Project is aligned with and fully supports the Government of Serbia's strategic target to provide the regulatory, institutional, and economic frameworks for the implementation of sustainable forest management. The two-year EU-funded Twinning project "Improvement of forest management in Serbia as a contribution to climate change adaptation and mitigation" was launched on 11 January 2021.	Ongoing 11 January 2021 – January 2023	Twinning Project Consortium of Austria and Slovakia (Austrian Research Centre for Forests and Austrian Federal Forest Office (BFW), the Federal Ministry of Agriculture, Regions and Tourism, Austria (BMLRT), the Austrian Federal Forests (Österreichische Bundesforste AG, ÖBF), the Environment Agency Austria (EAA), the Ministry of Agriculture and Rural	http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3846 https://eu-for-forests-in-serbia.eu/zatebe.rs/en/about-project

			Development of the Republic of Slovakia (MARD) and the National Forest Centre (Národné lesnícke centrum, NLC)/EU/MOAFWM – Directorate of Forests	
Forest Resilience to CC and BD loss via mitigation and adaptation investments	This project will undertake pre-feasibility studies in relation to the climate change adaptation and mitigation potential of the forestry sector, based on which a Project Identification Note (PIN) will be prepared to decide together with Serbian counterparts on the development of a Concept Note and eventual fully-fledged project to be submitted to the GCF. Additionally, the project will support the discussions with national and sub-regional administration to contribute to and achieve a strong commitment to supporting a future climate change adaptation and mitigation intervention in the forestry sector of Serbia.	Ongoing 01-Apr-2021 - 30-Apr-2022	FAO/MOAFWM	
Support to organic agriculture	The TCP will support the development of the organic sector in Serbia, by focusing on strengthening the policy session to support the compliance of the national legislation with the EU acquis, including the road map for alignment of the organic legislation with the EU standards and procedures and support the underdeveloped organic livestock subsector.	Ongoing 01-Oct-2021 - 30-Sep-2023	FAO/MOAFWM	
Enabling environment at policy, field and market levels for Forest Landscape Restoration (FLR) to achieve Land Degradation Neutrality (LDN) in Serbia (MSP) GCP/SRB/007/GFF	The project objective is to promote FLR and LDN practices for the recovery and restoration of prioritized landscapes that sustain environmental services and food security and to establish support mechanisms for achieving and monitoring LDN at the national level. This project also prepares the ground for an envisaged GCF initiative that will upscale successful FLR practices and contribute to the government's UNCCD commitment to increase forest cover to 41% of in Serbia's national territory (LDN target) by 2050. Through its three components, the project will promote a scenario for wide adoption of FLR strategies and practices in priority intervention landscapes, applying the LDN hierarchy avoid - reduce - recover. Project has been approved and financed by GEF Trust Fund, and its implementation will start in early 2022.	Ongoing 01-Nov-2021 - 31-Oct-2024	FAO/GEF/MOAFWM	https://www.thegef.org/projects-operations/projects/10814

Table 9: key lessons learned from previous projects in forestry sector

Key lesson learnt	Brief summary
Forestry sector at the centre of climate change adaptation and mitigation strategies	<ul style="list-style-type: none"> • Need to incorporated Climate Adaptive Silviculture into current forest management practices to exploit multiple benefits of the sector for sustainable development of whole society. • Forest Information system is main tool for evidence-based decision making
Forest Cover target of 41.4% by 2050	<ul style="list-style-type: none"> • Need to identify new areas for afforestation, preferably on degraded agricultural land. • Afforestation integral part of landscape restoration with multiple benefits from CC action, DRR to controlling land degradation. • Selection of most suited species and planting techniques are key for success.
Integration of fuelwood consumption in management	<ul style="list-style-type: none"> • It is important that the energy sector is timely informed about the objectives of the Country's forest strategy and policy, to see the real potential for wood biomass supply in relation to the strategic goals of the energy sector, and to better define the target parameters for the installation of CHP plants.
Impact of Sofia Declaration on the Green Agenda for the Western Balkans	<ul style="list-style-type: none"> • The Declaration will have impacts on the forest sector in the areas of climate change and pollution prevention, energy development, circular economy, biodiversity development and sustainable agriculture.
Planning of project	<ul style="list-style-type: none"> • The scope of a project and areas of interventions should match available funds to prevent fragmentation of activities. • Project designers tend to include as many potentially relevant elements as possible, which limits the success at prioritizing and focusing activities, as well as strain limited local implementation capacities

94. In Serbia's forest sector, valuable lessons have been learned and good practices have emerged (additional information is provided in the working paper on the Forest Sector – Serbia: Assessment and Recommendations (Appendix 7). The recognition of forests' significance and the adoption of close-to-nature forest management principles have become key strengths. Incorporating Climate Adaptive Silviculture (CAS) will further enhance the sector's ability to contribute to climate change mitigation and adaptation. In addition, below is a summary of additional lessons learned and good practices:

- Revision of forest management guidelines after floods and damages
- Forest Information System (FIS) for evidence-based decision making can be constructed from GEF projects
- Identification of new areas for afforestation, preferably on degraded agricultural lands
- Selection of suitable species and planting techniques for afforestation
- Increased demands on forests for land degradation prevention, biodiversity protection, recreation, and non-wood forest products
- Successful replacement of fossil fuel boilers with biomass boilers in certain locations
- Timely communication between the energy sector and forest strategy objectives
- Commitment to green agenda actions and phasing out coal subsidies
- Holistic approach while considering project scope and available funds

V. Renewable Energy and Forest nexus

95. According to the International Energy Agency (IEA), Serbia generates most of its total energy supply (664,224 Tera Joule (TJ) in 2020) from coal (49.6%), followed by crude oil (22%) and natural gas (12.5%). Biofuels, including mainly solid fuelwood (10.8%)^{vi} and Hydropower (4.9%) are the most significant renewable energy sources (RES), while wind and solar were only contributing 0.6%. Fuelwood extraction is largely uncontrolled and poorly regulated by outdated forest management processes, partly explaining why official statistics generally represent a fraction of its consumption. In 2019, the energy balances bulletin^{vii} indicated

that households consumed 1.957 million m³ of fuelwood annually [RoS, 2019], an exponentially lower value than the consumption estimated by scientific studies of about 6.7 million m³ per year [E4tech, 2017].

96. Climate change, rising energy prices and current geopolitical tensions threaten Serbia's energy security. Since the country obtains approximately 60% of its oil imports and 89% of natural gas imports^{viii} from the Russian Federation (2019), the current conflict in Ukraine is negatively impacting long term energy planning. It is also leading to higher energy costs for the state and ultimately for consumers. In addition, CC is also expected to negatively impact hydropower production^{ix}. It will also likely further increase Serbia's dependency from imports of energy and fossil fuels. Electricity prices are expected to rise by 15%^x to 30% for households and 30% to 70% for industry by 2023, and wood pellet prices skyrocketed in 2022 (+60%) due to the changing costs of electricity and raw material from an average retail price of Euro 200/t (2021) to Euro 320/t (2022).

97. These increases will particularly impact poor and vulnerable people. An electricity tariff increase of 16.3% will lead to an increase in the share of household income spent on electricity by 0.5 percentage points. At the same time, the overall poverty rate (already on the rise due to COVID-19 adverse impacts) can increase by 1% under these conditions [World Bank, 2022a]. Despite government intervention, energy costs are already a high burden for the country, as evidenced by the fact that households currently spend more than 10% of their average expenditure on energy (the threshold to be considered "energy poor") [World Bank, 2017] and that Serbia ranks among the 10 continental European countries with the highest share of households reporting that they could not keep their home adequately warm [World Bank, 2022a]. These trends reduce households' purchasing power, especially for the poor and vulnerable, and slow poverty reduction. Given that fuelwood is still the cheapest and most easily available source for heating, rising energy prices suggest that its consumption will increase further. According to official statistics, the share of wood fuels in final energy consumption has increased from 11% in 2017 to 11.86% in 2020.^{xi} Private and public forests are under pressure to increase logging to meet growing demand, even though current forest use is already unsustainable [UNDP, 2017].

98. In the BAU scenario, fuelwood extraction continues to be the main anthropogenic driver of forest degradation. As most of GHG emissions stem from the energy sector, the expansion of renewable energy from biomass plays an important role for the country's efforts to mitigate its CC impact and achieve its development goals. As a European Union (EU) candidate country, Serbia aligns its actions to EU-directives and policies and generally to the EU *acquis*, e.g. the 2030 Climate and Energy framework that sets as Renewable Energy Sources (RES) target a share of 32% of the final energy consumption. Serbia has declared to increase its share in the same time frame from the current 26.3% (2020) to 33.6%.^{xii} Biomass, mainly from forest resources (44%) and agricultural harvesting residues (48%), represents 63% of the total potential for RES in Serbia and is therefore essential to reach any RES targets. 67% of the total calculated technically feasible energy potential of forest resources are already utilized. There is therefore an urgent need to organize the sector in a sustainable and integrated manner to allow efficient resources use and to utilize the potential of other biomass sources - like short rotation plantations (SRP) and agricultural harvest residues for energy purposes. If properly and sustainably addressed, biomass, including fuelwood, can act as a central element in fulfilling national energy, climate and development objectives and can also serve as a tool to alleviate poverty in rural areas. It is important that the energy sector is timely informed about the objectives of the country's forest strategy and policy, to see the real potential for wood biomass supply in relation to the strategic goals of the energy sector.

99. The working paper: "Sustainable utilization of biomass for low emission energy purposes in Serbia" (Appendix 8) provides more detailed information on energy supply, households' consumption and expenditure on energy.

Energy sector's institutional set-up, strategies, and policy framework

100. The energy sector in Serbia is governed by a variety of laws, regulations, and policies that aim to promote renewable energy sources, energy efficiency, and climate change mitigation. Serbia became a member of the Energy Community in 2006, committing to implementing European directives in the

energy sector. The country is also a candidate for EU membership. Here is a summary of the institutional set-up, strategies, and policies in the energy sector in Serbia:

Table 10: Laws, policies and strategies in the energy sector

Name of law, policy, strategy	Adoption year	Highlights
Biomass Action Plan	2010	<ul style="list-style-type: none"> - Aims to enhance biomass utilization as a renewable energy source - Focuses on efficient resource use, climate change mitigation, and job creation - Estimates 63% of total renewable energy potential from biomass sector
National Action Plan for Use of Renewable Energy Sources	2013	<ul style="list-style-type: none"> - Aims to increase renewable energy share in gross final energy consumption - Sets goal to increase share from 21.2% in 2009 to 27% in 2020 - The share of renewable energy in 2019 was 21.44%. - Aligned with EU Directive 2009/28/EC on renewable energy sources
National Energy Efficiency Action Plans	Updated every three years	<ul style="list-style-type: none"> - Focus on improving energy efficiency in various sectors, including the modernization of district heating systems
The Energy Law	2014	<ul style="list-style-type: none"> - Promotes renewable energy and energy efficiency - Provides improvements for the use of renewable energy sources - Transposes EU Directive 2009/28/EC and introduces feed-in tariffs (FiT)
Law on Rational Use of Energy	2013	<ul style="list-style-type: none"> - Addresses efficient energy production, transmission, and consumption - Aims to increase renewable energy production
Energy Sector Development Strategy until 2025	2015	<ul style="list-style-type: none"> - Focuses on modernization of energy facilities, energy efficiency, and renewable energy - Highlights increasing importance of biomass in heating and electricity production
Energy Security Plan	2022	<ul style="list-style-type: none"> - Aims to achieve energy transition and phase out coal-fired power plants by 2050 - Establishes "green energy of Serbia" company for building green power plants - Sets targets for RES share in energy consumption
Climate Change Law	2021	<ul style="list-style-type: none"> - Establishes legal framework for climate change adaptation and GHG emission reduction - Sets emission reduction target of 33% by 2030 - Harmonizes with EU regulations and Green Deal objectives
National Determined Contributions		<ul style="list-style-type: none"> - Revised NDC sets emission reduction target of 33.3% by 2030 - Includes measures to increase carbon sink and promote energy efficiency and renewable energy
Low Carbon Development Strategy with Action Plan	2019	<ul style="list-style-type: none"> - Aims to reduce GHG emissions by 33% by 2030 and at least 65% by 2050 - Focuses on increasing carbon sink of forests and implementing mitigation measures - Aligns with EU Climate and Energy framework
Third National Communication (TNC)		<ul style="list-style-type: none"> - Includes adaptation measures for afforestation, climate-smart forestry, and forest management - Estimates investment needs for afforestation targets
National Strategy of Sustainable Development		<ul style="list-style-type: none"> - Promotes local and national sustainable development - Includes increased share of renewable energy sources

Energy sector performance

101. The energy sector performance in Serbia, particularly in the field of biomass energy, has seen significant growth and potential for further development. Biomass represents 63% of the total potential renewable energy sources in the country, with 44% of biomass coming from forest sources. However, Serbia is already utilizing 66% of its total technical potential, highlighting the need for increased energy efficiency and the exploration of other biomass sources such as agricultural biomass and short rotation energy crops.

102. Biomass from wood energy, primarily fuelwood for heating, has a long tradition in Serbia and is used in both rural (67% of total consumption) and urban areas (33% of total consumption). However, the per

capita consumption of fuelwood is lower compared to neighbouring countries like Austria and Finland. The energy from fuelwood accounts for 3.4% of the gross final energy consumption and 25% among renewable energy sources. However, the actual contribution might be higher, as official statistics tend to underestimate consumption.

103. The production and consumption of wood pellets, a form of biomass fuel, have significantly increased over the last decade. The surplus of wood pellets is exported, providing Serbia with an opportunity to export low-carbon and cost-effective energy. However, this also makes Serbia dependent on costlier energy imports such as fossil fuels.
104. The private sector plays a significant role in the production of various wood fuels, including wood pellets and briquettes. However, there is a lack of quality control and assurance standards for wood fuels in the domestic market, except for exported products. This highlights the need for improved quality control measures throughout the value chain.
105. To improve the energy sector and mitigate climate change, Serbia should focus on increasing fuelwood quality, utilizing efficient combustion technologies, reducing energy demand through thermal insulation, and promoting technology transfer to stakeholders. These efforts would enhance the energy content of wood fuels, increase combustion efficiency, decrease fuelwood consumption, and promote sustainable practices.
106. In addition to wood fuels, agricultural residues have untapped potential for energy production in Serbia. Harvesting residues from crops, such as corn, wheat, and sunflower, can be utilized as biomass energy sources. However, their utilization is currently limited, and further exploration and investment are needed to harness their full potential.
107. The working paper: Sustainable utilization of biomass for low emission energy purposes in Serbia” provides more detailed information on biomass from wood, solid biomass energy and potential large-scale consumers from biomass (Appendix 8).

SWOT Analysis of the energy sector

108. The SWOT analysis of woody biomass for energy use in Serbia highlights its strengths as a renewable and local energy source, with a long tradition of utilization and a strong market for wood-burning appliances. However, weaknesses include high moisture content in fuel, a lack of awareness and inconsistent quality standards. Opportunities exist through alignment with EU regulations, VAT exemptions, and growing interest in medium and large-scale bioenergy projects. Threats include competition for biomass sources, resistance to change, and potential forest degradation. Overall, woody biomass presents a promising energy option but requires addressing weaknesses and capitalizing on opportunities for sustainable growth.
109. The SWOT analysis of agro biomass for energy use in Serbia reveals its strengths as a renewable and local energy source with high potential for utilization in the AP Vojvodina, leading to regional job creation and rural development. However, weaknesses include a lack of standardization, inadequate financial resources, variations in biomass quantity and quality, higher appliance costs, and insufficient knowledge for project development. Opportunities exist through alignment with EU regulations, increased job creation in rural areas, and the potential for substituting fossil fuel boilers. Threats include negative past examples, changes in the legal framework, and competition for biomass sources.
110. The table below shows the several past and ongoing development projects/programs that have been implemented in Serbia related to the energy sector.

Table 11: Past and ongoing development projects/programs relevant to the funding proposal

Project Name	Brief description	Time period	Implementing agency/funding source/ Partners	Link
Development of a sustainable bioenergy market in the Serbian republic	The initiative focused in initially on the promotion of wood fuels and wood-based technologies in pilot regions. In the second phase from 2017 onwards agro-biomass was included and aspects like policy advice, supply chains and modern heating systems were addressed. The initiative is supporting the conversion of district heating from fossil fuel to biomass. The first phase of these investments launched in 2017 amounted to Euro 27 mln, consisting of a loan from the KfW of Euro 20 mln in combination with a grant from Switzerland of Euro 5 mln and one grant of Euro 2 mln from KfW. The loan has an interest rate of 1.1%, a two-year grace period and a repayment period of 18 years.	2013-2020	GIZ/German Government/partially funded also from Switzerland	http://www.bioenergy-serbia.rs
Reducing Barriers to accelerate the Development of Biomass Markets in Serbia	The initiative concentrated on the following: (i) Improve capacity of governmental/ institutional bodies, municipalities and local entrepreneurs to identify, prioritize and develop bankable biomass energy projects in Serbia; (ii) Develop more effective secondary legislation related to biomass energy, developed, approved and adopted operate Biomass Support Unit which leads to increased capability of municipalities and entrepreneurs in Serbia to develop, finance, construct and operate bankable biomass energy projects. (iv) Successfully finance and construct biomass projects.	2014-2018	UNDP/GEF	http://biomasa.undp.org.rs/?lang=en
Rehabilitation Of Distance Heating System In Serbia	Implemented since 2001 by the KfW, and the German Federal Ministry for Economic Cooperation and Development (BMZ). 4 Phases have already been realized with a total volume of Euro 123 mln, rehabilitating 21 DHS. The 5 th phase commenced in 2020 comprising Euro 35 mln and the participation of 8 DHS	Since 2001	KfW/ German Federal Ministry for Economic Cooperation and Development (BMZ)	https://www.energy-community.org/dam/jcr:640543f8-7f6a-4483-9bc7-2d3ad56179cd/EECG062016_KfW.pdf
BioRES - Sustainable Regional Supply Chains for Woody Bioenergy	The project aimed at supporting the dissemination of domestic woody bioenergy chains by introducing Biomass Logistic and Trade Centres (BLTC) as regional hubs increasing local supply and demand. In Serbia the project partner was SERBIO the national bioenergy association.	2015-2017	European Union's Horizon 2020 research and innovation programme in seven countries including Serbia	http://www.bioresproject.eu/
Integrated biomass logistic centres for the agroindustry - AGROinLOG	The project is based on three agro-industries in the fodder (Spain), olive oil production (Greece) and cereal processing (Sweden) sectors that are willing to deploy new business lines in their facilities to open new markets, among others also for energy purposes. Partners from 7 countries participated in the project, in Serbia it was the University of Belgrade that reviewed among others the state of some agro-industry sectors in Serbia (sugar, cereal drying, fruit processing, etc.).	2017-2020	European Union's Horizon 2020 research and innovation programme	http://agroinlog-h2020.eu/en

111. Lessons learned from past experiences in the energy sector in Serbia is summarized in the table below. Additional information is provided in the working paper: Sustainable utilization of biomass for low emission energy purposes in Serbia (Appendix 8).

Table 12: Key lessons learned from previous projects in energy sector

Key lesson learnt	Brief summary
low quality of fuelwood	<ul style="list-style-type: none"> - Utilization of freshly cut wood with high moisture content - Wood mainly purchased raw or air-dried for a short period - Lack of space for air drying in urban areas - Need for raising awareness on high-quality wood selection - Lack of regulations and inspections for wood trading/supply
Medium/large scale projects	<ul style="list-style-type: none"> - Involvement of stakeholders and financing institutions for clear legal framework and bankable projects - Standardization, guidelines, and regulations for feasible business plans and investments
Local availability vs. wood consumption	<ul style="list-style-type: none"> - High wood consumption in some regions despite low availability of wood. - Wood sometimes transported over long distances - Lack of activities to promote sustainable local value chains and mitigate forest degradation drivers
Coordination and regular meetings	<ul style="list-style-type: none"> - Ad-hoc meetings beneficial for sector strengthening - Need for regular coordination meetings on decision maker level for strategic development
Private sector involvement	<ul style="list-style-type: none"> - Private sector investment crucial for biomass use success - Recommendation for major private involvement in projects
Challenges in Biomass Logistic and Trade Centres	<ul style="list-style-type: none"> - Difficulty in mobilizing capital for investment - Inability to secure sale channels
Customer confidence and quality standards	<ul style="list-style-type: none"> - Importance of customers' confidence in the supply chain - Implementation of quality standards crucial - Need to improve demand side measures parallel to supply side measures
Local leadership and communication	<ul style="list-style-type: none"> - Importance of leaders keen to change current situations - Considerations of environmental, economic and social factors - Communication of the project idea and connecting it with local development visions and strategies

VI. Carbon financing and access to finance for decarbonization investment

112. Carbon pricing and carbon markets are an opportunity to provide price signals to discover and implement efficient climate mitigation options, reduce the cost of attaining a particular emission reduction target and thereby raise ambition for greater climate action. Serbia has the opportunity as well as pressure linked to regional policy frameworks - in the EU, its key trading partner, to which it is also an accession candidate, and in the Energy Community - to adopt and implement carbon pricing for key emitting sectors. Forestry and agriculture are not among the sectors on which carbon pricing is currently imposed in the EU and envisaged in the Energy Community. However, there are opportunities to create domestic offset mechanisms through which sectors that face carbon pricing may meet some of their reduction targets through offsets generated at the national level. Companies may also purchase offsets to enhance their carbon balance beyond regulatory requirements, as well as enhance insetting within their own production and supply chains.

113. Further, international carbon finance from the voluntary carbon markets (VCM) as well evolving frameworks to implement Article 6 of the Paris Agreement, can provide additional financing streams for climate action in forestry and agriculture. Serbia's experience in carbon finance and related institutional capacity¹⁸ is limited and the project will support the development of suitable frameworks to unlock new carbon finance opportunities for these sectors.

¹⁸ based upon targeted interviews with representatives of government ministries and academia.

114. Serbia signals its commitment to its green agenda and decarbonization through several national policies, strategies and laws and its participation in regional fora. The main ones include the recently passed Low Carbon Development Strategy, Serbia's Decarbonization Roadmap, Climate Action Plan, Law on Climate Change, and its Integrated National Energy and Climate Plan. In addition, the country's Nationally Determined Contribution or its climate pledge under the Paris Agreement and its National Council on Climate Change where it lays out its tasks and responsibilities in tackling climate change.

115. We note that the policy review is not a comprehensive stocktaking of all policies related to decarbonization and the green agenda; it only focuses on policies and strategies with direct or indirect implications for carbon finance in the agriculture and forestry sector. For instance, the review does not cover the Energy Efficiency Action Plan (EEAP) for Serbia that cover the legal framework around energy consumption that include emissions reduction goals but do not explicitly mention carbon markets.¹⁹ It also does not review the 2021 Law on Use of Renewable Energy Sources (RES) that is a step in Serbia's alignment with the EU climate and environment acquis but does not cover carbon finance issues.

National policies, laws, strategies, and national setup

116. At the national level, the government has announced several policies and strategic documents to address climate change. These policies are at varying levels of implementation. Their contents as they relate to carbon finance is summarized below. A caveat is necessary here: most national policies, laws and strategies do not mention carbon finance explicitly. However, through the inclusion or exclusion of certain sectors, institutional measures or prioritization of the green agenda, they shape the enabling environment around carbon finance.

Table 13: Policies, laws, strategies and institutions related to carbon financing and climate change

Policy/Strategy/body	Enacted date	Summary
Law on Climate Change. ²⁰	2021	Aims to mainstream Serbia's climate policies into its institutional and legal framework, includes a system for monitoring, reporting, and verification (MRV) of GHG emissions, and has a focus on addressing institutional challenges to climate change
Low Carbon Development Strategy with Action Plan ²¹	2023-2030 (2023)	The government adopted this strategy to set reduction goals for greenhouse gas emissions, excluding the land use, land use change, and forestry (LULUCF) sectors. The plan targets emissions reduction from electricity and heat and aims to increase energy efficiency and the use of renewable energy sources. It emphasizes the importance of green finance instruments such as green bonds, green loans, sustainable investment funds, impact funds/investments, and blended finance to support these measures. The strategy also includes the implementation of an Emission Trading Scheme (ETS) and carbon tax to achieve its goals, as well as considering the use of the Budgetary Forest Fund (BFF) replenished with ETS revenues for afforestation on state lands
Decarbonization Roadmap ²²		Serbia, as a contracting party of the Energy Community, adopted the Decarbonization Roadmap, committing to establish the necessary regulatory framework to implement carbon pricing by 2026. The roadmap involves a phased approach with the first phase focusing on establishing the necessary regulatory framework for carbon pricing and transposing and implementing certain EU acts. The second phase depends on decisions by countries on their carbon pricing regimes and involves the transposing and implementation of national acts related to the EU ETS. Serbia is currently in the first phase of this roadmap

¹⁹ https://www.energy-community.org/dam/jcr:40aa7e23-a6c4-49fc-a773-5659b8906693/RS_4thNEEAP_092021.pdf

²⁰ Ministry of Environmental Protection, Republic of Serbia. 2021. Law on Climate Change.

https://www.ekologija.gov.rs/sites/default/files/2022-09/zakon_o_klimatskim_promenama.pdf

²¹ <https://balkangreenenergynews.com/serbia-adopts-low-carbon-development-strategy/>

²² Energy Community, Decarbonization Roadmap for Contracting Parties. https://www.energy-community.org/dam/jcr:c28b58eb-22db-4ad5-9ed1-4e93b5b613b7/19thMC_Decarbonisation_Roadmap_301121.pdf

Nationally Determined Contribution (NDC) ²³	2022	Serbia's revised NDC, submitted under the Paris Agreement in August 2022, commits to an unconditional emissions reduction target of 13.2% compared to 2010 levels, or 33.3% compared to 1990 levels, by 2030. The NDC explicitly includes forestry and agriculture in capturing mitigation co-benefits, signalling a commitment to decarbonize in these sectors. However, it does not mention an intention to use voluntary cooperation under Article 6 of the Paris Agreement
National Council for Climate Change ²⁴	2014	The National Council on Climate Change's mandate, as clarified by the 2021 Law on Climate Change, does not explicitly mention climate finance or carbon markets policies. It has an advisory role in reviewing Paris Alignment implementation and providing opinions on climate change policies, regulations, and measures
Integrated National Energy and Climate Plan (INECP or NECP)	(draft)	The NECP covers decarbonization, energy efficiency, energy security, the internal energy market, and research, innovation, and competitiveness. It does not directly address the role of carbon finance
Circular Economy Roadmap ²⁵	2020	The Serbian Circular Economy Roadmap focuses on four priority sectors, including agriculture, for the country's green transition. The government has adopted a program for the circular economy and a three-year action plan, with a focus on waste management and green procurement

Regional and International Context

117. At the regional level, as a signatory of the Sofia Declaration and the Green Agenda of the Western Balkans, Serbia has several entry points to engage with carbon finance. In addition, the EU's upcoming CBAM and ETS provide a broader framework for engaging with carbon markets.

Table 14: Related regional and international treaties and commitments

Regional and international related policies or treaties	Summary
Serbia's EU Accession and Engagement with Energy Community	Serbia's candidacy for EU accession and engagement with the Energy Community imply alignment of environmental policies with the EU. Serbia has not yet implemented its Emissions Trading Scheme (ETS) or clear carbon tax regime, but once it joins the EU, a robust carbon markets mechanism in line with EU regulations will become mandatory. In 2026, Serbia will face a levy on carbon for exported products through the EU's Carbon Border Adjustment Mechanism (CBAM). Multinational groups are imposing emissions-related requirements on their subsidiaries or franchisees in Serbia, necessitating compliance with EU/group-wide decarbonization and sustainability practices
EU Carbon Border Adjustment Mechanism (CBAM)	The EU CBAM will impact Serbia's export competitiveness in certain sectors. Serbian exporters of specific goods to the EU will have to pay a carbon levy unless they prove compensation through a tax or carbon price. This will increase the cost of Serbia's exports relative to EU countries, affecting emission-intensive sectors ²⁶ . The CBAM's introduction is expected in 2026, starting at 10% annually and reaching EU ETS levels by 2035. Serbia's steel production could be significantly reduced by 2035 due to the CBAM ²⁷

²³ https://unfccc.int/sites/default/files/NDC/2022-08/NDC%20Final_Serbia%20english.pdf

²⁴ <https://www.klimatskepromene.rs/en/news/national-committee-on-climate-change-established-in-serbia/>

²⁵ Republic of Serbia – Ministry of Environmental Protection, Circular Economy and UNDP (2020). "Roadmap for circular economy in Serbia." <https://circulareconomy.europa.eu/platform/sites/default/files/roadmap-for-circular-economy-in-serbia.pdf>

²⁶ World Bank, 2022. Supporting Serbia's Transition to Greener and More Resilient Growth.

<https://documents1.worldbank.org/curated/en/099530111022255705/pdf/P17641306e85c00100a145093af447ee1fa.pdf>

²⁷ <https://www.rabobank.com/knowledge/d011297275-the-carbon-border-adjustment-mechanism-explained>

European Green Deal ²⁸ and Western Balkans Green Agenda ²⁹	<p>Serbia's growth strategy aligns with the European Green Deal and the Western Balkans Green Agenda. These frameworks encourage resource efficiency, clean production, climate action, and pollution reduction. They provide guidelines, investments, and funds to achieve these goals.</p> <p>The Western Balkans Green Agenda focuses on decarbonization, circular economy, soil use for depollution, and ecosystem restoration. While climate finance is considered, carbon finance is not, despite the emerging consensus on carbon pricing as an important instrument for climate goals</p>
Sofia Declaration and Regional Commitments	Serbia, as a signatory to the Sofia Declaration, commits to adopting clear carbon pricing. The Sofia Declaration extends regional commitments to decarbonization, circular economy, biodiversity, and sustainable food systems ³⁰ . It reaffirms alignment with the EU ETS and introduces carbon pricing instruments to achieve climate goals ³¹
MRV system and an Emissions Trading Scheme (ETS)	Montenegro has adopted an MRV system and an ETS in line with the EU system, covering the industry and power sectors ³² . However, it does not allow offsets and has received criticism for setting emission baselines based on higher historical production levels, potentially impacting its effectiveness ³³

Potential nature-based solutions in Serbia for carbon finance

118. Serbia has significant potential for nature-based solutions for climate mitigation linked the agriculture and forestry sectors. While no systematic assessment has yet been carried out of the full potential of nature-based solutions, as recent assessment³⁴ highlights afforestation, reforestation, sustainable forest management, agroforestry, conservation agriculture & nutrient management, biochar use, improved livestock and pasture management, as well as restoration of abandoned agricultural land and peatlands as promising for mitigation, often with co-benefits in adaptation.

Carbon finance opportunities from compliance and voluntary carbon markets

119. Carbon finance opportunities for Serbia's forestry and agriculture sectors exist in the international voluntary carbon markets. may grow in the context of Art.6 mechanisms under the Paris Agreement and can be enhanced through the creation of domestic offset schemes.

120. Voluntary Carbon Markets (VCMs) are substantial and growing and offer considerable opportunities for carbon finance in agriculture and forestry. The voluntary carbon market has grown considerably over last five years to reach approximately USD 2 billion in 2022³⁵ with expectations of further growth to between US \$5 billion to US \$50 billion by 2030.³⁶ The key driver of this growth has been the increase in corporate commitments to net zero emissions. Regulatory and reputational uncertainty of carbon credits and the sense of legitimacy in their use as part of corporate net zero commitments, as well as geopolitical and economic instability, led to a slight dip in 2022, but with emerging quality reference frameworks, the expectations are of renewed growth. Nature-based solutions show signs of overtaking renewable energy

²⁸ <https://sdg.iisd.org/news/european-commission-launches-green-deal-to-reset-economic-growth-for-carbon-neutrality/>

²⁹ European Commission, 2020. Guidelines for the Implementation of the Green Agenda for the Western Balkans. Commission Staff Working Document. https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-10/green_agenda_for_the_western_balkans_en.pdf

³⁰ <https://www.rcc.int/docs/546/sofia-declaration-on-the-green-agenda-for-the-western-balkans-rn>

³¹ Pillar 1: Climate, energy, mobility of the Sofia Declaration on the Green Agenda for the Western Balkans, 2020.

<https://www.rcc.int/docs/546/sofia-declaration-on-the-green-agenda-for-the-western-balkans-rn>

³² <https://icapcarbonaction.com/en/ets/montenegro>

³³ <https://bankwatch.org/blog/the-cautionary-tale-of-montenegro-s-emission-trading-scheme>

³⁴ Vuković Vimić, A., Petrović, N., Weinreich, A., Pistorius, T., 2021: Nature-based Solutions for climate change and potential for their implementation in Serbia, UNDP, Belgrade, Serbia.

³⁵ Shell & BCG, 2023

³⁶ IETA, 2022

for market share in the VCM.³⁷ Credits from carbon removal, such as reforestation or agroforestry, have seen stronger buyer interest than carbon avoidance, for instance through REDD+.

121. The implementation of Article 6 mechanisms will offer further carbon finance opportunities, but the market architecture still needs to be further defined. Article 6 of the Paris Agreement, of which Serbia is a signatory, recognizes the voluntary use of “internationally transferred mitigation outcomes to achieve nationally determined contributions”. Article 6 aims to facilitate collaboration through carbon trading, lowering costs and ideally raising global ambition, while generating a source of additional revenue for countries that help countries channel funds towards adaptation and cover administrative expenses (paragraph 6).³⁸ While the rulebook for bilateral country to country, or NDC to NDC, exchanges under article 6.2 has largely been finalized, the exact centralized mechanism under UNFCCC for exchanges through article 6.4. in which project generated credits can be traded for market and non-market purposes, is still under development. Trades can take place from 2024 at the earliest if guidance is approved by COP 28. The first methodologies are likely to be adapted from the Clean Development Mechanism of the Kyoto Protocol.³⁹

122. Lack of clarity around rules for voluntary markets and article 6.4. and challenges in monitoring and verification of offsets are key barriers to Serbia increasing its participation in voluntary markets. Difficulties in monitoring and verifying the emissions reductions or carbon sequestration achieved by a project presents a key barrier to effectively utilizing carbon offsets. Currently, Serbia has low capacity, and lacks systematic approaches to monitor and verify mitigation outcomes from projects, including forestry or agriculture, that could facilitate companies’ participation in the voluntary carbon market. Strong MRV systems are essential to capture whether emission reductions or removals and related carbon credits are additional, their quality and verifiability, the time horizon at which they are generated and durable.

123. Domestic offset mechanisms can generate additional carbon finance opportunities for forestry and agriculture. Compliance markets, in which companies that face emission reduction targets can trade carbon allowances (a permit to pollute rather than a reduction credit) at a market size of nearly USD 900 billion are infinitely greater than the voluntary carbon market. In some jurisdictions, including California and Quebec, though notably not the EU, ETS allow entities to meet some of their emission reduction obligations through credits originating from projects outside the scope of the ETS. The trend has been towards domestic offset schemes that allow credits from sectors not included in the ETS but generated within the same geographic boundaries.⁴⁰ In some countries, offsets have been linked to carbon tax regimes, with entities allowed to offset parts of all of their carbon tax liabilities through the purchase of credits. In Colombia 100 percent of tax liabilities were eligible to be offset with credits generated within Colombia, mostly from REDD+. Globally, there is an increasing interest in integrating GHG removals through offsets, including from, to help reach net zero. Offsets from afforestation and reforestation are already allowed in some schemes in California, China, Korea and New Zealand. Governments can control the balance of abatement and removals by creating separate mechanisms for “removal units” and setting the rules on how these can be integrated with the ETS.⁴¹ The EU has been developing a voluntary carbon removals certification framework, but there are no plans to link this to the EU-ETS, rather financing for removals will come from other financing sources, including the Common Agricultural Policy.⁴²

Climate-Related Risks in Lending Decisions

124. Regulatory requirements around assessing climate impact of investment are increasing. Financial institutions are increasingly required to international standards on climate risks, such as the new Basel III principles on effectively managing climate-related financial risks, in particular risks related to adaptation.

³⁷ <https://www.ecosystemmarketplace.com/articles/world-bank-carbon-markets-resilient-in-a-high-pressure-2022-with-seismic-changes-afoot/>

³⁸ Law on ratification of the Paris Agreement: <https://www.ekologija.gov.rs/sites/default/files/2023-06/zakon-o-potvrdivanju-sporazuma-iz-pariza.pdf>

³⁹ https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_Article_6_Explainer_260523.pdf

⁴⁰ https://icapcarbonaction.com/system/files/document/ICAP%20offsets%20paper_vfin.pdf

⁴¹ https://icapcarbonaction.com/system/files/document/icap-netzeropaper_final-draft.pdf

⁴² https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en

Serbia is no exception. According to interviews by the Chamber of Commerce with seven commercial banks, there is a high level of awareness that the importance of green finance will increase in the coming years. A few banks already have internal regulations prohibiting “brown” investments, e.g., in fossil fuel industries but do not have adequate staff to ensure compliance with Environmental, Social and Corporate Governance (ESG) regulations or awareness in this area.

125. Banks have internal tools to assess climate impact though internal capacity remains low. Only one out of six Serbian banks interviewed by the project team in May 2022 mentioned they were developing their own ESG tool. In general, banks give clients a “climate and environment questionnaire to analyse the bank’s risk exposure to a firm’s proposed activities along three dimensions: level of exposure, vulnerability, and economic impact. Questions include if a firm reported on its emissions in the past year, its energy and water consumption, rating (if any) and target emissions. There are also industry-specific questions. For example, specific questions for Agriculture, Forestry-Farming and Meat Production include those around the use of pesticides.

126. The working paper on: Access to Finance for decarbonization investment (Appendix 12) provides a concise summary of various aspects related to decarbonization and financing in Serbia. It discusses the existing financial products offered by banks for energy efficiency and decarbonization, along with the challenges faced in financing decarbonization investments. The agrifood sector in Serbia is examined, highlighting the demand for decarbonization from firms and the current financial support provided by the government and donor agencies. The state of regulations concerning environmental and social criteria.

Agrifood firms’ demand for decarbonization

127. The agrifood sector is significant for Serbia's economy, contributing 6.3% to GDP and employing 14% of the formal workforce. It accounts for over 20% of the country's exports and plays a vital role in the Western Balkans' agricultural market. The majority of agrifood firms in Serbia are small and medium-sized enterprises (SMEs). Regional disparities exist in agricultural growth, with Vojvodina being a major contributor due to large-scale production of agricultural commodities.

128. The Serbian government, along with donors and the EU, offers subsidies and incentives to support agribusinesses. Programs like the Rural Development Program for Serbia (IPARD) provide grants for investments in equipment, machinery, facilities, and various sectors such as meat, milk, fruits, and vegetables. The Serbia Competitive Agriculture Project (SCAP) offers support for start-ups costs, capital investments, training, and credit support to agricultural producers and SMEs. Additionally, the IFC's Western-Balkans Manufacturing Value Chains Project connects Serbian companies, including those in agribusiness, with global and regional value chains.

129. Decarbonization of the agrifood sector is a government priority, but regulatory uncertainty poses challenges for SMEs. The absence of sufficient capital and financial instruments targeted at MSMEs is a significant obstacle to adopting green technologies. Despite this, firms express a willingness to increase energy efficiency in their operations to reduce costs. Lack of technical expertise and support for implementing green projects, reporting environmental performance indicators, and accessing climate change-related assistance are additional barriers to investing in decarbonization.

Relevant Projects (past and ongoing) in carbon financing

130. Key projects in Serbia of relevance to carbon finance are summarized in the below table:

Table 15: Past and Ongoing Development Projects / Programmes

Project Name	Funding Source	Objective	Available funds

UNDP Transparency Framework for Serbia Project ⁴³	UNDP, Austrian Government, GEF	Establish MRV system and enhance transparency in line with Article 13 of the Paris Agreement	USD 1.45 million
World Bank Green Transition Development Policy Operation	World Bank	Implement MRV system and support green and climate-responsive capital expenditures	EUR 149.9 million
World Bank and AFD Green Transition Operation	World Bank, AFD	Strengthen public financial management and institutional capacities for achieving a green transition	EUR 69 million
EBRD and EIB Multilateral Carbon Credit Fund ^{44, 45} (Serbia included)	EBRD, EIB	Generate carbon credits from projects in Central European and Central Asian countries, including Serbia	Euro 208.5 million
Belgrade Waste Management Public-Private Partnership Project ⁴⁶	Serbia	Recent voluntary carbon market project to reduce 210,000 tons of CO _{2eq} annually over the project's 25-year contract term; certified by Gold Standard	NA
Renewable Energy (Biogas Plant) Project	Serbia	Under validation by Verified Carbon Standard (VCS)	NA
Clean Development Mechanism Projects in Serbia ⁴⁷		Seven registered CDM projects in the energy sector, including a biogas plant construction project	
Bilateral Cooperation with Italy ⁴⁸	Italy	Identified potential CDM projects, including afforestation, establishment of wind belts, and methane recovery from animal waste/manure treatment	

Table 16: Key lessons learned from previous projects related to carbon finance

Lesson Learned 1	Voluntary Carbon Markets (VCMs) are substantial and growing and offer considerable opportunities for carbon finance in agriculture and forestry.
Lesson Learned 2	The implementation of Article 6 mechanisms will offer further carbon finance opportunities, but the market architecture still needs to be further defined.
Lesson Learned 3	Serbia signals its commitment to its green agenda and decarbonization through several national policies, strategies and laws and its participation in regional networks, but framework for carbon finance is still missing.

⁴³ <https://www.undp.org/serbia/projects/establishing-transparency-framework-republic-serbia>

⁴⁴ Multilateral Carbon Credit Fund: A joint EBRD and EIB climate change initiative.

<https://www.ebrd.com/downloads/research/factsheets/mccfe.pdf>

⁴⁵ https://www.eib.org/attachments/eib_and_carbon_finance_briefing_note.pdf

⁴⁶ <https://www.itochu.co.jp/en/news/press/2022/221108.html>

⁴⁷ <https://www.klimatskepromene.rs/en/unclimate/kyoto-protocol/cdm-projects/>

⁴⁸ https://www.mase.gov.it/sites/default/files/archivio/allegati/CDM/2007/serbia_report_EN.PDF

4. PROJECT AREAS AND TARGET GROUP

Selection criteria for project areas:

131. Below is a summary of the project selected areas (additional information provided in the Working Paper on Forest Sector (Appendix 7) – Serbia: Assessment and Recommendations):

- a. **"Central Serbia"** refers to the central part of the country, which is not a separate administrative unit but falls under the jurisdiction of the Republic. It comprises four regions: Belgrade region, Šumadija and Western Serbia, Eastern Serbia, and South and Eastern Serbia. Central Serbia covers 63.25% of the country's territory, with a population of 5,058,274 inhabitants. The region features diverse terrain, including hills, rivers, and mountains. The economy of Central Serbia is multifaceted, with a strong focus on agriculture, forestry, mining, food processing, and the automotive industry. Forest cover in the region is 37.6%, with the majority of forests being privately owned.

Central Serbia is rich in diversity of forest tree species and forest types. Along the riverbanks of Danube and Sava forests are characterized by *Salix*, *Ulmus* and *Betula* forest type, followed by *Fraxinus-Alnus* and *Quercus robur* forests in low plains. In hilly and mountainous regions 38 beech and oak forest types are determined (*Fagus sylvatica* and *Q. pubescens*, *Q. frainetto*, *Q. petraea*, *Q. cerris*) together with conifer forest species on high altitudes (*Abies alba*, *Pinus silvestris*, *P. nigra*, *Picea abies*) in pure or mixed forest types.

Broadleaved forests represent 90.7% of forest cover (beech 27.6% and oak 24.6%, other hardwood species with 6.0%, poplars 1.9%, other softwood tree species, like willows 0.6%, mixed broadleaved forests 30%), while conifers cover 6.0% and mixed forests 3.3% of the territory under the forest of Serbia.

The climate projections for Central Serbia indicate for the period 2050-2100 (when planted trees will reach maturity) significant increase in annual temperature, quite stable annual precipitation but with a very large year to year variation and an increased occurrence of extreme heat waves [29]. The proposed temperate native species that show higher capacity to withstand the predicted climate changes are listed in Appendix 3.

- b. **The "Autonomous Province of Vojvodina"** is located in the northern part of Serbia. It covers 28% of the country's territory and has a population of 1,840,852 inhabitants. Vojvodina is administratively divided into seven districts, consisting of 45 municipalities and cities. The region is characterized by fertile agricultural soil, moderate continental climate, and diverse industries such as agriculture, food processing, metal, chemical, electrical, oil, construction, and ICT sectors. Forests in Vojvodina are primarily found along rivers, in hilly and mountainous areas, and the Deliblato Sands. The majority of forests in Vojvodina are state-owned and managed by the Public Enterprise Vojvodina Shume.

Summer temperature in Vojvodina can reach up to 40°C, although the average temperature is around 22 °C, while in winter it may reach down to -29°C. In Vojvodina, forest areas are concentrated in the river valleys and on mountainous areas of Fruska gora and Vrsacki breg. Forest types in river valley are characterized by pedunculate oak forests (*Quercus robur*) as well as poplar (*Populus x euramericana*) and willow (*Salix alba*) plantation with *Fraxinus angustifolia*, *Ulmus minor*, *Ulmus laevis*, *Carpinus betulus*, *Populus alba*, *Populus nigra*. Mixed sessile oak forests (*Quercus petraea*) are prevalent on Fruska gora and Vrsacki breg with mostly *Tilia tomentosa*, *Fagus sylvatica* and *Prunus avium*. Floodplain forests the occurrence of invasive species is on the rise, mainly: *Amorpha fruticosa*, *Ailanthus altissima*, *Acer negundo* and *Fraxinus pennsylvanica*.

The climate projections in Vojvodina indicate for the period 2050-2100 (when planted trees will reach maturity) moderate to significant increase of annual temperatures, slight decrease in annual rainfall and the intensification of summer drought conditions. Forest fire risk might significantly increase. Under these conditions, the most suitable native species for forest restoration are listed in Appendix 4.

Afforestation and selection criteria for afforestation

132. Afforestation planning faces challenges due to changing climate conditions and salt-affected soils, particularly in the Vojvodina region. Around 4.2% of Vojvodina's territory (about 106,622 ha) is affected by salt, mainly in Southern-Bačka, Banat, and Srem. Salt dissolved in water negatively affects vegetation and can be toxic. Different tree species have varying tolerance thresholds; for instance, poplars are sensitive to salt content over 0.15%, while oaks tolerate higher levels. *Elaeagnus angustifolia* and Tamarix species can handle up to 0.5%. Oak, poplar, and white willow are suitable for afforestation on salt-affected soils, especially with adequate moisture. Trials suggest that native species like pedunculate oak, turkey oak, wild pear, and white poplar, along with some Asian species, show good salt and drought tolerance. A list of native species for afforestation areas is listed in appendix 5.

133. The selection of afforestation areas involves several steps and criteria. Initially, FAO and the Government of Serbia identified approximately 20,000 hectares of potential areas based on criteria such as clear land ownership, absence of land tenure conflict, and absence of land cultivation or pasture use. These areas include both state-owned forest land and underused or abandoned private-owned land. The criteria for the preliminary identification will be reviewed and fine-tuned before final decisions are made on each site. The selection of individual afforestation plots will consider factors such as clearly defined land ownership, minimum plot size of 10 hectares, accessibility, slope steepness (sites with slope average over 30 degrees will be excluded), distance from human settlements, availability of workforce within a 25 km radius, and the possibility of establishing wildlife corridors. The selection process will involve obtaining consent from concerned landowners or their representatives, municipalities, and civil society organizations to ensure legal compliance and mitigate conflicts. Afforestation plans will be developed by relevant partners with guidance from an international expert. These plans will include site descriptions, history, justification for interventions, species selection criteria considering climate change impacts, detailed intervention descriptions, roles and responsibilities, required equipment, and a monitoring plan. More information provided in the working paper: "Forest Sector - Serbia: Assessment and Recommendations". (Appendix 7)

Selection criteria for coppicing (public land)

134. The majority of coppice forests in Serbia is about 50-70 years old and characterized by the absence of or limited silvicultural management, thus not making use of the specific forest site's potential in wood production, both in terms of quantity and quality, as well as provision of ecosystem services (e.g. carbon storage). There have been pilot studies by the national research institutions addressing the issue of possible conversion of coppice forests into high forests, however, the actual annual conversion rates continue to remain significantly behind the declared target by the government of conversion of 7,000 ha per year [29].

135. The selection process for the conversion of state-owned coppice forests into high forest involves several steps and criteria. Each year, approximately 7,000 hectares of state-owned coppice forests will be gradually converted into high forest. PE Serbia Shume and PE Vojvodina Shume will identify and map potential intervention sites, which will be reviewed and finalized by the project. The final selection process considers factors such as ensuring areas of high biodiversity value remain untouched, clear land ownership, minimum plot size of 20 hectares, accessibility, slope steepness (sites with slope average over 30 degrees are excluded), and availability of workforce within a 25 km radius. Land plots that require active restoration interventions due to deforestation or degradation (e.g., after forest fires) may also be considered for re-establishing high forest. The final selection of sites will be consulted with the MOAFWM based on criteria provided by the national and regional Nature Protection Agency. Forest intervention plans for selected sites will be prepared by PE Serbia Shume and PE Vojvodina Shume with guidance from an international expert. These plans will include site descriptions, history, justification for interventions, detailed descriptions of enrichment planting interventions, roles and responsibilities, required equipment, and a monitoring plan. More information provided in the working paper: Forest Sector - Serbia: Assessment and Recommendations". (Appendix 7)

Selection criteria for coppicing (private land)

136. The project aims to convert both state-owned and private-owned coppice forests into high forests through afforestation activities. For state-owned forests, approximately 7,000 hectares will be converted annually, while for private-owned forests, an average of 3,600 hectares will be targeted each year. The selection process involves identifying and mapping potential intervention sites, with criteria such as biodiversity value, clear land ownership, minimum plot size, accessibility, slope steepness, and proximity to available workforce taken into consideration. The final selection of sites will be consulted with relevant authorities to ensure the preservation of areas with high biodiversity value. Forest intervention plans will be developed, covering site descriptions, historical information, justification for interventions, detailed planting strategies, roles and responsibilities, equipment requirements, and monitoring plans.
137. To engage private forest owners, awareness campaigns and a digital platform will be employed to gather information and interest in managing degraded coppice forests. Clustering of private forest land parcels will be done to achieve a minimum area of five hectares for interventions or to coordinate efforts with adjacent state-owned coppice forests. The selection criteria for private-owned forests align with those for state-owned forests, prioritizing areas of high biodiversity value, clear land ownership, plot size, accessibility, slope steepness, and workforce availability. The final selection of intervention sites will undergo consultation with relevant authorities to ensure compliance with biodiversity preservation criteria. Forest intervention plans will be formulated, covering ecological and social contexts, site history, proposed interventions, planting details, roles and responsibilities, necessary equipment, and monitoring strategies. More information provided in the working paper: Forest Sector - Serbia: Assessment and Recommendations" (Appendix 7)

Beneficiaries

138. The total number of direct beneficiaries includes: (i) the number of persons in communities living in and in proximity of forest areas that the project will address (ii) the number of people currently using fuelwood as their primary source of energy for heating; and (iii) smallholders and forest owners that dispose of increased value of the forest due to increased climate resilience of their properties; (iv) the rural population that will increase its resilience due to enhanced forest ecosystem services (more details in Annex 25).
139. Proposed investments are prerequisites to enable the forestry sub-sector to: (i) continue sustaining the country's energy security, particularly of the country's most poor and vulnerable; (ii) support the increase of renewable energy sources (RES) in the national energy mix (par.19); and (iii) maintain and expand the sector's contribution to reducing national net emissions by 2030 and neutralizing them by 2050. Finally, each adaptation investment will contribute directly to carbon removal. Detailed information about the beneficiaries is included in Annex 25.

Table 17 Beneficiaries mapping and project involvement / benefits

Beneficiaries	Rationale	Involvement / Benefits
(I) Owners of forests ^{xiii}	The high rate of privately owned coppicing stands that are not managed is reducing the capacity of forests to support communities and the economy through ecosystem services. Due to the high fragmentation of private forests and the limited capacity of investment of smallholders, private forests are largely not managed, and very few are the owners that joined the forest owners' associations (~1,800 owners). This has reduced the maintenance of forests and reduced their resilience.	The project will support the aggregation of forest owners through a dedicated platform (Activity 3.1) and will involve them in all the training and investments planned by the project. This will include, via the owners' associations and the chambers of commerce, TA to manage their plots, access lands, and support in maintenance and enhancement (e.g., conversion into high forest stands) of their plots. The project aims to reach at least 10% of all private forest holders (88,054) from those owning less than 20 ha of forest (99% of the total forest owners, or 880,540) ^{xiv} . Priority will be given to single-headed women and women owners (< 30% of total forest owners) ^{xv} . Access to project activities will be volunteer and will be regulated by the specific selection criteria presented in every activity.
(II) Wood biomass fuel consumers	While the efficiency of heating appliances is improving, and a recent law requires efficiency to be at least 60% (fuel/heat), the efficiency of biomass itself (processing, storage, consumption) has yet to be addressed. Consumers are, therefore, far from using	To directly benefit at least 638 thousand rural people depending on fuelwood who are poor or at risk of poverty based on WB assumptions of 2022 ^{xvi} , pellets and briquettes for their energy security (i.e. heating), the project will support with technical assistance and policy / standard development national

	wood biomass fuels (e.g., fuelwood, briquettes, and pellets) following efficiency criteria, and up to 60% of fuelwood users do not have access to properly dried material.	institutions and biomass value chain actors in increasing the efficiency of wood biomass for fuel (e.g. fuelwood, pellets, briquets) while reducing the impacts of production, storage, and consumption. Finally, the project will reach at least 10 thousand wood biomass energy users through dedicated campaigns designed to ensure the highest behavioral change, specifically focusing on gender.
(III) Smallholders that have halted farming their land due to soil degradation.	Decades of intensive farming compromised the quality of agricultural land, leading to 424,054 ha of unused agricultural land (5.5% of the territory) ^{xvii} . This phenomenon is particularly evident in Vojvodina (northeastern districts), where farmers have stopped farming in their fields. The project will support the private sector in planting Short Rotation Plantations for energy, allowing farmers to profit from their lands with a reduced investment need and allow soil to recover. In a BAU scenario, unfarmed lands will increasingly degrade, compromising sustainable biomass production's potential.	The project will support private smallholders who own degraded and unfarmed lands and plant trees for biomass in unfarmed/degraded lands. This will allow at least 500 small farmers to profit from their lands with a reduced investment need. It will allow the soil to recover and the market and the country to plan for biomass fuel production, reducing anthropogenic pressure from forests. Priority will be given to single-headed women and women owners (< 30% of total landowners) ^{xviii} . Access to project activities will be voluntary and regulated by the specific selection criteria presented in every activity.
(IV) Smallholders, and municipalities that want to establish windbreaks and shelterbelts to protect their crops.	Increasing winds, soil erosion and reduced crop field productivity negatively impact Serbia farming. In the past, due to the need for fuelwood, shelterbelts and windbreakers have been removed. In a BAU scenario, erosion caused by wind and described CCs (i.e. increasing temperatures and erratic rainfall patterns) will continue and magnify current erosion and land degradation phenomena. On the contrary, reestablishing windbreakers and shelterbelts will reduce the exposure of agriculture while contributing to decarbonization.	The project will support private landowners and municipalities in agricultural areas (i.e., Vojvodina) to establish windbreakers and shelterbelts, reducing the adverse impacts of increasing wind and contributing to increasing the national forest cover and enhancing key ecosystem services such as carbon removals from the forest sub-sector. Priority will be given to municipalities and to single-headed women and women owners (< 30% of total forest owners) ^{xix} . Access to project activities will be voluntary and regulated by the specific selection criteria presented in every activity.
(V) Municipalities	Forest communities are not involved in forestry management, and land under towns and municipalities is often neglected and not managed. Towns and municipalities are mandated to protect themselves from natural and other disasters (Article 20 of the Local Self Government Act 12/2007) and perform other duties and services delegated by national legislation provisions in protection and firefighting, among others. Local municipal institutions also have competencies in performing delegated services within the inspection in environmental protection, agriculture, forestry, and water, among others (Article 22 of the Local Self Government Act) [IUCN, 2022].	The project will ensure the involvement of municipalities and their communities in identifying forest investments and supporting forest investments in over 2,200 hectares. Administrations and local society organizations will be involved in the training and knowledge transfer process. The project will involve 174 municipalities in Central Serbia and Vojvodina. Access to project activities will be voluntary and regulated by the specific selection criteria presented in every activity.

Option Analysis

140. This section provides a description of the options analysis conducted to evaluate the potential impact of each option and its interventions under each output/component of the project. The criteria included in evaluating each option considered: the advantages and disadvantages of each option, the cost implications, the climate action potential, the value for money and specific related factors to each output/component.

Table 18 Option Analysis related to Output 1.1: Forest management and monitoring policy framework for climate adaptive silviculture enhanced and disseminated

Option Analysis	Cost Implication	Climate Impact	Advantage	Disadvantage	Value for Money
<i>Option 1: No action approach</i>	<p>Current management of forests is hindered by an incomplete governance framework that fails to incorporate ecosystem services adequately and maximize potential both adaptation and mitigation benefits</p> <p>In the period 2000 to 2020, the country suffered damages estimated at EUR 6.8 billion, caused by climate change and extreme weather events, partly caused by missing ecosystem functions of degraded forests</p> <p>.</p>	<p>Fuelwood extraction is leading to forest degradation and at the same time a main source of energy for heating for 49% of the population.</p> <p>Consumption is expected to grow further by an average of 0.5% year leading to further degradation of forests and threatening energy security of vulnerable population.</p> <p>Climate Change impacts due to extreme weather events are expected to increase in the future and will be exacerbated by degraded forests that cannot carry out its protective function.</p>	<p>The main advantage is that there will be no need of investing.</p>	<p>Forests cannot be prepared and managed to face current and future climate challenges.</p> <p>Fuelwood extraction and utilization remains largely uncontrolled leading to non-manageable impacts and forest degradation.</p>	<p>Non-adaptation of forests will exacerbate the occurrence of natural disasters impacted by climate change, like floods and their damages and losses. This is expected to decrease GDP by -0.15% to -0.32% per year.</p> <p>Direct contribution of the production of the forestry sector to the GDP on the other hand is expected to decrease annually on average by 0.3% (2037) to 1.6% (after 2067) with a temperature increment of 3 C.</p> <p>Furthermore, non-adaptation of forests places at risk the energy security of 49% of the population and a market with an estimated volume of EUR 220 mln per year.</p>
<i>Option 2: Sector approach</i>	<p>The cost of this option is estimated to be</p>	<p>A continuous forest monitoring system</p>	<p>Decision-makers can rely on a permanent</p>	<p>Without increase in efficiency of fuelwood</p>	<p>Forest-provided job opportunities and non-</p>

Option Analysis	Cost Implication	Climate Impact	Advantage	Disadvantage	Value for Money
<p><i>Activity 1.1.1. Establish the National Forest Monitoring and Assessment System (NFMA)</i></p> <p><i>and</i></p> <p><i>Component 2: Upgrade of Nurseries and Capacity Development and tailored forest investments on public land (coppice conversion and afforestation)</i></p> <p><i>and</i></p> <p><i>Activity 3.1.1 Private sector investments in conversion of coppice stands</i></p>	<p>Activity 1.1.1 13,043,695 USD</p> <p>All of Component 2 46,039,485 USD</p> <p>Activity 3.1.1. USD 15,126,278</p> <p>Total Budget of Option USD 74,209,458</p>	<p>allows for evaluation of results on an annual basis on the actual condition of forests and latest trends in timber harvesting, carbon storage, etc.</p> <p>The public and private sector investments offer concrete and large-scale CAS investments contributing significantly to the fulfilment of national climate change commitments and can be further upscaled beyond the project.</p>	<p>inflow of unbiased and relevant information to adjust decision-making processes for a more sustainable forest exploitation.</p> <p>The investments allow the involvement of the private sector in large scale forestry modernization.</p>	<p>and engagement of the private sector in promotion of alternative biomass the high risk persists that current unsustainable practices would continue, leading to further forest degradation and to counteract CAS investments.</p> <p>Furthermore, intervening only in the forestry sector without addressing drivers of degradation as well as the relevance of ecosystem services will not permit to have multiple impacts of investments.</p> <p>In addition, limiting the interventions to the forestry sector does not allow to release further synergies and opportunities with other sectors (e.g. rehabilitation of degraded agricultural</p>	<p>wood forest products (NWFPs) such as mushrooms, herbs, honey, and berries. These products are estimated to generate an annual value of approximately USD 39.6 per ha per year.</p> <p>Additional ecosystem services associated include pollination, direct and indirect protection from natural hazards, tourism, and flood protection, for an average estimated social value of about US\$ 11.1 per hectare per year.</p> <p>There is considerable value added in reforming the forestry sector.</p> <p>The overall project has a 20-year Economic IRR of 15.0% (higher than the social discount rate), an NPV of US\$ 78.4 million, and a 40-</p>

Option Analysis	Cost Implication	Climate Impact	Advantage	Disadvantage	Value for Money
				land through forestry investments)	year Economic IRR of 17.6% with an NPV of US\$227.5 million.
<p>Option 3: NEXUS approach</p> <p><i>Implementation of activities of option 2</i></p> <p><i>and</i></p> <p><i>Activities 1.1.2; 1.1.3; 1.1.4 related to the Provision of framework for more efficient fuelwood use and Short Rotations Plantations (SRPs) as alternative energy source and soil rehabilitation guidelines. (Output 1.1.)</i></p> <p><i>and</i></p> <p><i>Activities 3.1.2, 3.1.3, 3.1.4, 3.1.5 related to diversified forestry investment on 1,000 ha agricultural land and to the greening of the biomass value chain</i></p>	<p>The cost of this option is estimated to be</p> <p>All of output 1.1.: USD 13,470,195</p> <p>All of Component 2: 46,039,485 USD</p> <p>All of Output 3.1.: 19,284,220</p> <p>Total 78,793,900</p>	<p>Combination of improved and diversified climate smart forest management techniques and promotion of alternative fuels and increase in fuelwood efficiency will lead to a sector more prepared to climate challenges and to long term sustainability of interventions</p>	<p>The continuous provision of up-to-date information on forest dynamics will permit to bring the existing carbon monitoring, reporting and verification (MRV) system of Serbia up to international standards and ensure CAS practices in day-to-day forest management and operations at field level.</p> <p>Biomass standards can significantly improve calorific value of fuelwoods up to 24% and hence reduce consumption.</p> <p>SRPs represent a significant alternative to fuelwoods and contribute to the country reaching its ambitious renewable energy goals (share of 49% by 2050)</p>	<p>There is no disadvantage for the integrated management and monitoring framework</p>	

Option Analysis	Cost Implication	Climate Impact	Advantage	Disadvantage	Value for Money
			Option ensures the involvement of private actors from different sectors in climate action.		

Table 19 Option Analysis related to Output 1.2. Enabling framework for national institutions to engage with carbon finance for AFOLU created

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
<i>Option 1: No action approach</i>	In a BAU scenario the LULUCF sector is expected to miss the additional sink foreseen by the low carbon development strategy (LCDS) of - 1,526 kt CO _{2eq} by 2030. This would impact overall total costs foreseen to balance total national net CO _{2eq} emissions	Governmental resources for climate smart forestry action are limited and Serbia reported in the second NDC (2021) that it will be able to speed up its decarbonization process and contribute to climate change mitigation only if financial support is provided for key investments.	There is no advantage with the current framework.	Without access to finance beyond the ordinary governmental budget it will not be possible to enhance carbon sinks through forests although these are considered among the most cost-effective measure for mitigation action.	Investments in forestry represent only 1.4% of overall additional investment costs of the LCDS. However, it will not be possible for the government to carry out these investments alone and without functioning mechanisms and enabling frameworks in place it will not be possible for the private sector to contribute to investments.
<i>Option 2: Support the design of an offset mechanism for AFOLU</i>	The cost of this option is estimated to be USD 296,850	A robust carbon pricing framework will constitute a necessary enabler for Serbia to meet AFOLU goals in the NDC and Low Carbon Development Strategy (LCDS).	The policy framework and options for finance for carbon from forest, soils and agriculture links to Serbia's carbon pricing plan, as it evolves in line with commitments in the LCDS.	The System and framework are complex and requires a well-designed and long-term functioning connection and engagement between state and private sector.	The voluntary carbon market has grown considerably over last five years to reach approximately USD 2 billion in 2022 with expectations of further growth to between US \$5 billion to US \$50

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
<i>Option 3: Support the design of an offset mechanism for AFOLU in combination with an enhanced access to voluntary carbon markets</i>	The cost of this option is estimated to be USD 699,600	Developing a domestic offset mechanism for forestry and opening up international carbon finance opportunities through the voluntary carbon market and evolving Article 6 strategies can unlock needed financing to upscale forest investments for mitigation (and adaptation co-benefits), over and above those that can be delivered with public financing alone. This requires concerted investments in national capacities and the development of respective regulatory frameworks.	Compared to option 2, this option adds more flexibility to the private sector in choosing its decarbonization strategies.	There are otherwise no disadvantages foreseen by the approaches.	billion by 2030. The financial flows obtained could provide significant and sustainable support to nature-based climate solutions in the country.

Table 20 Option Analysis related to OUTCOME 2 - Improved energy security and livelihood from climate resilient forest ecosystem and GHG emission reductions from increased carbon sinks and decarbonization opportunities

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
<i>Option 1: Do nothing (BAU)</i>	Serbia's current total growing stock of forests is unsatisfactory. Forests	Under the absence of action, the following impacts of climate	None	Addressing only a few steps of the process (e.g. planting of seedlings or	Non-adaptation of forests will exacerbate the occurrence of natural disasters

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
	have in fact a low standing volume of about 161 m ³ ·ha ⁻¹ with a low annual increment of about 4.0 m ³ ·ha ⁻¹ . Forests also has an unfavourable production capacity due to inadequate management in recent decades (high stands represent 27.5% and coppice regenerate stands 64.7%). This leads to low productivity from the forestry sector	change on forests would be exacerbated: - pests, diseases, fires and climatic hazard on Serbian forests will continue to increase (+268% of m ³ of wood lost between 1966 and 2019). - by the end of the century, between three-fourths and all Norway spruce, Silver fir, European beech and pine habitats will be found outside their current climate space - Forest stands will be less diverse and even more exposed to climate change with immediate adverse impacts on the livelihood and energy security of the rural population and the poor, as well as on biodiversity and ecosystem resilience.		maintenance of forests) is not functional and does not respond to the existing challenges linked to climate change, people's needs and healthiness of ecosystems.	impacted by climate change, like floods and their damages and losses. This is expected to decrease GDP by - 0.15% to -0.32% per year. Direct contribution of the production of the forestry sector to the GDP on the other hand is expected to decrease annually on average by 0.3% (2037) to 1.6% (after 2067) with a temperature increment of 3 C. Non-adaptation of forests places furthermore at risk the energy security of 49% of the population and a market with an estimated volume of EUR 220 mln per year.
Option 2: Upgrade of Nurseries	Total Project Costs: 4,677,565 USD	The option foresees to involve Serbian stakeholders to ensure a 360-degree approach	Transferring technology and knowledge with on-the-job training to forests' stakeholders will	<ul style="list-style-type: none"> • High public investment required. • In order to be functional and 	Overall, the economic returns of the forestry interventions are largely positive.

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
Option 3: Upgrade of Nurseries And Capacity Development	Total project Costs: USD 5,069,015	to forestry where climate change and its adverse impacts are addressed fully. This entails: (I) technology and knowledge transfer to ensure climate adaptive forestry investments; and (II) tailored forest investments (i.e. afforestation and forest restoration).	create the precondition to secure the highest possible survival rate of forestry investments and to ensure their long-term climate proofing of forestry investments.	<p>impactful, all options from 2 – 4 need to be in place. One of them alone would not lead to success as explained as follows:</p> <ul style="list-style-type: none"> - Capacity Development is essential for the functioning and the sustainability of upgraded nurseries and forestry investments - Forestry investments are essential to provide practical experience and demonstration of feasibility and impact. - Nurseries have to be in place and upgraded to provide seedling material for planting activities 	<p>All public investment generates positive Economic-IRR and Economic- NPV all forestry investments are largely solid from an economic standpoint (more details in Annex 3)</p> <p>Conversion of coppice to high forest result in 30% more productive forests. At the beginning of the conversion cycle, approximately 25m3 of wood can be extracted per hectare from thinning activities and sold to population.</p>
Option 4: Upgrade of Nurseries And Capacity Development and tailored forest investments (coppice conversion and afforestation on public land)	Total project Costs: USD 46,039,485				

Table 21 Option Analysis related to Output 3.1 Private sector contribution to climate resilience of forests enhanced through climate adaptive and diversified investments on 19,000 ha and through greening of the biomass value chain initiatives

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
Option 1: Do nothing (BAU)	Serbia suffered damages estimated at USD 6.8 billion for the	No action will further compromise adaptation of forests	None	Under the BAU scenario degradation state of	High fragmentation of private forests as well as the limited capacity of

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
	<p>period 2000-2020 (USD 1.8 billion from 2015 to 2020) due to extreme weather events caused by climate change and exacerbated among others due to degraded forests.</p> <p>In a BAU scenario the LULUCF sector is expected to miss the additional sink foreseen by the low carbon development strategy (LCDS) of - 1,526 kt CO_{2eq} by 2030 leading to increased costs to balance increased net emissions. The government cannot provide alone for additional investment needs in the low carbon pathway of the sector.</p> <p>Estimated extraction rate of fuelwood already surpassed 6.7 mcm and demand is growing due to continuously and</p>	<p>preventing rural communities and the poor from being energy secure,</p> <p>Furthermore, non-adaptation of forests, especially in the lowlands, will exacerbate the occurrence of natural disasters impacted by climate change, like floods and their damages and losses.</p> <p>Under BAU forest will further degrade and decrease sink functions, threatening national climate change commitments.</p>		<p>forests will further worsen.</p> <p>Inefficient Fuelwood use will increase and further compromise ecosystems services of forests.</p>	<p>investment of smallholders lead to unproductive and hence by large, abandoned forests.</p>

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
	significantly increasing prices of other sources of energy. Therefore				
Option 2: Sector approach The traditional sector approach option consists of focusing solely on the forestry sector addressing the adaptation deficit of public stakeholders with limited actions focused on capacity development and infrastructure investments.	Due to the fragmented nature of Serbian forests, investments in the sector are often not viable.	Applying a traditional sectorial approach will have positive short-term impact due to the improved forest governance, but in the medium-long term will have de facto have similar consequences as the no action option. The approach will not allow applying climate adaptive silviculture to forestry investments and will not allow engaging private sector operators from the forestry sector as well as from others like the agrifood to mitigate main driver of forest degradation (i.e. fuelwood).	The approach brings results in terms of policy and capacity development.	it will only partially initiate the paradigm shift as it will remain in the forestry dimension with a BAU focus of wood production for different markets. Without immediate investments in stabilizing forests and increasing their cover especially in lowlands there will be not incentives for private sector actors to engage in forestry or to rely on forests to ensure their resilience and contribution to decarbonization. A BAU sectorial approach will have limited sustainability and replicability due to the lack of inclusiveness and diversity of stakeholders. Finally, a traditional sectorial approach will not be coherent with the 2021	Overall, the economic returns of forestry interventions are largely positive. All investments generate positive Economic-IRR and Economic- NPV. All forestry investments are largely solid from an economic standpoint (more details in Annex 3). The problem is that investments will often not occur as the sector is too fragmented and not able to obtain required initial financing.

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
				NDC update that expressly identifies the link between the need to adapt forest to yield results also in terms of mitigation.	
Option 3: Nexus approach All investments in forestry (conversion of coppice stands, shelterbelts, soil rehabilitation and land rehabilitation) are connected with activities related to the greening of the biomass value chain	Costs of Option correspond to USD 19,284,220	Considering the importance of forests for livelihoods of local rural communities as well as for both the rural and urban poor, the option bridges public and private actors to ensure sustainable management of forests and fuelwood and the adoption of approaches and technologies that will ensure availability of biomass with high quality at the national scale while reducing impacts on ecosystems and increasing the energy security of the poor and those at higher risk of poverty.	The nexus approach will integrate all the features of the sector approach expanding its range of activities to focus on ecosystem services (e.g. energy security, livelihood, protection and decarbonization) applying an inclusive livelihoods approach targeting specifically private sector operators and communities that are not traditionally involved in forest management. Particularly, the participation of agrifood sector operators, local communities and private forest owners' participation will help ensure the envisaged paradigm shift, the sustainability of the activities and the	High investment costs necessitate support through public actors or financing institutions that are often not able to define bankable projects	<p>Overall, the economic returns of the forestry interventions are largely positive.</p> <p>All public investment generates positive Economic-IRR and Economic- NPV all forestry investments are largely solid from an economic standpoint (more details in Annex 3)</p> <p>Conversion of coppice to high forest result in 30% more productive forests. At the beginning of the conversion cycle, approximately 25m3 of wood can be extracted per hectare from thinning activities and sold to population.</p>

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
			integration of the forest-energy security-decarbonization nexus. The options represent furthermore an efficient approach to engage the private sector in sustainable forestry activities and greening the value chain. The choices offered are very diversified and offer a wide range of possibilities to carry out sustainable investments. This can lead to a decrease in degraded land areas (approx.6% of agricultural land) and to the rehabilitation of private coppice stands, which have unsatisfactorily low standing volume and low productivity.		If organized in an efficient manner the fuelwood market (6.8 MCM with a value of about EUR 224 million, 2016) offer significant potential for local economic development and job creation.

Table 22 Option Analysis related to “Output 3.2. Mobilized private finance for agribusinesses involved in decarbonization processes” and “Output 3.3. Financial institutions, consultancy service providers, and academia capacitated on climate-related challenges and opportunities”

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
Option 1: Do nothing (BAU)	About 45% (USD) 8.43 billion of agrifood	Serbia is a candidate for Eu membership	Not investing in decarbonization might	The private sector will not be able to contribute	In the long term not investing

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
	exports are destined for the EU, where planned carbon taxes may require in the future products to be decarbonized in order to remain competitive.	and is therefore applying rules and regulations of the EU on their territory. Decarbonization is therefore one of the main topics related to sustainable development and the industry one of the main sectors required to include it in its long-term planning. Not acting would therefore mean that the sector is not aligning its strategy to national and international policies.	have some benefits on the short term, as industries can invest in other sectors to achieve cost-efficiency of the production.	significantly to national climate change commitments while at the same time risking its international competitiveness.	decarbonization is expected to have very negative impacts on companies' international competitiveness and on cost-efficiency of production.
Option 2: Support to decarbonization processes through capacity development, technical assistance and financing	Costs correspond to USD 2,876,000	The option increases agribusiness firms' capacities to assess the potential for decarbonization, to incorporate climate-related risks in their production decisions, assist them in defining their decarbonization strategies and facilitate linkages with financial institutions to meet their eventual funding requirements.	The approach is necessary to proactively involve industries in the decarbonization processes. In fact, the large majority of businesses do not have the capacity and knowledge to engage in the process. The approach is therefore useful to overcome this barrier to facilitate access to finance and to accompany the private	There persists still critical mass on the understanding of the process and the possibilities to create bankable decarbonization options.	Decarbonization investments, facilitated by commercial loans at market interest rates, generate positive economic returns over a 10- and 20-year period. For a 10-year horizon, the Economic IRR for the decarbonization loans is 25.4%.

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
			<p>sector on low carbon pathways.</p> <p>The approach will create a longer-term change in doing business, such that firms incorporate decarbonization in their activities and processes beyond the project life cycle.</p>		
<p>Option 3: Support to decarbonization processes through capacity development, technical assistance and financing and Capacity Development</p>	<p>Costs correspond to USD 3,096,000</p>	<p>Added to the support to decarbonization processes presented in option 2, this option focusses on enhancing national financial institutions' capacity on climate change and service providers to support agribusiness investment adhering to international standards on climate risks and decarbonization. Banks express willingness to increase decarbonization investments but require capacity</p>	<p>The option will provide the basis for all further decarbonization processes of the private sector in the country. In fact, only with the actions presented under option 2 together with sufficient critical mass and knowledge it will be possible to support the private sector in contributing to the national climate change commitments, while maintaining competitiveness in international markets.</p>	<p>The option requires concerted involvement of a variety of private sector actors and absence of disruptive events that might shift the focus of participants on other, perceived as more urgent, matters.</p>	

Option Analysis	Cost Implication	Climate Action	Advantage	Disadvantage	Value for Money
		development and client outreach support.			

Key technologies, practices and sectorial approaches identified by stakeholders to address climate change adaptation and contribute to climate change mitigation

141. For comprehensive information regarding the three components' rationale, detailed description, contribution, activities, implementation, work modalities, costs, and time frame of the proposed interventions, please refer to the main working papers available: Forest Sector – Serbia Assessment and Recommendations; Sustainable utilization of biomass for low emission energy purposes in Serbia; Access to Finance for decarbonization investment; (Appendices 7,8,12). These papers provide extensive insights into the project's objectives and strategies, offering a comprehensive overview of the proposed initiatives.

COMPONENT 1 – National level upscaling of sustainable and climate adaptive silviculture and carbon finance framework

Project output 1.1: Forest management and monitoring policy framework for climate adaptive silviculture enhanced and disseminated

Project output 1.2: Enabling framework for national institutions to engage with carbon finance for AFOLU created

142. Forests are crucial for the well-being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources and by serving as habitats for plants and animals. Forests also provide a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.
143. Land degradation in the Republic of Serbia leads to a reduction in the provision of ecosystem services that take different forms – decline in food availability, soil fertility, carbon sequestration capacity, wood production, groundwater recharge, etc. – with significant social and economic costs to the country. As a solution, restoration of degraded and deforested landscapes has gained recognition at the international level as a way for countries to achieve multiple national and international priorities on mitigating climate change, improving livelihoods, reducing desertification and conserving biodiversity. Restoring degraded and deforested landscapes using the Forest Landscape Restoration (FLR) approach would be the cost-effective long-term sustainable nature-based solution in the region.
144. However, to accelerate the adoption of a FLR approach on a larger scale in Serbia, the main root causes and bottlenecks to address the forest - decarbonization nexus are to be overcome, namely: (I) the adaptation deficit of forestry's stakeholders (public and private) and the incomplete mechanisms for forest assessment, monitoring and management; (II) the incomplete strategic, policy and legal framework to ensure the optimal contribution of the AFOLU sector to the decarbonization process of the Serbian economy; and (III) the limited incentives for private sector engagement in sustainable forest management and in decarbonization
145. Although policies and long-term strategies for the forestry sector are in place, the lack of reliable and up-to-date information on the current status and dynamics of forest ecosystems of Serbia seriously hampered evidence-based decision making in relation to forest governance and management issues at local, regional and national levels. In response to the demand for reliable information on forest and tree resources in Serbia, the 2nd National Forest Inventory has been conducted within the framework of the GEF6 forestry project (GCP/SRB/002/GFF) which delivers for the first-time up-to-date information which goes beyond timber-related key attributes, such as forest health, carbon stock, biodiversity, etc.
146. However, the impacts of climate change on forest ecosystems and other wooded lands require a continuous process of closely monitoring forest and tree resources as well as other land uses to recognize and address undesired developments in a timely manner. Therefore, the project will support establishing a national forest monitoring and assessment (NFMA) system, to generate cost-effective information on forests and trees outside forests, including all benefits, uses and users of the resources and their management

147. The activities on the NFMA will be complemented by activities related to the (i) development of Develop guidelines for decision makers on AFOLU to prevent soil degradation, (ii) the creation of national standard for biomass production / handling for energy purposes and (iii) the development of the national strategy, action plan and execution guidelines for Short Rotation Plantations

COMPONENT 2- Improving energy security and livelihood from climate resilient forest ecosystem and GHG emissions reductions from increased carbon sinks and decarbonization opportunities

Project output 2.1: Production of climate-adaptive seedlings enhanced

Project output 2.2: Knowledge on climate adaptive silviculture (CAS) of key stakeholders enhanced

Project output 2.3: Public and private forest land restored and afforested in a climate adaptive and participatory manner

148. In line with the Draft Low Carbon Development Strategy with Action Plan⁴⁹ underlying principle of applying an ecosystem-based adaptation approach to the proposed national contributions on climate change adaptation and mitigation, the project aims to restore forest ecosystems and to afforest degraded agricultural and other lands to enhance ecological processes and ecosystem services, while at the same time fostering climate resilience. The project will increase diversity at different levels:

- Genetic diversity from different populations of the same species in order to increase the gene pool of collected seeds and therefore the probability of having a representation of varieties better adapted to drought, frost, pests, etc;
- Species diversity by mixing different trees and shrubs in the same restoration site, to accelerate the recovery of the forest ecosystem, in terms of plant composition, structure and ecological processes, and consequently enhance ecosystem services and the resilience against climatic risks.

149. The project has selected a number of native trees and shrub species of the reference ecosystems that better suits future climate conditions in Central Serbia as well as Vojvodina region. Please refer above to the section 5 “Project areas” contains a more detailed description of the selected areas and appendices 3-5 provide more details on the native species. These species have a wide ecological range (they grow under large temperature and precipitation gradients), and the capacity to withstand drought, re-sprout after fire and to attract seed-dispersal fauna.

150. Transferring technology and knowledge with on-the-job trainings to forests’ stakeholders is a precondition to secure the highest possible survival rate of forestry investments and to ensure their long-term climate proofing. Addressing only a few steps of the process (e.g. plantation or maintenance of forests) is not functional and does not respond to the existing challenges linked to climate change, people’s needs and healthiness of ecosystems. Therefore the project will work with Serbian stakeholders to ensure a 360-degree approach to forestry where climate change and its adverse impacts are addressed fully. The project will support forest stakeholders with: (i) technology and knowledge transfer; (ii) reducing the atrophic pressure caused by fuel wood; and (iii) addressing the governance of forests’ stakeholders ensuring the participation and action of private owners and local public administrations and communities.

Component 3 – Engaging Private sector in climate adaptive silviculture and decarbonization investments

Project output 3.1: Private sector contribution to climate resilience of forests enhanced through climate adaptive and diversified investments and greening of the biomass value chain initiatives

⁴⁹ https://balkangreenenergynews.com/wp-content/uploads/2020/01/Low-Carbon-Development-Strategy-with-Action-plan-Serbia_eng.pdf

Project output 3.2: Mobilized private finance for agribusinesses involved in decarbonization processes

Project output 3.3: Financial institutions, consultancy service providers, and academia capacitated on climate-related challenges and opportunities

151. The project will support the decarbonisation path of Serbia by enhancing the operationalization of the existing legal framework (e.g. Climate Change Law, 2021) and supporting the private sector decarbonisation efforts. The project will work with both national institutions and cofinanciers (IFIs, national banks and investment funds) to provide companies in Serbia with the needed technical assistance and possibility to access financial resources to invest in best available technologies for decarbonisation and to apply the possibility of offsetting and insetting unavoidable emissions.

152. Within the framework of this project, the private sector will be involved in forestry investment on a voluntary basis and all applicable rights protected. The project will attract the interest of private forest owners to invest through awareness raising campaigns in various media, accompanied by establishing a digital platform to collect and structure cadaster data and information on private forest owners interested in forestry investment, including conversion of coppice, establishing new forests or shelterbelts, or the management of their degraded coppice forests. This will allow to cluster private forest land parcels to reach a minimum scope of five (5) hectares for forest interventions or to plan jointly with interventions in adjacent state-owned coppice forests. Thanks to the utilization of the digital cadaster, the PEs will ensure direct contact with private forest owners and ensure that women and single women headed households (representing less than 30% of forest's owners) can be prioritized. Of particular importance will be the support of the output to the establishment of a technical partnership between the MOAFWM, the University of Belgrade and the University of Florence to transfer to Serbia the technology and knowledge of the tool www.forestsharing.it. (Letters of support are included in Annex 1.b). Forest Sharing is a multifaceted tool designed for sustainable and profitable management of small-forest properties. By integrating diverse approaches—such as digital engagement, innovative forest management models, and science-backed precision forestry techniques—it not only enhances forestry practices but also serves as a foundational instrument for the Payment for Ecosystem Services (PES) scheme. This empowers forest owners with training, support, and guidance to transform previously unmanaged or neglected lands into forests that are environmentally responsible, economically viable, and socially beneficial. At the same time the digital platform will allow forest owners to contact the Ministry to engage in project activities or any other initiative that the department of forests will launch in the future. Furthermore, learning from the experience related EU regulations such as Regulation (EU) 2023/1115, the platform will allow to include data and information related to biodiversity, potential carbon storage (based on options) and ecosystem services. This will also support possible participation of private landowners into the voluntary carbon market.

CARBON ACCOUNTING ANALYSIS

153. The GHG emission analysis and calculation in Serbia utilize the NEXT tool, which is composed of several modules for evaluating GHG emissions in the AFOLU sector⁵⁰. Annex 22: Assessment of GHG

⁵⁰ The Nationally Determined Contribution Expert Tool (NEXT) is a greenhouse gas accounting tool developed by the Food and Agriculture Organization of the United Nations (FAO) to support the assessment of environmental impacts in the Agriculture, Forestry, and Other Land Use (AFOLU) sector. It utilizes Intergovernmental Panel on Climate Change (IPCC) methodologies and provides estimates of carbon removal and greenhouse gas emission reductions based on actions determined by countries in their climate policies. NEXT helps countries interpret, track, and enhance the ambition of their Nationally Determined Contributions (NDCs) and supports the transparency framework outlined in the Paris Agreement. It offers a comprehensive overview of climate actions by providing detailed temporal results and a range of indicators, including the social value of carbon. The tool enables assessment and reporting of progress, evaluation of additional emissions reductions, and assessment of achievements in GHG emissions reductions over a 30-year time frame. It helps countries understand the impacts of past and ongoing climate actions and informs the development of necessary measures and investments to meet climate targets.

emission reductions report provides further methodological and detailed information on the NEXT tool and the results of the calculation in the Serbian context. The analysis follows the IPCC 2006 methodologies and uses the Global Warming Potentials (GWP) from the 5th Assessment Report.

154. The project implementation period is 7 years, but the NEXT tool captures the full impact of management and conservation strategies on biomass and soil carbon stocks until these stocks reach equilibrium. Carbon stock changes, including biomass, litter, deadwood, and soil, are estimated over the implementation period and the additional time required for each carbon stock to reach equilibrium. The changes in biomass carbon stock are estimated over a 30-year time series. The total lifetime considered for the project is 27 years to capture soil organic carbon changes until the year 2050.
155. The GHG analysis includes CO₂, CH₄, and N₂O emissions. However, it does not account for the life cycle GHG impacts of materials used in the project. The analysis focuses on the activities implemented by the project, such as afforestation, forest management, cropland and grassland management, and harvested wood products.
156. The monitoring approach for verifying GHG emission reductions includes ex-ante technical assessments, on-site verification, continuous site visits, and ex-post expert evaluations of forestry and decarbonization practices.
157. The assumptions associated with the activity data vary depending on the component. For example, in the forest management and governance component, climate adaptive silvicultural management practices are assumed to prevent 1% of the land from being fully degraded and promote regeneration on an additional 1% of the remaining land. Carbon stock changes are estimated using different approaches, such as a simple carbon stock approach and a gain-loss approach.
158. In the afforestation component, collaborative and effective afforestation activities are planned on at least 7,000 hectares of currently set-aside land. The biomass growth values for different tree species are considered in the estimation of carbon stock changes. Similar approaches are taken for the conversion of public and private coppicing stands to high forests, planting shelterbelts, and rehabilitating degraded land.
159. The private sector engagement component involves the conversion of private coppicing stands to high forests and decarbonization of the private sector. The emissions reductions due to decarbonization are estimated based on the total loan amount available for decarbonization and the average cost per tCO_{2eq} avoided or removed by the private sector.
160. The GHG appraisal results show the carbon accounting of forestry activities for specific years, such as the year 2030 (completion of afforestation activities), year 2043 (20 years after the project start), and year 2050 (project lifetime). The project's GHG emission reduction is expected to contribute significantly to Serbia's national targets of increasing the carbon sink in forests by 17% by 2030 and 22% by 2050 compared to 2010 levels.
161. Overall, the project is estimated to avoid at least -8.4 million tCO_{2eq} over the 27-year project lifetime. Most of the emissions are avoided through the implementation of forestry activities. The cost per tCO_{2eq} avoided is approximately USD 10, which is in line with other similar projects approved by the Green Climate Fund.

ENVIRONMENTAL AND SOCIAL SAFEGUARDS

162. This project is classified as a moderate risk (Category B) and focuses on identifying triggers, potential impacts, and mitigation measures related to environmental and social issues. The project's risk assessment was conducted using FAO's Environmental and Social Screening Form, resulting in the moderate-risk categorization. The Environmental and Social Management Framework (ESMF) serves as a practical tool to guide the identification and mitigation of potential negative environmental and social impacts and facilitates consultations with stakeholders and project beneficiaries.

163. To support the project, a Project Management Unit (PMU) will be established under the guidance of a steering committee consisting of representatives from line ministries, stakeholders, and the private sector. An Environmental and Social Safeguards (ESS) Specialist will be hired within the PMU, responsible for ensuring compliance with the ESMF, conducting environmental and social assessments, and overseeing mitigation measures. The ESS Specialist will collaborate with the Monitoring and Evaluation unit and Gender Specialist for reporting and stakeholder engagement.
164. The workplan for implementing the ESMF includes capacity building, ESS screening and assessment, oversight, stakeholder engagement, a Gender Action Plan, and monitoring and reporting. The project is expected to have positive impacts on the environment, society, and economy, including job creation, poverty reduction, improved fuel efficiency, enhanced biodiversity, soil quality, and water availability. Negative impacts related to on-ground activities in the forestry sector can be mitigated through careful species selection and considering climate change projections.
165. Throughout the project design, consultations were held with relevant government agencies and stakeholders in the forestry, energy, and agriculture sectors. Stakeholder engagement will continue during project implementation, with annual consultations and the sharing of the ESMF, Grievance Redress Mechanism, and Gender Action Plan. Additional consultations will take place as needed for sub-activities.
166. Additional information on FAO and GCF Safeguards applicable to this project, mitigation measures, approaches to enhancing positive impacts, and principles and procedures for impact mitigation during implementation can be found in Annex 6: Environmental and Social Management Framework.

IDENTIFIED ACTIONS TO TRANSFER TECHNOLOGIES AND PRACTICES AND TO SCALE UP RESULTS NATIONALLY

167. The project interventions outlined above encompass a range of strategies that will facilitate the transfer of technologies and practices, leading to nationwide scaling up of results. Through the implementation of these diverse strategies, the project's primary objective is to ensure the effective transfer, adoption, and scaling up of knowledge and best practices among stakeholders, sectors, and regions. This collective effort will play a crucial role in promoting sustainable and climate adaptive forest management practices throughout the country:
1. **At-the-job training and capacity development:** The project will provide practical training opportunities to professionals, academic, financiers and forest workforce, allowing them to acquire hands-on experience in implementing sustainable and climate adaptive silviculture practices/approaches, climate adaptive forest management, ecosystem management, using the MRV, highlight quality plant/seedling production, conversion techniques, economic and environment benefits of sustainable biomass value chains, decarbonization practices and climate risk assessments among others. The capacity development trainings will take place in the field and workshops, enabling participants to apply the acquired knowledge directly to their work.
 2. **Field conferences:** The project will organize conferences and workshops where experts and practitioners can share their experiences, present research findings, and discuss best practices. These conferences will serve as platforms for knowledge exchange and networking, enabling participants to learn from each other and gain insights into successful approaches.
 3. **Raising awareness:** Various awareness-raising guidelines, campaigns, workshops, and public events will be conducted to educate and inform stakeholders about the importance of sustainable forest management, climate adaptive approaches and decarbonization strategies. These initiatives will target a wide range of audiences, including local communities, decision-makers, and the general public, to foster a broader understanding of the benefits and significance of the project's interventions.

4. **E-knowledge diffusing:** The project will leverage digital platforms and online resources to disseminate knowledge and share information. This may involve the creation of an online portal, webinars, video tutorials, and interactive tools that provide accessible and user-friendly information on sustainable forest management practices.
5. **Updating national curricula:** The project will collaborate with relevant educational institutions and the Ministry of Education, Science and Technology Development (MESTD) to incorporate sustainable and climate adaptive forest management practices into the national curricula. This integration will ensure that future professionals and students receive comprehensive training and education on these important topics.
6. **Private sector involvement:** The project will engage the private sector in all the projects components, including financial institutions, forestry companies and forest owners, in the implementation of sustainable practices. This involvement may take the form of partnerships, capacity-building initiatives, loans and financial support; and sharing of best practices to promote the adoption of sustainable forest management approaches within the private sector.
7. **Civil society and community organizations involvement:** The project will actively involve civil society and community organizations, such as non-governmental organizations (NGOs) and local community groups, in project activities. These organizations can play a vital role in raising awareness, mobilizing communities, and ensuring the participation of local stakeholders in decision-making processes related to forest management.
8. **Policy dialogue between public, private, and NGOs:** The project will facilitate policy dialogues and collaborative platforms where representatives from the public sector, private sector, and NGOs can come together to discuss policy frameworks, share insights, and develop strategies for promoting sustainable forest management. This dialogue will help align priorities, address challenges, and create an enabling environment for effective knowledge transfer and implementation.
9. **Rural community education:** The project will prioritize educating and training rural communities on sustainable land and forest management practices. This may involve workshops, demonstrations, and targeted capacity-building initiatives aimed at enhancing farmers' understanding of climate adaptation, agroforestry, and sustainable land use practices.

PROJECT FEASIBILITY ASSESSMENT

168. The feasibility of the project has been thoroughly assessed by national and international experts, who have conducted detailed analyses documented in various working papers. These analyses serve as the basis for the project proposal and supporting documents. The feasibility assessment examines the coherence of the proposed project interventions with the relevant laws, policies, and strategies governing the sector. It also evaluates the project against the investment criteria of the GCF and emphasizes its contribution to the UN Country Framework, including the FAO. Furthermore, the assessment highlights the economic and financial viability of the project and presents different options and scenarios for investment examination.
169. The project activities respond to the main root causes and bottlenecks identified to a sustainable, adaptive, efficient, effective and transparent management of the forest – energy security and decarbonization nexus are (I) High CC Adaptation deficitxx of forests stakeholders to guarantee for key ecosystems services (energy, protection, livelihood, others. (II) Incomplete mechanisms for forest management and carbon governance and (III) Limited capacities and incentives for private sector and community engagement in sustainable forest management and decarbonization. Further information on how the project will address the barriers are included in Table 23.

Table 23: Main barriers addressed by the project

Main Barrier	Rationale	Activity	Contribution of the project
(I) High CC Adaptation deficit ^{xxi} of forests stakeholders to guarantee for key ecosystems services (energy, protection, livelihood, others)	Forest productivity is decreasing while the need for ecosystem services (e.g. energy, livelihood, protection, and carbon removals) is increasing and forests are at the brink of overexploitation. Existing investments in forest's restoration and reforestation are still based on a BAU scenario with limited biodiversity that does not include climate change nor the potential benefits deriving from ecosystem services and their role in sustaining key national strategies for climate, energy security and rural development. Institutions operating in the forestry sector and their infrastructure (e.g. nurseries, forest roads and fire breakers among other) are currently not prepared to address the adverse impacts of climate change nor to face the current energy crisis initiated with the Ukraine war.	<p>1.1.2: Develop guidelines for decision-makers on AFOLU to prevent soil degradation.</p> <p>2.1.1: Upgrade public nurseries</p> <p>2.1.2: Train and support operators of public and private nurseries in the production of diverse and climate-adaptive forestry seedlings</p> <p>2.2.1: Produce guidelines on climate adaptive silviculture.</p> <p>2.2.2: Train public and private stakeholders in climate adaptive silviculture (CAS)</p> <p>2.2.3: Upgrade the National curricula of the faculty of forestry and vocational schools working on forestry, agriculture and accounting with introduced practices and technologies</p>	<p>Support to investments and on-the-job training to rehabilitate degraded soils and forests. (O 1.1)</p> <p>Capacity development and engagement of public and private stakeholders in Climate Adaptive Silviculture (CAS) (Output 2.2)</p> <p>Upgrade of nurseries to ensure the production of climate-adaptive seedlings for CAS investments. (O 2.1)</p> <p>Technical assistance to produce missing guidelines and intervention protocols. (O 2.2)</p>
(II) Incomplete mechanisms for forest management and carbon governance	Stakeholders lack the necessary knowledge, tools, and mechanisms to manage forest resources efficiently and sustainably. The management of forests is hindered by an incomplete governance framework that fails to incorporate ecosystem services adequately and maximize potential from both adaptation and mitigation benefits. The lack of perspective and evidence-based reporting on the status of national forests, evidenced among others by the outdated NFM and the incomplete MRV ^{xxii} system, deters private sector actors from	<p>1.1.1: Establish the National Forest Monitoring System (NFM).</p> <p>1.1.3: Create national standard for biomass production / handling for energy purposes.</p> <p>1.1.4: Develop the national strategy, action plan and execution guidelines for Short Rotation Plantations.</p> <p>1.2.2: Support the development of Serbia's Article 6 strategy related to "AFOLU" opportunities</p> <p>1.2.3: Promote and support knowledge-sharing at the regional level</p>	<p>Provide framework and capacity development for forest monitoring and assessment, climate smart silviculture, mitigation of forest degradation drivers and for stakeholders to engage with carbon finance for AFOLU. (O 1.1; O 1.2.)</p> <p>Technical assistance to produce missing policy documents, standards, and guidelines. (O 1.1)</p> <p>Technical assistance to establish forest and land aggregation tools and practices. (O 3.1)</p>

	<p>(i) investing in the sustainable use of forest resources (e.g. green biomass fuel), (ii) adapting their businesses through forestry and (iii) paying for key ecosystem services such as carbon removals. Forests are at the core of the national strategic framework, nonetheless, their role is hampered by the lack of standards, policies and regulations surrounding their sustainable utilization. Consequently, forests are more exposed and vulnerable due to unregulated local extraction of wood biomass, inadequate fuelwood management, and the absence of standards to address emerging priorities like decarbonization (Annex 2, Appendix 8, and Appendix 12).</p>	<p>1.2.4: Support access to voluntary carbon finance for forestry to enable sequestration beyond NDC targets and to ensure long term sustainability</p> <p>1.2.5: Enable insetting as part of company decarbonization strategy support</p> <p>3.1.1: Convert degraded private coppice stands into high forest 170.</p>	
(III) Limited capacities and incentives for private sector and community engagement in sustainable forest management and decarbonization	<p>Forest management is fragmented, exclusive to public forests and with limited participation of municipalities and their communities. 47% of forests are private and property is highly fragmented and often not managed (average forest smallholding is 0.3 ha) and landowners have limited possibilities to engage in forest management. Additionally, the current absence of programs and policies to systematically involve private operators and other key stakeholders in the forestry sector and in the provision of ecosystem services such as energy and carbon removals excludes de facto a large share of forests from being sustainably managed. Finally, the contribution of</p>	<p>1.1.2: Develop guidelines for decision makers on AFOLU to prevent soil degradation</p> <p>1.1.4: Develop the national strategy, action plan and execution guidelines for Short Rotation Plantations (SRP)</p> <p>3.1.1: Convert degraded private coppice stands into high forest</p> <p>3.1.2: Rehabilitate unfarmed private lands through forestry investments such as short rotation plantations, agroforestry or soil rehabilitation purposes</p> <p>3.1.3: Establish shelterbelts in agricultural landscapes</p> <p>3.1.4: Engage private actors in sustainable biomass value chains</p>	<p>Support private investments in forestry and soil rehabilitation, e.g. agroforestry, short Rotation Plantations (SRP), shelterbelts, degraded coppice conversion to include agrifood companies in the decarbonization and forest management processes of the country. (O 1.1; 3.1)</p> <p>Provide the tools and knowledge to ensure aggregation of forest owners to overcome fragmentation and allow economies of scale in forest management. (O.3.1)</p> <p>Provide technical support to biomass platforms to provide sustainable and high-quality biomass</p>

	other actors such as the agrifood companies and financial institutions reduce the effectiveness of existing strategies around forestry as their involvement is paramount in ensuring that forests can play a key role in the decarbonization and energy security of the country.	3.1.5: Support platforms involving stakeholders of the forestry and agricultural sector for a modern and transparent biomass energy value chain 3.2.1: Involve agribusiness and other companies in the decarbonization process of the private sector 3.3.2: Support to chamber of commerce and the association of financial institutions and academia to train decarbonization service providers	ensuring private sector's contribution to fuelwood extraction. (O.3.1) Provide technical assistance and linkages between agribusiness, forestry, public and banking sector to ensure access to finance and innovative and sustainable investments in forest management and decarbonization (O 3.1; O 3.2.; O 3.3)
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171. The project's alignment with national policies, strategies, and international commitments, as well as national laws and regulations, is summarized in tables (17-18), demonstrating how the project adheres to existing climate change policy frameworks and sector-specific standards. In cases where specific laws and standards are not yet established, the project will be assessed based on available international standards and legal frameworks implemented in similar contexts in other countries.

Table 24: Contribution of the proposal to the main national strategies, policies and international commitments⁵¹

#	Policy/Strategy	Addressed Priority	Contribution	Comp.
1	Low Carbon Development Strategy with action plan (2019)	Specific objective 2: Reduce GHG emissions not covered by the EU-ETS by 9.7 percent in 2030 and between 33.5 percent and 54.5 percent by 2050 compared to 2010.	5 decarbonisation service providers (e.g. accountants/auditors) are operational.	3
			USD 50 million loans are disbursed to private sector companies to execute their respective decarbonisation strategies (including insetting). No financial support will be provided for the purchase of offsets or carbon credits.	3
		Specific objective 3: Increase the carbon sink in the Serbian Forests by 17 percent by 2030 and 22 percent by 2050; compared with 2010	7 000 ha of afforestation ⁵² , 500 ha of shelterbelts established.	2,3
			33,000 ha of degraded state coppice stands converted into high forest.	2
			500 ha of abandoned & degraded agricultural land is converted into bioenergy plantations.	2
			18,000 hectares of private coppice stands is converted into high forests forest.	2
		Specific objective 5: Promote transition to climate neutral	Technical Assistance to private sector to create bankable	3

⁵¹ For additional information please see Appendix 11.

⁵² Afforestation activities will be funded on public land owned by the state or municipalities currently not devoted to any use.

		and climate resilient economy and society.	decarbonization projects and access to finance	
		General objective: Reduction of national GHG emissions by 33 percent, up to 2030, and at least 65 percent by 2050 compared to 1990.	1 national carbon offsetting ⁵³ / ⁵⁴ insetting mechanism is developed and active ⁵⁵ . Reduced emissions Involvement of the private sector in the decarbonization process	1,2,3
		Integration of climate change relevant issues into the national development strategies, including in the area of mitigation of climate change, there is a need to strengthen the institutional capacity to design, implement and monitor mitigation policies and measures, with particular attention to GHG emission reduction activities	4 National curricula (University and vocational schools working on forestry, agriculture and accounting) are upgraded with introduced practices and technologies.	2
3	Nationally determined contribution (NDC-2015-2025)	GHG emission reduction by 33 percent in 2030 compared to 1990 levels	Carbon sink of -8.4 mln CO _{2eq.} over 27 years	2,3
		Reforestation using climate adaptable tree species (5,000 ha annually by 2030)	33,000 ha of degraded state coppice stands converted into high forest.	2
		Conversion of coppice into high forests (7,000 ha annually by 2030)	33,000 ha of degraded state coppice stands converted into high forest.	2
			18,000 hectares of private coppice stands is converted into high forests forest.	2
4	National Adaptation Plan (2015-2021)	Establishment of new forests (total target area should amount to 6,000 ha per annum)	7, 000 ha of afforestation and 500 ha of shelterbelts/windbreaks established.	2
		Improving the quality of forests.	500,000 ha under sustainable and climate adaptive silviculture management.	1
5	National Communications (2013, 2017, 2020)	Increase adaptive capacity of forests, adaptive management of forests and forest resources	Establishment of a National Forest Monitoring and Assessment System.	1
			200 operators of public and private enterprises, including nurseries, supported and trained in the production of diverse and climate adaptive forestry.	2

⁵³ The possibility of including a blockchain technology approach to offsets to ensure transparency and efficiency of the process is currently being evaluated. A study is currently ongoing and results will be available during the design phase.

⁵⁴ The price of offsets is currently being studies. A detailed market analysis and pricing strategy for the country will be provided with the full funding proposal.

⁵⁵ The project and the NDA will formulate the proposed mechanism following the best practices from France, California, UK, Colombia, New Zealand and Australia

			2 public nurseries upgraded to ensure the production of climate adaptive seedlings.	
		Choice of adequate tree species and change of forest management practices	500,000 ha under sustainable and climate adaptive silviculture management.	1
			33,000 ha of degraded state coppice stands converted into high forest.	2
		Rehabilitation of degraded lands by afforestation and prevention of erosion and land slide of forests	500 ha of abandoned & degraded agricultural land ⁵⁶ are cultivated with fast-growing wooden species in short rotation for energy use	2
		Development of a reliable and timely activity data collection system to estimate GHG emissions and removals.	Establishment of NFMA system. Regional knowledge sharing platform for national offsetting/insetting mechanisms in place.	1
		Development and improvement of country-specific emission factors and other parameters, including supporting methodologies.	One national carbon offsetting / insetting mechanism is developed and active.	1
		National Forest Inventory and integrated information system.	Establishment of NFMA system Upgrade of the MRV system to address the forest sector. Regional knowledge sharing platform for CAS in place.	1
		Improving cross-sectoral cooperation and incorporating aspects of climate change into planning documents in the forestry sector.	1 national strategy for wood energy plantations prepared.	1
			2 Guidelines on climate adaptive nursery production and planting developed.	1
6	Forestry Development Strategy of the Republic of Serbia (2006) - not adopted	Conservation and improvement of the state of forests and the development of forestry as an economy branch.	500 ha of abandoned/degraded land is converted into bioenergy plantations. 1 national carbon offsetting/insetting mechanism is developed and active.	1,2
		Increase of the area under forest cover, which is necessary for increasing the contribution of forest sector to the State economy	7,000 ha of afforestation 500 ha of shelterbelts/windbreaks established.	2
7	Forestry Development Program (2010) ⁵⁷	Provision of forest seed and planting material and preservation of the gene pool of forest trees	33 million climate adaptive seedlings (local species/varieties) produced.	2
			2 public nurseries (Vojvodina/C. Serbia) upgraded and operational.	2

⁵⁶ The accredited entity will launch dedicated surveys and assessments to map the interest of households for planting forests on the abandoned agricultural and other bare lands in the regions of East Serbia and Vojvodina.

⁵⁷ The program has not been adopted yet.

		System of planning in forestry	Establishment of the NFMA.	1
		Climate change mitigation (organized promotion of use of wood biomass for energy production)	1 platform involving stakeholders of the forestry and agricultural sector to support a modern and transparent biomass value chain. 1 national standard for biomass is endorsed 1 national strategy for wood energy plantations prepared.	1,3
8	National voluntary Land Degradation Neutrality targets	Improvement, restoration, rehabilitation of degraded areas, implementation of measures of sustainable land management.	500 ha of abandoned/degraded land are cultivated with fast-growing wooden species in short rotation for energy use	3
		To increase the area of national territory under forests to 41.4 percent by 2050	7,000 ha of afforestation 500 ha of shelterbelts/windbreaks established.	
9	Biodiversity strategy of the Republic of Serbia (2011)	Promote the conservation of forest biodiversity, including genetic diversity, through the development of a forest certification programme and best practice guidelines for ecosystem-based sustainable forestry.	33 million climate adaptive seedlings (local species/varieties) produced.	2
		Develop forest management measures and guidelines to prevent genetically modified tree species, as well as non-native and invasive species, from negatively impacting on forest and general biodiversity.	2 Guidelines on climate adaptive nursery production and planting developed	2
10	National strategy for Sustainable Use of Natural Resources and Goods (2012)	Embed the aspect of climate changes in all long-term investments (in particular, in the biological works such as amelioration of coppice and degraded forests and afforestation, primarily in the selection of types and technology of works).	33,000 ha of degraded state coppice stands converted into high forest. 18,000 hectares of private coppice stands is converted into high forest.	2,3
11	Promote the conservation of forest biodiversity, including genetic diversity, through the development of a forest certification programme and best practice guidelines for ecosystem-based sustainable forestry.	Preservation of biological diversity at the genetic, species and ecosystem level.	33,000 ha of degraded state coppice stands converted into high forest.	2
		Monitoring the impact of climate change on biodiversity and the impact of biodiversity on mitigating the effects of climate change.	Establishment of a NFMA.	1

	Develop forest management measures and guidelines to prevent genetically modified tree species, as well as non-native and invasive species, from negatively impacting on forest and general biodiversity.			
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Table 25: Contribution of the project to the FAO Country Programme Framework 2022-2025

CPF Outcome	Component	Main Contributing Activities
<i>Serbia adopts and implements climate change and environmentally friendly strategies that increase community resilience, decrease carbon footprint and amplify equitable benefits of investments.</i>	Component 1 Component 2 Component 3	Sustainable forest management Creation of shelterbelts. Restoration of degraded and abandoned agricultural lands via forestry investments. Support to the decarbonization of the agriculture sector. Training and capacity development.
<i>Natural and cultural resources are managed in a sustainable way</i>	Component 1 Component 2 Component 3	Introduction of Climate Adaptive Silviculture (CAS) practices and investments in the restoration / natural regeneration / reforestation in public lands. Conversion of coppice stands into high stand forests. Enhancing the fund-raising opportunities in the forestry sector. Greening of the wood biomass value chain. Training and capacity development.
<i>Equitable economic and employment opportunities are promoted through innovation</i>	Component 3	Support to the decarbonization of the agrifood sector. Greening of the wood biomass value chain. Training and capacity development.

172. Following consultations with the Ministry of Agriculture Forestry and Water Management, other national institutions, UN agencies, civil society and private sector stakeholders, the Government of Serbia and FAO agreed to implement FAO's Country Programme Framework (CPF) focusing on three priority areas during the period 2019-2022. Building on FAO's past experience in the country and its comparative advantages - and in line with key national strategies, the project will contribute to each priority area. Additionally, the project will strengthen the EU accession process focusing on alignment to the EU Common Agricultural Policy (CAP), environmental protection and standards.

173. The main elements of the feasibility are reported in tables 24,25, and 26. For the economic/financial, social/gender and environmental feasibility detailed information is reported in Annex 3/25, 8 and 6. Concerning climate and water details and additional information are available in the chapters 3 and 4 of this document.

174. The proposed project is developed in accordance with GCF investment criteria and in adherence with the principle of national ownership. The scope and objectives of the projects have been defined in consultation with national stakeholders taking into account all the relevant climate change strategies, national adaptation plans and NEMAs. More information about the other investment criteria provided in the table below (Table 22)

Table 26: Component 1 main elements of feasibility

Component 1: National level upscaling of sustainable and climate adaptive silviculture and carbon finance framework						
Project Component/Sub-component	Climate Relevance ⁵⁸	Coherence with National Policies and Standards ¹	Technical Feasibility	Economic Feasibility ⁵⁹	Social Feasibility ⁶⁰	Environmental Feasibility ⁶¹
Output 1.1: Forest management and monitoring policy framework for climate adaptive silviculture enhanced and disseminated	<p>Forest degradation, along with resulting habitat loss and fragmentation, is one of the key environmental problems at present, resulting in loss of forest carbon, biodiversity and other key ecosystem goods and services, including the potential to act as carbon sinks</p> <p>The project addresses the adaptation deficit of forestry and accelerated degradation of forests due to climate change.</p> <p>The project aims to address root causes of forest degradation, including land-use change</p>	<p>The project is aligned with major national policies and strategies, including the Low Carbon Development Strategy (LCDS), Instrument for EU Pre-Accession Assistance IPA II ; National Communications (2013, 2017, 2020); Forestry Development Strategy of the Republic of Serbia (2006) ; Biodiversity strategy of the Republic of Serbia (2011) through upgrading the National MRV system, improving educational curricula, establishing a National Forest Monitoring and</p>	<p>The establishment of a national monitoring and assessment system will provide valuable information on forest dynamics and contribute to addressing climate change impacts on forest ecosystems. It will also enhance the exiting carbon monitoring, reporting and verification system of Serbia by bringing it up to international standards.</p> <p>The project will assist public and private stakeholders to get involved in climate</p>	<p>Forest provided job opportunities and non-wood forest products (NWFPs) such as mushrooms, herbs, honey, and berries. These products are estimated to generate an annual value of approximately USD 39.6 per ha per year. Additional ecosystem services associated include pollination, direct and indirect protection from natural hazards, tourism, and flood protection, forest</p>	<p>The project will place special attention on monitoring the state and changes of forests, and on their social, economic and environmental functions, to provide evidence and inform authorities as well as the public in a transparent and consistent manner on the forest sector's performance.</p> <p>The project aims to raise awareness, stimulate public discussions and involve communities to enhance</p>	<p>Through using the FLR approach and focusing on climate change adaptive silviculture practices, the project contributes to restoring degraded landscape and enhancing forest management</p>

⁵⁸ Details on climate change and climate change adaptation are above in chapter 3

⁵⁹ Details of the economic and financial feasibility are available in Annex 3

⁶⁰ Details on social feasibility are available in Annex 6 and Annex 8

⁶¹ Details on environmental feasibility are available in Annex 6 and above in Chapters 3 and 4.

Output 1.2. Enabling framework for national institutions to engage with carbon finance for AFOLU created			.	The voluntary carbon market has grown considerably over last five years to reach approximately USD 2 billion in 2022 with expectations of further growth to between US \$5 billion to US \$50 billion by 2030. The financial flows obtained could provide significant and sustainable support to nature-based climate solutions in the country.		
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Table 27: Component 2 main elements of feasibility

Component 2: Improving energy security and livelihood from climate resilient forest ecosystem and GHG emissions reductions from increased carbon sinks and decarbonization opportunities						
Project Component/Sub-component	Climate Relevance ⁶²	Coherence with National Policies and Standards ¹	Technical Feasibility	Economic Feasibility ⁶³	Social Feasibility ⁶⁴	Environmental Feasibility ⁶⁵
Output 2.1: Production of climate-adaptive seedlings enhanced	The project's investments in forest nurseries, raising knowledge on CAS and restoring coppicing stands and afforested land will not only support the establishment of new forested areas and restoration of degraded coppice forests but also contribute to the long-term objective of increasing the country's forest area to 41% by 2050, thus enhancing climate resilience and carbon sequestration.	The project is aligned with the Draft Low Carbon Development Strategy with Action Plan in: restoring forest ecosystems and promoting ecosystem-based adaptation approach, increasing genetic and species diversity within the restored areas, and enhancing species diversity by mixing different trees and shrubs in restoration sites	The project will support forest stakeholders with: (i) technology and knowledge transfer; (ii) reducing the atrophic pressure caused by fuel wood; and (iii) addressing the governance of forests' stakeholders ensuring the participation and action of private owners and local public administrations and communities.	Overall, the economic returns of the forestry interventions are largely positive. All public investment generates positive Economic-IRR and Economic- NPV all forestry investments are largely solid from an economic standpoint (more details in Annex 3) Conversion of coppice to high forest result in 30% more productive forests. At the beginning of the conversion cycle, approximately 25m3 of wood can be extracted per hectare from thinning activities and sold to population.	The project will work with Serbian stakeholders to ensure a 360-degree approach to forestry where climate change and its adverse impacts are addressed fully.	Transferring technology and knowledge with on-the-job trainings to forests' stakeholders is a precondition to secure the highest possible survival rate of forestry investments and to ensure their long-term climate proofing.
Output 2.2 – Knowledge on climate adaptive silviculture (CAS) of key stakeholders enhanced						
Output 2.3: Public and private forest land restored and afforested in a climate adaptive and participatory manner						

⁶² Details on climate change and climate change adaptation are available above in chapter 3

⁶³ Details of the economic and financial analyses are available in Annex 3

⁶⁴ Details on social feasibility are available in Annex 6 and Annex 8

⁶⁵ Details on environmental feasibility are available in Annex 6 and above in chapter 3 and 4.

Table 28: Component 3 main elements of feasibility

Component 3: Engaging Private sector in climate adaptive silviculture and decarbonization investments						
Project Component/Sub-component	Climate Relevance ⁶⁶	Coherence with National Policies and Standards ¹	Technical Feasibility	Economic Feasibility ⁶⁷	Social Feasibility ⁶⁸	Environmental Feasibility ⁶⁹
Output 3.1. Private sector contribution to climate resilience of forests enhanced through climate adaptive and diversified investments and greening of the biomass value chain initiatives	<p>The project aims to enhance long-term climate resilience and forest sustainability in Serbia.</p> <p>The project will support the private sector in adopting sustainable and climate-adaptive forest management practices, encourages agroforestry, and promotes greener fuelwood value chains.</p>	<p>The project will support the decarbonisation path of Serbia by enhancing the operationalization of the existing legal framework (e.g. Climate Change Law, 2021) and supporting the private sector decarbonisation efforts. unavoidable emissions. 47% of forests are under private ownership and the fact that the state-owned areas for afforestation are limited in scale, call for an active involvement of non-state actors to reach the national forestry targets stated in the Draft Low-Carbon Development Strategy with Action Plan</p>	<p>The project will work with both cofinanciers and national institutions (national banks and investment funds) to provide companies in Serbia with the needed technical assistance and possibility to access financial resources to invest in best available technologies for decarbonisation and to apply the possibility of offsetting and insetting.</p> <p>The project will work with the Ministry of Agriculture, Forests and Water Management (MOAFWM), the respective PEs and private landowners to pre-identify forest stands for project intervention</p>	<p>Overall, the economic returns of the forestry interventions are largely positive. All public investment generates positive Economic-IRR and Economic-NPV</p> <p>All forestry investments are largely solid from an economic standpoint (more details in Annex 3)</p> <p>Conversion of coppice to high forest result in 30% more productive forests. At the beginning of the conversion cycle,</p>	<p>The project aims to address the important role of fuelwood in the lives of local rural communities and the rural and urban poor.</p> <p>The project will ultimately enhance energy security for vulnerable populations, particularly those at higher risk of poverty, and promote their well-being.</p>	<p>The project will be working with financial institutions to provide technical assistance and finance for climate change adaptation and decarbonization strategies, creating incentives for private sector engagement in forestry management and reducing dependence on national and international financial support.</p>

				approximately 25m3 of wood can be extracted per hectare from thinning activities and sold to population.		
Output 3.2. Mobilized private finance for agribusinesses involved in decarbonization processes	The outputs increase agribusiness firms', banks and service providers capacities to assess the potential for decarbonization, to incorporate climate-related risks in their production decisions, assist them in defining their decarbonization strategies and facilitate linkages with financial institutions to meet their eventual funding requirements.	The actions are in with the policy framework, in particular the climate change law and the low carbon development strategy that aims at a low carbon industry and Serbian society	The Technical Assistance provided through the project will ensure that decarbonization projects are bankable and also technical feasible. Furthermore, they provide capacity development to local service providers to carry out consultancy beyond the project and the sectors tackled	The project maintains a positive stream of aggregate economic returns under different sensitivity analyses, even when factoring in fluctuating carbon prices and climate change scenarios. Additionally, scenarios assuming 75%, 50%, and 0% loan disbursements for the decarbonization investments were evaluated. In all cases—except for the 10-year scenarios—the	The agrifood sector is one of main importance for employment in the country. Every measure that increases its competitiveness has therefore a strong positive impact on the social aspects.	Carrying out the project will ensure that agrifood production is decreasing GHG emissions. Furthermore, many synergies with circular economy will be activated and in this regard the project will have positive impacts on more environmental aspects beyond climate change.
Output 3.3. Financial institutions, consultancy service providers, and academia capacitated on climate-related challenges and opportunities						

⁶⁶ Details on climate change and climate change adaptation are available above in chapter 3

⁶⁷ Details of the economic and financial feasibility are available in Annex 3

⁶⁸ Details on social feasibility are available in Annex 6 and Annex 8

⁶⁹ Details on environmental feasibility are available in Annex 6 and above in chapter 3 and 4.

				<p>aggregated economic outcomes remain positive, regardless of variations in carbon prices.</p> <p>Even in a scenario where no loans are disbursed, the project's aggregated economic results remain positive over a 20-year horizon, with an EIRR of 11.5% and an NPV of US\$39.7 million.</p>		
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Table 29: Coherence of the proposal against GCF Investment Criteria

	Indicator	Expected Result	Rationale
Impact Potential	Project lifetime emission reductions (in tonnes of carbon dioxide equivalent)	8.4 million tonnes of CO _{2eq}	<p>The project will increase the capacity of public and private forests to remove CO₂, it will reduce the negative impact of drivers of forest degradation, and it will support Serbian companies to decarbonize their processes and increase their resilience.</p> <p>With regards to mitigation impacts, the project used FAO NEXT, a tool specifically designed for evaluating the carbon impact of projects in the AFOLU sector that uses IPCC methodology (Annex 22).</p>
	Expected change in loss of lives, value of physical assets, livelihoods, and/or environmental or social losses due to the impact of extreme climate-related	<p>558,000 hectares of public and private forests are under CAS/SFM</p> <p>3.6 mln beneficiaries</p>	The project will transfer to Serbia the knowledge, technology and CAS practices needed to reduce the climate change and adaptation deficit of public and private forest stakeholders, as well as to enable the forest sector to become more resilient to climate change and contribute effectively and efficiently to the national decarbonization process. The adaptation impact of this proposal on ecosystem and ecosystem services originates from the estimation that every year 1/10 of the Forests

	disasters and climate change in the geographical area of the GCF intervention.		Management Plans (FMPs established with the 2010, Law on Forests) will be developed with climate adaptive silviculture practices and executed. This is calculated based on current capacities of forestry institutions. Concerning the number of beneficiaries, the proposal included those that will be included in the trainings and capacity development programs as well as those that will benefit directly from forests and new forests in terms of disaster risk reduction, improved access to non-wooded products and biodiversity.
Paradigm Shift	Project Vision	<p>IF the forestry sector is climate resilient and forests are restored and managed according to climate adaptive management protocols by all concerned stakeholders, THEN forest ecosystems will stabilize and grow providing essential ecosystem services to vulnerable communities while supporting Serbia's low carbon development targets BECAUSE the transfer of knowledge and technology, coupled with climate-sensitive forestry investments, and clear, transparent, and inclusive governance mechanisms for forests and carbon, will serve as a guarantee for the resilience of both forests and communities.</p>	<p>The paradigm shift of the project lays on three pillars. First, the adaptation, renewable energy, poverty alleviation and decarbonization strategies of Serbia are strictly connected to the health of forests and their capacity to provide for key ecosystem services such as carbon removals, energy, livelihood, water and protection. Therefore, the adaptation of the forestry sector, the expansion of forest areas and the reduction/removal of the negative impacts of drivers of forest's degradation are preconditions for the adaptation of the most vulnerable people and communities as well as decarbonization in Serbia. Second, the governance of forests as well as provision of ecosystem services (i.e. carbon removals, biodiversity, non-wooded forest products, protection and fuel biomass) can no longer be delegated to central institutions only (Component 1). It requires new paradigms where communities, local authorities and the private sector could effectively participate and invest. Therefore, the project will enhance stakeholders' participation to provide the forestry sector with new approaches for people to engage and additional financial resources making the sector less dependent on national budget or external donors. Third, transparency and evidence-based forest monitoring and reporting are paramount to secure the trust of national and international stakeholders and to assure that reported data about forests and emissions are verified (Component 1). Through the three pillars the project will support Serbia in transforming the forest from "mines" to effective and transversal engines of sustainable and climate resilient development.</p> <p>Innovation: The project offers an innovative approach to forest investments, forest management and mobilization of private actors in getting involved in decarbonization processes. As presented in the Theory of Change, the combination of climate adaptive silviculture practices and investments (Component 1 and 2), improvements in governance / institutional capacity development of stakeholder (Component 1) and involvement of communities and the private sector (Component 2,3) will increase carbon removals from the forest sub-sector and ensure the adaptation of the poorer and most vulnerable communities while enhancing biodiversity and ecosystem services.</p> <p>Initiating the decarbonization process or addressing poverty in rural areas without addressing forests and community reliance on key ecosystems services such as energy and livelihood is not cost effective as it will not guarantee adaptation impacts nor reduce net emissions. Coherently the project will introduce a number of innovations: (I) introducing climate adaptive silviculture practices, technologies and investments; (II) addressing forests with a crosscutting approach to ensure that investments in adaptation also yield mitigation and poverty alleviation results; (III) involving the diverse actors of the sector in the decision making process; (IV) ensuring the instruments and</p>

		<p>technical assistance to private sector companies to engage in decarbonization also via forestry; (V) establishing digital tools to aggregate and engage private owners of land and forests; (VI) creating the linkages with national banks and investors with private sector companies interested in decarbonization and forestry; and (VII) guaranteeing with no additional costs quantifiable benefits such as: (a) increased biodiversity in forest and agriculture land; (b) expansion of bio-corridors; (c) socio-economic condition of rural households; (d) protection from disasters; and (e) soil erosion control. Each innovation is detailed with the FP and the Economic and Financial Analysis of the project. Finally, supporting the country in establishing a national offsetting and insetting mechanism will also allow to include soil carbon and therefore expand the mechanism to the entire agriculture sector.</p> <p>Potential for scaling up and replication: The established mechanisms and introduced practices / technologies will allow the country to scale up introduced investments on over 1,717,360 ha representing the MOAFWM's target for 2022-2030⁷⁰ and expand it on the entire forest cover and the agriculture sector. Furthermore, the proposed theory of change and intervention strategy are replicable in the entire Balkan where the forestry sector is confronted with similar bottlenecks and drivers of degradation, the project will support the knowledge sharing at regional level to ensure immediate scaling up of activities through FAO offices. In terms of adaptation, the activities of the project will allow stakeholders to expand the adaptation benefits to all the rural communities in Serbia. In addition, within the lifespan of the project - this proposal will create high potential for attracting all companies and contribute to the national offsetting / insetting opportunity. Finally, the project will work with public and private stakeholders including key associations such as the Chamber of Agriculture, the Serbia Grain Association, the Chamber of Commerce, Association of Financial Institutions, the Forest Owner Guild, SerBio and other associations as well as with renowned NGOs such as WWF-Serbia, BirdLife Serbia and NALED to ensure immediate scale up to the whole country. This will increase the ownership and participation of the private sector into the process supporting the scale up and replication at the national level of the project's activities. Finally, the AE is currently in the process of developing similar projects in the Republic of Moldova, North Macedonia and other countries and it will apply a blueprint approach⁷¹. In addition, the project will enable companies to access already available green loans aimed at decarbonizing their processes. This will create high potential for attracting other companies in the future and contribute to the national offsetting market.</p>
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⁷⁰ In the period 2022-2030, Serbia has planned to invest (if resources will be available) in: 48,000 ha of afforestation, 4,000 ha of shelterbelts, 199,200 ha of natural regeneration, 6,000 ha of plantation (mainly poplar), 1,258,440 ha of coppice stands restored of which 922,400 converted into high stands, and protection of forests from weather hazards on 201,720,000 ha.

⁷¹ The current project blueprint approach as well as the main architecture of this concept note have been discussed and agreed with the NDA of the Republic of Moldova and it's currently being discussed with the NDA of the Republic of North Macedonia.

		<p>Potential for knowledge sharing and learning: the project will invest in trainings and capacity development of both public and private stakeholders in each component. As reported in funding proposal, the project will build and develop capacities of over 4250 persons investing over USD 8 million. Additionally, to further ensure long-term sustainability beyond the execution of funded activities and the project life cycle, the project will fund and coordinate with the Ministry of Education, Science and Technological Development the upgrade of national curricula (universities and vocational schools) related to topics covered by the project such as sustainable forest management practices. Finally, partnering with communities, civil society organization and universities will prove critical in maximizing the project's impact in terms of disseminating knowledge and retaining implementation best practices related to decarbonization. Finally, the project will share lessons learned and best practices in the region to support and enhance knowledge sharing in the region.</p> <p>Contribution to the creation of an enabling environment: The establishment of the National Forest Monitoring and Assessment System (NFMA), the upgrade of the MRV system, the establishment of the offsetting/insetting scheme as well as the standards and strategy for fuelwood production/handling/management/use will strengthen the regulatory framework of the forest sector and will have a spill-over effect in other sectors of the Serbian economy. Combined with the decarbonization strategies (Component 3) of companies, the project will set up the enabling conditions for the private sector to keep being engaged in the long-term decarbonization of the national economy, for the agriculture sector to contribute to the decarbonization process and to create new market opportunities in the forestry sector (e.g. green biomass) and for private forest owner to engage in both decarbonization and forest management.</p> <p>Contribution to the regulatory framework and policies: the project will abide to and contribute to the execution of the climate change policy framework of Serbia (table 17 above) contributing to a number of processes such as the forest management, the energy efficiency, the renewable energy, the NDC, and others. Furthermore, the project will ensure the provision of non-financial incentives (e.g. technical assistance and evidence based decarbonization governance) and will contribute to enable key financial support (leveraged financing) from national finance institutions to the private sector to promote investments in low-emissions and climate resilient development.</p> <p>Overall contribution to climate resilient development pathways is consistent with a country's climate change adaptation strategies and plans: the project will induce a radical transformation of how forests contribute to adaptation, mitigation and poverty reduction in Serbia. Furthermore, by involving – according to their functions and potential – stakeholders, the project will ensure a considerable reduction of national expenditures to secure high carbon removals from forest. Finally, the project will radically change the way private sector owners of forests participate and engage in</p>
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			the management of forests and in the provision of ecosystem services (e.g. fuelwood production, carbon removals).
Sustainable Dev.	Economic co-benefits		Directly monitorable benefits will originate from: (I) the improved efficiency of wood biomass used for fuel that will reduce the energy expenditures of the poor and the most vulnerablexxiii; (II) the increased value added from NWFP markets (example, fruits, beekeeping etc.) and eco-tourism thanks to the increased biodiversity and greater forest cover; ; (III) the potential benefits that will originate from the degraded private lands converted to bioenergy plantations and from the agricultural lands protected by shelterbelts. With regards to energy, the lower unit cost of energy will enhance affordability of energy for the poorest segments of the population. In Serbia, households currently spend more than 10% of their average expenditure on energy. Coupled with environmental / energy efficiency awareness campaigns to avoid increase of consumption of fuel wood, lower fuel costs will also imply a lower share of overall spending going toward energy, freeing up resources for other household needs.
	Social co-benefits		Thanks to the introduced practices and technologies the project will contribute to creating new jobs and new markets (e.g. CO ₂ management, green biomass, climate adaptive nurseries). Furthermore, relevant co-benefits of reducing the adverse impacts of fuelwood include distinctive social benefits as project's activities will help reduce poverty in Serbia in three ways: (i) improved quality of fuelwood with energy efficiency gains; (ii) greater transparency of the solid biofuel value chain, and (iii) enhanced economic opportunities through the sector's modernization. First, the availability of higher quality fuelwood (drier with higher calorific potential) will increase energy efficiency at the household level. Households are expected to face a lower unit cost for energy output produced by fuelwood. This lower unit cost of energy will enhance affordability of energy for the poorest segments of the population. In Serbia, households currently spend more than 10% of their average expenditure on energy. Coupled with environmental / energy efficiency awareness campaigns to avoid increase of consumption of fuel wood, lower fuel costs will also imply a lower share of overall spending going toward energy, freeing up resources for other household needs. Second, the project will enhance transparency around fuelwood availability and quality. Specifically, rural consumers will have greater knowledge on the correct user behavior and around fuelwood types and heating appliances to make more informed consumption decisions. Third, the modernization of the biomass sector will create economic opportunities in rural areas, directly benefiting the population of these areas. A detailed description of how the proposal will involve and engage private sector operators is available in table 10
	Environmental co-benefits		In addition to the presented positive impacts in terms of CCA and CCM, the project will have positive impacts on biodiversityxxiv, on soil qualityxxv and water availability, decrease of evapotranspiration and slow down soil erosion, increase agricultural yields, and protection of rural communities and infrastructures from flash floods, floods and landslides. To this end the project will collaborate with the Serbian Water Management Directorate to ensure, among the areas to be afforested, those identified by the Water Management Strategy (2017-2034) and paramount to prevent and mitigate

			soil erosion and floods. Furthermore, via afforestation activities and shelterbelts/windbreakers, the project will support the active protection and conservation of biodiversity. These will create corridors and shelter for wild animal species and flora. Forestry investments will be executed in accordance with the Law on Nature Conservation and the Decree on the Ecological Network (Official Gazette of RS, No. 102/2010). Finally, the project will partner during the entire execution with key NGOs such as WWF-Serbia that will support and advice on community participation as well as biodiversity and nature conservation.
	Gender empowerment co-benefits		The project will benefit the entire population of Serbia with some specific focus on sectorial stakeholders and private companies. In all training and investments, when possible, the project will give higher priority to women ⁷² owning degraded coppice stands or abandoned/degraded lands cultivation of wooden species for bioenergy or other purposes and will ensure that at least 30% of beneficiaries are women.
	Sustainable Development Goals	<p>Direct Contribution: 7 Affordable and Clean Energy; 12 Responsible Consumption and Production; 13 Climate Action; 15 Life on Land.</p> <p>Indirect Contribution: 1 End poverty in all its forms everywhere 3 Ensure healthy lives and promote well-being for all at all ages 6 Ensure availability and sustainable management of water and sanitation for all 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p>	<p>Identified SDGs indicators are additional to those that will be presented in detail in the logical framework matrix of the project. SDGs will be accounted for separately. Project's indicators will be clearly described and presented in the FP.</p> <p>Direct Contributions</p> <ul style="list-style-type: none"> - Target 7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services. Indicator 7.1.2 <i>Proportion of population with primary reliance on clean fuels and technology</i> - Target 7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix. Indicator 7.2.1 <i>Renewable energy share in the total final energy consumption</i> - Target 7.3 - By 2030, double the global rate of improvement in energy efficiency. Indicator: 7.3.1 <i>Energy intensity measured in terms of primary energy and GDP</i> - Target 7.A - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology. Indicator: 7.a.1 - <i>International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems</i> - Target 12.2 - By 2030, achieve the sustainable management and efficient use of natural resources. Indicator: 12.2.1 - <i>Material footprint, material footprint per capita, and material footprint per GDP.</i> - Target 12.6 - Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle. Indicator 12.6.1 - <i>Number of companies publishing sustainability reports.</i>

⁷² A preliminary list of beneficiaries disaggregated by gender will originate from the digital cadastre of the Republic of Serbia to ensure that gender accounting is well reflected in both the baselines and targets. Depending on the results of the analysis of the cadastre targets will be increased at design.

		<p>17 Partnerships for the goals</p>	<ul style="list-style-type: none"> - Target 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. <i>Indicator 13.1.2 - Number of deaths, missing persons and persons affected by disaster per 100,000 people</i> - Target 13.2 - Integrate climate change measures into national policies, strategies and planning. <i>Indicator 13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other).</i> - Target 13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. <i>Indicator 13.3.2 - Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions</i> - Target 13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible. <i>Indicator 13.a.1 - Mobilized amount of United States dollars per year starting in 2020 accountable towards the \$100 billion commitment</i> - Target 15.2 - By 2030, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally. <i>Indicator 15.2.1 Progress towards sustainable forest management</i> - Target 15.a - Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems. <i>Indicator 15.a.1 - Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems</i> - Target 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation <i>Indicator 15.b.1 - Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems.</i> <p>Indirect contributions</p>
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			<ul style="list-style-type: none"> - Target 1.5 - By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters. Indicator 1.5.1 - <i>Number of deaths, missing persons and persons affected by disaster per 100,000 people</i> - Target 3.9 - By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination. Indicator 3.9.1 - <i>Mortality rate attributed to household and ambient air pollution</i> - Target 6.6 - By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. Indicator 6.6.1 - <i>Change in the extent of water-related ecosystems over time</i> - Target 8.4 - Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead. Indicator 8.4.1 - <i>Material footprint, material footprint per capita, and material footprint per GDP.</i> - Target 11.5 - By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations. Indicator: 11.5.2 - <i>Direct disaster economic loss in relation to global GDP, including disaster damage to critical infrastructure and disruption of basic services.</i> - Target 11.6 - By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management. Indicator 11.6.2 - <i>Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)</i> - Target 17.3 Mobilize additional financial resources for developing countries from multiple sources. Indicator 17.3.1 - <i>Foreign direct investments (FDI), official development assistance and South-South Cooperation as a proportion of total domestic budget</i>
Need of Recipients	Vulnerability	<p>558,000 hectares of public and private forests under CAS/SFM.</p> <p>3.6 mln beneficiaries</p>	<p>The forestry sector is among the most vulnerable sectors in Serbia. The reported decrease in carbon removal (-19.4% compared to 2010) is limiting the capacity of Serbia to execute the low carbon development strategy of its economy. As described in FP, the project will address the vulnerability of the forestry sector by introducing climate adaptive silviculture technologies, processes and practices and will support the country in expanding/enhancing/establishing the needed policy and legal reforms to remove the bottlenecks that are at the root of the identified climate change adaptation</p>

			deficit of the sector. The project will address the three main priority areas identified by the country for the forestry sector: (i) Risk Reduction; (ii) Monitoring and Research; and (iii) Policies, capacity building and awareness raising. Furthermore, the project will support the country in addressing the reported forest's overexploitation risk existing at local level due to fuelwood needs as well as the overall vulnerability of the population to natural hazards.
	Country's financial, economic, social and institutional needs and the barriers to accessing domestic (public), private and other international sources of climate-related finance		Public debt reached in 2020 about 58.2 % of GDP and the country is facing a recession (-1% GDP) due to COVID-19 pandemic. The country continues to implement programs that address structural weaknesses, increase public sector efficiency, and eliminate bottlenecks to private sector growth, along with maintaining macroeconomic stability including the introduction of a "green growth" program to its post-COVID-19 economic recovery efforts while responding to challenges that include a shrinking population, labor shortages, and climate change [WB, 2021]. Therefore, as reported in the NDC the country will be able to increase their share of climate change mitigation if financial support is provided. The project will only cover the additional cost of adapting to climate change and mitigation investments.
Country Ownership	Alignment with nationally determined contributions (NDCs), relevant national plans indicator, and/or enabling policy and institutional frameworks		The project will address the needs and priorities reported by the Republic of Serbia in its NDC(s) (2015 and 2021), National Communications, National Adaptation Plan, Low Carbon Development Strategy, EU-related commitments and other national policy framework. In addition, the project will contribute to implement the GCF Country Programme of Serbia, by supporting the priority areas: cluster 1 Energy efficiency and use of renewable energy sources and cluster 3 NEXUS Water Resources – Agriculture – Forestry. Additional details are available in Table 17.
	Engagement with relevant stakeholders, including national designated authorities' indicator		In March 2020 the Ministry of Agriculture, Forestry and Water Management informed FAO-REU that the project idea "Enhancing the resilience of Serbian forests through climate change adaptation and mitigation investments" submitted by the Directorate of Forests following a call for submission of project ideas issued by the National Designated Authority (NDA) in Serbia on 9 July 2019, was selected for inclusion into the Country Programme of the Republic of Serbia. The Ministry has accordingly requested FAO's support in developing a GCF full project proposal.
Efficiency and Effectiveness	Cost per tonne of carbon dioxide equivalent		The project will promote a more efficient and effective way to address forests, fuel wood and carbon removals. Private sector includes stimuli for private sector investments. Private sector investments will be incentivized and mobilized as an impact of the project via the offsets and insets. Private sector leveraged financing is also being explored with private banks and forest owners' associations. Cost per Tonne of CO _{2eq} . (GCF): USD 3 / tonne Cost per Tonne of CO _{2eq} . (Total): USD 10 / tonne
	Ratio of co-financing		GCF/COFINANCING= 1/2.5
	Expected rate of return		The economic and financial analyses highlight that the project exhibits efficiency in the achievement of its targets. The models show positive financial parameters and present 20-year IRRs higher than the financial discount rate of 7% used as a relevant cost of capital for private investment decision. On the economic side, at aggregate level and accounting for all relevant economic and ecosystem benefits, the project shows solid parameters, with a 20-year Economic IRR of 15.0% (higher than the social discount rate), an NPV of US\$ 78.4 million, and a 40-year Economic IRR of 17.6% with an NPV of US\$227.5 million.

	Application of best practices	The project will apply best practices from well-established climate adaptive silviculture experiences from Europe and other geographical areas that will secure forestry investments from design to maintenance. Additionally, the project will apply best practices from other countries (i.e. France, Australia) that have established their own national offsetting mechanisms. Finally, the project will apply biomass management best practices (e.g. wood biomass fuels standards for processing and use, creation of national biomass platforms) from Europe and other areas.
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Economic and financial feasibility

175. The economic and financial analysis of the project "Enhancing the resilience of Serbian forests and the carbon storage potential of the country to support and boost the decarbonization process through adaptation and mitigation investments" focuses on determining the net incremental financial and economic benefits generated by the project investment. The project aims to reduce national net emissions by increasing carbon removals from the forestry sector and reducing net emissions from the private sector through various measures such as increasing forest cover, transforming degraded coppice stands into high forest, implementing offsetting and insetting mechanisms, and promoting decarbonization efforts in the private sector.
176. The project has total beneficiaries comprising 3.57 mln individuals, which accounts for 54% of the national population in 2021. Indirect positive impacts are expected, including increased carbon storage, reduced emissions from fuelwood use, and enhanced market opportunities for the Serbian population.
177. The analysis conducted on various models indicates that the project efficiently achieves its mitigation targets. The economic activities stimulated by the project investment are financially profitable for the private sector and beneficiary households. The models demonstrate positive financial parameters, with a 20-year Internal Rate of Return (IRR) exceeding the financial discount rate of 7% typically used as a relevant cost of capital for private investment decisions. The forestry investments generate high net ecosystem services production with relatively low financial value, but significant economic benefits derived from ecosystem services.
178. The economic and financial analyses highlight that the project exhibits efficiency in the achievement of its targets. The models show positive financial parameters and present 20-year IRRs higher than the financial discount rate of 7% used as a relevant cost of capital for private investment decision. On the economic side, at aggregate level and accounting for all relevant economic and ecosystem benefits, the project shows solid parameters, with a 20-year Economic IRR of 15.0% (higher than the social discount rate), an NPV of US\$ 78.4 million, and a 40-year Economic IRR of 17.6% with an NPV of US\$227.5 million.
179. The project considered the impact of climate change on forestry, including temperature and water stress. Practices such as using climate-adapted tree species and replanting seedlings were implemented to increase survival rates and resilience. The models account for climate patterns by adjusting yields, harvest potential, and returns based on climate-related stressors.
180. The lending terms used in the analysis were based on the maturity and interest rates prevailing in the Serbian financial sector. Loans were expected to be repaid in equal instalments over a five-year period, with a one-year grace period.
181. The financial discount rate was set at 7% to reflect average interest rates for short-medium term loans in the context.
182. The economic discount rate of 6% reflects society's intention to value future benefits, considering increased ecosystem services and renouncing part of current consumption. The discount rate is used as a criterion for selecting viable investments with an internal rate of return (IRR) above the opportunity cost of capital.
183. The financial models were analyzed over two-time horizons: 10 years for financial prospects under market conditions and 20 years for the capitalization period of carbon sequestration investment. An additional 40-year horizon was considered to account for comprehensive deployment of ecosystem benefits from forestry investment.
184. The economic analysis considered assumptions such as the shadow exchange rate, price conversion factors, and valuation of ecosystem services. The minimum shadow price of carbon used was USD 40/CO_{2eq}, and additional benchmarks were tested for sensitivity. Harvesting of wild fruits and beekeeping activities were directly accounted for, while other ecosystem services were included using proxy values from similar contexts in the final economic results.

185. The Findings of the scenarios analysis: The financial performance of the forestry sector is generally low and unattractive for private sector investment. Even with high concessionality, private owners' profitability remains minimal, and positive financial returns are only seen after 6-10 years. This indicates that public resources are necessary for forestry investment, as the benefits primarily have economic value. The analysis suggests that private sector participation is only feasible with a high level of concessional financing. The scenarios narrow down the options for private sector involvement, with a minimum of 90% concessionality being considered, and a preference for 95% concessionality due to the models' sensitivity to price and cost fluctuations. Under these scenarios, private owners would contribute between \$25/ha and \$450/ha, which could be covered by revenues from fuelwood sales in the first year. Additionally, forestry investments require significant labor, with over 560,000 person days and approximately 2,570 full-time equivalent jobs needed for the project. Local labor will be contracted and trained to enhance local capacity and sustainability.

5. PROJECT COORDINATION AND COLLABORATION

186. FAO will assume these responsibilities in line with the detailed provisions listed in the Accreditation Master Agreement (AMA) between FAO and the GCF. As Accredited Entity (AE) of the Project, the FAO's supervision role will be attributed to the FAO Regional Office for the Regional Office for Europe and Central Asia (REU) in Budapest and relevant Offices and divisions at FAO headquarter (HQ), in Rome Italy, such as the FAO Office of Climate, Biodiversity, and Environment (OCB) and other technical divisions as required.

187. To perform the AE functions, FAO will set up a dedicated FAO-GCF Project Task Force (PTF) comprising relevant staff from REU, FAO Office in Serbia and HQ. The segregation of responsibilities within FAO will ensure that the Organization can independently and effectively perform the AE functions. The project implementation and supervision function will remain independent of the Executing Entity functions. The Project Task Force (PTF) will be established by FAO as a management and consultative body with a Formulator/Budget Holder (BH), a Lead Technical Officer (LTO) and a Funding Liaison Officer (FLO) / TCP Officer.

188. The project will include several Government of Serbia line Ministries. Thus, the MOAFWM, the Ministry of Environmental Protection (MoEP), the Ministry of Interior (MoI), the Ministry of Finance (MoF), the Ministry of Education Science and Technological Development (MoESTD) and its affiliated departments at the Government level will be involved as beneficiaries. The Ministry of Agriculture Forestry and Water Management (MOAFWM) and its affiliated Directorates (e.g. Forests) in the field will assist with the facilitation of activities in the provinces. The Ministry of Environmental Protection (MoEP), together with the Ministry of Finance (MoF) will lead the activities connected with the development of carbon governance and related regulatory framework. The participation and contribution of the Ministries will help to build their ownership and sustainability of project investments and participation of NDA will help to identify opportunities for building synergies with other projects dealing with climate change finance. Other essential entities to involve are the Ministry of Economy (ME) and the Ministry of Mining and Energy (MME), in particular related to all activities in support of the biomass energy value chain.

189. The Project Steering Committee (PSC) will be established for the overall strategic guidance of the project and housed at the MOAFWM. The MOAFWM as the National Designated Authority (NDA) for GCF in Serbia will notify the formation of the PSC and chair and convene regular six-monthly meetings to assess performance and issue appropriate guidance. The PSC will be composed of primary stakeholders such as the Ministry of Environmental Protection (MoP), Ministry of Finance (MoF), the Ministry of Interiors (MoWR), the Vojvodina Undersecretary for Agriculture, forests and Water and the Under-secretariat for Environment as well as representatives of municipalities in project areas, the Chamber of Commerce/Finance Institutions, Forest Owners Guild, FAO (Observer) and Civil Society (Observer). The role of the PSC will be to: (i) Provide overall guidance and direction to the project; (ii) Ensure that co-financing support is provided in a timely and effective manner and report against its availability and use; (iii) Address project issues as raised by the PMU and/or PSC members or EEs; (iii) Review the project progress, and provide direction and recommendations to ensure that the agreed deliverables are

produced satisfactorily and within the approved project framework; (iv) Review and approve annual work plan and provide necessary strategic guidance for its implementation; (v) Appraise the annual project reports; (vi) make recommendations for subsequent work plans to build on achievements and address any shortcomings, etc. One representative from the PMU will act as Rapporteur to the PSC that should ensure through its overall leading and central role a strong country ownership

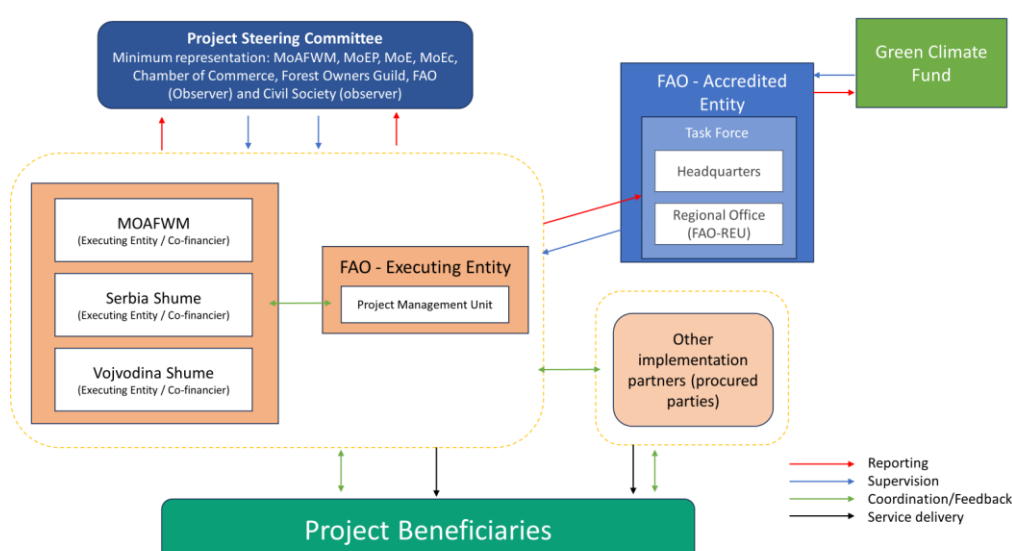
190. A complete list of relevant ongoing projects and their complementarities and synergies with this project are available in Table 30 below. Recent project experiences of FAO in Serbia are:

- FAO / GCF (Readiness) / National Designated Authority (NDA): increasing national capacities to accelerate climate related investments, with focus on engagement of private sector. The project works on strengthening Serbia's capacities to access climate finance for climate investments, with the objectives to: a) raise awareness in the public; b) engage with private sector and facilitate direct access to the climate investments; c) implement priority investments in the forest energy, agriculture, water resources, and hydrology sectors.
- FAO / Ministry of Agriculture Forestry and Water Management/Ministry of Environmental Protection: support to Serbia sustainable forest management including forest monitoring, close-to-nature forestry, climate change mainstreaming.
- FAO / EU / Ministry of Agriculture Forestry and Water Management: building climate change resilience in the agricultural sector with focus on increasing institutional capacities in the context of EU chapter 27.
- FAO / Hungary / Ministry of Agriculture Forestry and Water Management / Ministry of Environmental Protection: supporting the development of organic agriculture in the country.
- FAO / Ministry of Environmental Protection (MoEP): developing a national report on land degradation for submission to the United Nations Convention to Combat Desertification (UNCCD).

Table 30 Lessons learned and synergies with past, ongoing and future initiatives

Project	Scope	Lesson(s) learned and/ or synergies	Relevant Component
Enabling environment at policy, field and market levels for Forest Landscape Restoration (FLR) to achieve Land Degradation Neutrality (LDN) in Serbia (GCP/SRB/007/GFF), FAO	Forestry	Lessons learned: Close-to-nature forest management, which considers the multi-functionality of forests, has become the guiding principle of the Serbian forestry sector. Incorporating Climate Adaptive Silviculture (CAS) will further contribute to realize the full potential of forests to contribute to climate change adaptation and mitigation in the country. Afforestation as an integral part of landscape restoration is not only important in the context of climate change adaptation and mitigation and disaster risk reduction, but also as the most effective measure in controlling land degradation.	1,2
Contribution of Sustainable Forest Management (SFM) to a Low Emission and Resilient Development” (GCP/SRB/002/GFF), FAO	Forestry	Lessons learned and synergies: Building upon the methodology, sampling design, and preliminary results of the ongoing second National Forest Inventory (NFI) of the GCP/SRB/002/GFF, the GCF project will establish / transform the periodic NFI cycle system into a continuous national forest monitoring and assessment (NFMA) system using permanent sample plots. Additionally, the GCF project will integrate climate change adaptation approaches and mitigation co-benefits into SFM practices.	1
Development of a sustainable bioenergy market in Serbia	Energy	Lessons learned Consumer awareness and well-organized value chains are prerequisites for a sustainable use of biomass on a larger scale.	1,3
Reducing Barriers to Accelerate the Development of Biomass Markets in Serbia	Energy Decarbonization	Lessons learned Capacity development of all relevant stakeholders essential to develop, finance, implement and operate bankable biomass energy projects;	1,3
EU for Green Agenda in Serbia: Get Started, Take Action, Scale-up	Forestry Decarbonization	Synergies: Exchange of experience related to community involvement in soil rehabilitation and forest restoration activities. Sharing of lessons learned related to decarbonization processes.	1,2,3
GCF 140 High Impact Programme for the Corporate Sector GCF 86 Green Cities Facility GCF 025 GCF-EBRD SEFF Co-financing Programme	Decarbonization	Synergies: Given the strong cooperation with EBRD, FAO will ensure synergy and complementarity with all GCF projects implemented in Serbia through the EBRD. Specifically, the project will strive to involve municipalities and companies agreed upon with the EBRD and the national counterpart in its activities, wherever and whenever possible.	1,3
Biomass district heating plants	Energy	Synergies: The country is currently heavily invested in switching fossil fuel district heating plants to biomass. The project will coordinate with these initiatives to support the greening of value chains and biomass fuels. In particular, the project will support the identification of and technical support to biomass hubs that could supply current and future biomass district heating plants.	3
Establishing Transparency Framework for the Republic of Serbia	MRV	Synergies: Coordination and collaboration with the project to create efficient MRV systems for AFOLU Cooperation in Capacity building activities for competent institutions for the development of GHG emissions projections that fulfil the criteria of transparency, accuracy, consistency, comparability and completeness conducted;	1

Figure 2: Project implementation arrangements



191. To ensure national engagement and strategic positioning, the project will also partner with both governmental (Ministries and Municipalities) and non-governmental partners (Chambers of Commerce and Industry; Forestry, Agriculture and other category organizations). Partnering institutions and organizations reflect the various dimensions of the projects. Each will have a specific role in ensuring the success and sustainability of planned activities.

Table 31: Role of the main institutional stakeholders

Institution	Description
Ministry of Agriculture Forestry and Water Management (MOAFWM)	As NDA and Responsible for developing and implementing policies in the field of forestry, agriculture and water management. The project will work mostly with the Forestry Directorate, with support and involvement of Agricultural Land Directorate, Rural Development Directorate, and others as necessary.
Ministry of Environmental Protection (MEP)	Responsible for development and maintenance of the system for protection and improvement of environment. The project will work with the MEP as the main partner for the establishment of the offsetting / insetting mechanism and in the activities related to the decarbonization process.
Ministry of Mining and Energy (MME)	Responsible for increasing energy efficiency and energy security. The project will work with the MoE in greening the fuel biomass value chains and in the activities related to the decarbonization process.
Ministry of Education, Science and Technological Development (MESTD)	Responsible for the national education system. The project will work with the MoESTD as main partner for the upgrade of the national universities and vocational schools' curricula that are relevant for the practices, technologies and methodologies introduced by the project.
Ministry of Economy (MoE)	Responsible for elaborating the national economic, trade and industrial development policies and the strategies of economic security and sustainable development. The project will work with the MoE to engage the private sector in both forestry and decarbonization activities.
Ministry of Finance	Responsible for national finance, tax, and coordination of the management system and implementation of programs financed from European Union funds. The project will involve the MoF in the definition of the carbon finance options and in the creation of related guidelines, methodologies, standards and approaches.
Municipalities	Municipalities are in charge of municipal lands (including insignificant forest area in a very limited number of municipalities) within the borders of their territory. The project will work with forested municipalities to ensure adherence to the newly introduced CAS and SFM.
Chamber of Commerce / Chamber of Industry. Categories' Associations	The project will work with both chambers and with producers' owners' association to identify private sector actors and to engage them in project's activities.

The National Biomass Association SerBio ^{xxvi}	SerBio is an association of NGO's, companies and individuals in the field of biomass utilization and can facilitate interactions with various stakeholders and in the biomass mobilization and utilization.
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192. FAO has extensive experience in supporting countries in the field of climate change adaptation and mitigation, as well as climate adaptive silviculture. Furthermore, having under implementation more than 138 climate and resilience projects worth over USD 600 million, the organization has the experience and technical capacity to manage the requested grant and to properly support Serbia in the forest sector and decarbonisation processes. In Serbia, FAO has been operational since 2001 in various areas, including in sustainable forest management, biodiversity and wildlife protection, sustainable management of natural resources, land degradation, disaster risk reduction and climate change adaptation. Activities include the capacity development of national institutions, NGOs, associations, companies and farmers as well as the formulation of investments in forestry (forest assessment, forest and landscape restoration, and afforestation) and policy assessment. Examples of recently implemented or ongoing projects in Serbia include:

- FAO / GCF (Readiness) / National Designated Authority (NDA): increasing national capacities to accelerate climate related investments, with focus on engagement of private sector.
- FAO / MOAFWM / MEP: support to Serbia sustainable forest management including forest assessment, close-to-nature forestry, climate change mainstreaming.
- FAO / EU / MOAFWM: building climate change resilience in the agricultural sector with focus on increasing institutional capacities in the context of EU chapter 27.
- FAO / Hungary / MOAFWM / MEP: supporting the development of organic agriculture in the country. FAO / MEP: developing a national report on land degradation for submission to the United Nations Convention to Combat Desertification (UNCCD).
- FAO / MOAFWM: comprehensive assessment on vulnerabilities to climate change impact of all municipalities in Serbia, identifying the root causes of vulnerabilities. In parallel, FAO provides direct support to local governments in improving their resilience to climate change impacts and address issues in the field of forestry and disaster risk management.

193. Table 32 provides an overview of the EEs executing each sub-activity and the respective source of financing.

Table 32 Executing entities of the different activities

Activity	Sub-Activity	Executing Entity (EE)				Financing Source
		FAO	MOAFWM	PES	PEV	
1.1.1: Establish the National Forest Monitoring and Assessment System (NFMA)	1.1.1.1		X			MOAFWM
	1.1.1.2	X				GCF
	1.1.1.3		X			MOAFWM
	1.1.1.4	X				GCF
	1.1.1.5		X			MOAFWM
1.1.2: Develop guidelines for decision makers on AFOLU to prevent soil degradation.	1.1.2.1	X				FAO
	1.1.2.2	X				GCF
1.1.3: Create national standard for biomass production / handling for energy purposes.	1.1.3.1	X				GCF
	1.1.3.2	X				GCF
	1.1.3.3	X				GCF
	1.1.3.4	X				GCF
1.1.4: Develop the national strategy, action plan and execution guidelines for Short Rotation Plantations (SRP)	1.1.4.1	X				GCF
	1.1.4.2	X				GCF
1.2.1: Support the design of an offset mechanism [for AFOLU] as part of the domestic carbon pricing framework and institutionalize knowledge in the national curricula	1.2.1.1	X				GCF
	1.2.1.2	X				GCF
1.2.2: Support the development of Serbia's Article 6 strategy related to "AFOLU" opportunities	1.2.2.1	X				GCF
	1.2.2.2	X				GCF
	1.2.2.3	X				GCF
	1.2.2.3	X				GCF
1.2.3: Promote and support knowledge-sharing at the regional level	1.2.3.1	X				FAO
	1.2.3.2	X				FAO

1.2.4: Support access to voluntary carbon finance for forestry to enable sequestration beyond NDC targets and to ensure long term sustainability	1.2.4.1	X				GCF
	1.2.4.2	X				GCF
	1.2.4.3	X				GCF
1.2.5: Enable inseting as part of company decarbonization strategy support	1.2.5.1	X				GCF
	1.2.5.2	X				GCF
	1.2.5.3	X				GCF
2.1.1: Upgrade public nurseries (Vojvodina/C. Serbia)	2.1.1.1	X				GCF
	2.1.1.2		X			MOAFWM
2.1.2: Train and support operators of public and private nurseries in the production of diverse and climate adaptive forestry seedlings	2.1.2.1	X				GCF
	2.1.2.2	X				GCF
	2.1.2.3	X				GCF
2.2.1: Produce guidelines on climate adaptive silviculture	2.2.1.1	X				GCF
	2.2.1.2	X				GCF
2.2.2: Train stakeholders, both public and private in climate adaptive silviculture (CAS)	2.2.2.1	X				FAO
	2.2.2.2	X				FAO
2.2.3: Upgrade National curricula (faculty of forestry and vocational schools working on forestry, agriculture and accounting) with introduced practices and technologies	2.2.3.1	X				GCF
	2.2.3.2	X				GCF
2.2.4: Facilitate regional knowledge-sharing dialogue on CAS	2.2.4.1	X				GCF
2.3.1: Carry out afforestation activities on public land.	2.3.1.1	X				GCF
	2.3.1.2	X				GCF
	2.3.1.3				X	PEV
	2.3.1.4			X		PES
	2.3.1.5	X				GCF
	2.3.1.6		X			MOAFWM
2.3.2: Convert degraded coppice stands on public forest land accessible and converted into high forest.	2.3.2.1	X				GCF
	2.3.2.2	X				GCF
	2.3.2.3		X			MOAFWM
	2.3.2.4		X			MOAFWM
	2.3.2.5	X				GCF
	2.3.2.6			X		PES
	2.3.2.7	X				GCF
3.1.1: Convert degraded private coppice stands into high forest	3.1.1.1	X				GCF
	3.1.1.2	X				GCF
	3.1.1.3		X			MOAFWM
	3.1.1.4		X			MOAFWM
	3.1.1.5			X		PES
	3.1.1.6	X				GCF
	3.1.1.7	X				GCF
3.1.2: Rehabilitate unfarmed private lands through forestry investments such as short rotation plantations, agro-forestry or soil rehabilitation purposes (Vojvodina)	3.1.2.1	X				GCF
	3.1.2.2	X				GCF
	3.1.2.3		X			MOAFWM
3.1.3: Establish shelterbelts in agricultural landscapes	3.1.3.1	X				GCF
	3.1.3.2	X				GCF
	3.1.3.3		X			MOAFWM
	3.1.3.4	X				GCF
3.1.4: Engage private actors in sustainable biomass value chains	3.1.4.1	X				GCF
	3.1.4.2	X				GCF
3.1.5: Support platforms involving stakeholders of the forestry and agricultural sector for a modern and transparent biomass energy value chain	3.1.5.1	X				GCF
	3.1.5.2	X				GCF
3.2.1: Involve agribusiness and other companies in the decarbonization process of the private sector.	3.2.1.1	X				GCF
	3.2.1.2	X				GCF
3.2.2: De-constrain access to credit for agribusiness and other companies.	3.2.2.1	X				GCF
	3.2.2.2	X				GCF
3.3.1: Support to the chamber of commerce and industry and the association of financial institutions to assess climate-related risk of banks and ensure client engagement.	3.3.1.1	X				GCF
3.3.2: Support to the chamber of commerce and industry and the association of financial institutions	3.3.2.1	X				GCF

and academia to train decarbonization service providers.						
Activity PMC.1.1: Project staff	PMC1.1.1	X				GCF
	PMC1.1.2		X			MOAFWM
Activity PMC.1.2: Office and Equipment	PMC1.2.1	X				GCF
	PMC1.2.2		X			MOAFWM

Appendices:

Appendix 1: DEFINITIONS ACCORDING TO IPCC AND FAO 73

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

Adaptive capacity/Readiness: The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

Anthropogenic: Resulting from or produced by human beings.

Baseline/reference: The baseline (or reference) is the state against which change is measured. It might be a 'current baseline,' in which case it represents observable, present-day conditions. It might also be a 'future baseline,' which is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.

Climate change: A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate projection: A projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/ concentration/radiative-forcing scenario used, which are based on assumptions concerning, e.g., future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.

Climate scenario: A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate.

Disaster risk reduction (DRR): Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.

Exposure: The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected.

Hazard: The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Land use and land use change: Land use refers to the total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration,

⁷³ Sources: [IPCC](#) and FAO

sources and sinks of greenhouse gases, or other properties of the climate system and may thus have radiative forcing and/or other impacts on climate, locally or globally.

ND-GAIN Index: The Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. It aims to help governments, businesses and communities better prioritize investments for a more efficient response to the immediate global challenges ahead.

Vulnerability: The propensity or predisposition to be adversely affected.

Other definitions⁷⁴

Biomass is defined: from a scientific and technical point of view – as material of biological origin form (EN 14558:2010). Biomass is organic material that is plant or animal based, including but not limited to dedicated energy crops, agricultural crops and trees, food, feed and fibre crop residues, aquatic plants, alga, forestry and wood residues, agricultural waste, processing by-products and other non-fossil organic matter (prENISO/DIS 16559:2013).

Biofuels are solid, liquid or gaseous fuel produced directly or indirectly from biomass.

Forest fuel (fuel wood) is produced directly from forest wood or plantation wood through mechanical process, the raw material has not previously had another use (prENISO/DIS 16559:2013).

Wood fuels are defined as all types of biofuels originating from woody biomass, where the original composition of the wood is preserved and unaltered from its original form (FAO unified bioenergy terminology (UBET))

Biomass DH systems: Modern biomass DH systems are equipped with process control systems supporting fully automatic system operation based on the system's head load.

Biomass CHP technologies: Cogeneration—also known as combined heat and power (CHP)—is the simultaneous generation of heat and power, both of which are used for better total efficiency than conventional energy systems, since better exploitation takes place and energy is used to produce heat as well.

Small-scale biomass heating appliances: Wood stoves and wood-log small boilers are widely used in all W-B countries, while wood-pellet and wood-chip appliances are less common. Use of agricultural biomass and dedicated energy crops in domestic appliances may cause technical problems from the formation of molten or partially fused deposits on grates and chimneys exposed to radiant heat.

⁷⁴ Based on Krajnc N, 2015. Wood fuels Handbook and World Bank, 2017. Biomass-Based Heating in the Western Balkans – A Roadmap for Sustainable Development

Appendix 2: Currency and Conversion Factors

1 Serbian Dinar = 0.0096 United States Dollar

1 kWh = 860 kcal = 3.600 kJ (3.6 MJ)

1 MJ = 239 kcal = 0.278 kWh

1 kcal = 4.19 kJ = 0.00116 kWh

1 toe = 41.87 GJ = 11.63 MWh

Standard metric system utilized

Appendix 3: List of Proposed Species for FLR in Central Serbia

Species ⁷⁵	Attributes ⁷⁶					Rationale
	DR	RS	SD	SS	FG	
<i>Picea abies</i>						Norway spruce could be used in ranges from 1000 to 1300 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Abies alba</i>						European silver fir could be used in ranges from 900 to 1100 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Acer heldreichii</i>						Heldrich's maple could be used in ranges from 1200 to 1800 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Fagus sylvatica</i>						European beech could be used in ranges from 600 to 1500 m. It shows a moderate resistance to drought. Possible for re-sprouting, browse and cutting. The plant material could be both direct seed sowing and seedlings produced in forest nurseries.
<i>Fraxinus excelsior</i>						European ash could be used in ranges from 600 to 900 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Prunus avium</i>			++			Wild cherry could be used in ranges from 600 to 900 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. Fruit tree attracting seed-dispersal fauna. The plant material could be seedlings produced in forest nurseries.
<i>Acer pseudoplatanus</i>						Sycamore maple could be used in ranges from 600 to 900 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Acer platanoides</i>						Norway maple could be used in ranges from 600 to 900 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Sorbus torminalis</i>			+			Chequer tree could be used in ranges from 600 to 900 m. It shows a low resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.

DR: Drought-resistant; RS: Re-sprouting after fire, browse and cutting; SD: fruit tree attracting seed-dispersal fauna; SS: instable soil stabilization; FG: colonizer of forest gaps and open areas

<i>Corylus colurna</i>	+		+		Turkish hazel could be used in ranges from 600 to 900 m. It shows a moderate resistance to drought. Possible for re-sprouting. The plant material could be seedlings produced in forest nurseries.
<i>Pinus sylvestris</i>	++				Scots pine could be used in ranges from 400 to 900 m. It shows a moderate resistance to drought. No possible for re-sprouting after fire, browse and cutting. The plant material could be seedlings produced in forest nurseries.
<i>Pinus nigra</i>	+				Black pine could be used in ranges from 200 to 500 m. It shows a high resistance to drought. The plant material could be seedlings produced in forest nurseries.
<i>Quercus petraea</i>	+				Sessile oak could be used in ranges from 300 to 500 m. It shows a moderate resistance to drought. Possible for re-sprouting. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus frainetto</i>	++				Hungarian oak could be used in ranges from 200 to 400 m. It shows a moderate to high resistance to drought. Possible for re-sprouting. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus cerris</i>	++				Turkey oak species could be used to ranges to 300 m. It shows a moderate resistance to drought. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus pubescens</i>	++				Downy oak could be used in ranges from 200 to 400 m. It shows a moderate to high resistance to drought. Possible for re-sprouting. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus robur</i>	++				Pedunculate oak has a wide ecological range and capacity to withstand drought. The plant material for restoration could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Fraxinus angustifolia</i>					Narrow-leaved ash is present on hydromorphic soils, very low resistance to drought. The plant material could be both seed, and seedlings produced in forest nurseries.
<i>Populus alba</i>		+			White poplar colonizes is low resistance to drought The plant material is seedlings produced in forest nurseries.
<i>Carpinus betulus</i>					Hornbeam is present on hydromorphic soils, low to moderate resistance to drought.
<i>Salix alba</i>					White willow is present on hydromorphic soils with low resistance to drought.
<i>Carpinus orientalis</i>	++				Oriental hornbeam could be used in ranges from 100 to 450 m. It shows a moderate to high resistance to drought. Possible for re-sprouting. The plant material could be seedlings produced in forest nurseries.
<i>Ostrya carpinifolia</i>	++				European hop hornbeam could be used in ranges from 100 to 400 m. It shows a moderate to high resistance to drought. Possibles for re-sprouting. The plant material could be seedlings produced in forest nurseries.
<i>Fraxinus ornus</i>	++				Manna ash could be used in ranges from 150 to 400 m. It shows a moderate to high resistance to drought. Possible for re-sprouting. The plant material could be seedlings produced in forest nurseries.

Appendix 4: List of potential Species for FLR in Vojvodina

Species ⁷⁷	Attributes ⁷⁸	Comments
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DR: Drought-resistant; RS: Re-sprouting after fire, browse and cutting; SD: fruit tree attracting seed-dispersal fauna; SS: instable soil stabilization; FG: colonizer of forest gaps and open areas

	DR	RS	SD	SS	FG	
<i>Quercus robur</i>	++		+			Pedunculate oak has a wide ecological range and capacity to withstand drought. The plant material for restoration could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus petraea</i>	+	+	+			Sessile oak could be used in ranges from 300 to 500 m. It shows a moderate resistance to drought. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Quercus cerris</i>	++	+	+			Turkey oak species could be used to ranges to 300 m. It shows a moderate resistance to drought. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Fraxinus angustifolia</i>						Narrow-leaved ash is present on hydromorphic soils, very low resistance to drought. The plant material could be both seed, and seedlings produced in forest nurseries.
<i>Populus euramericana</i>		+				This species colonizes is low resistance to drought The plant material is seedlings produced in forest nurseries.
<i>Populus alba</i>		+				White Poplar colonizes is low resistance to drought The plant material is seedlings produced in forest nurseries.
<i>Populus nigra</i>						Black pine colonizes is low resistance to drought The plant material is seedlings produced in forest nurseries.
<i>Ulmus minor</i>						Field elm is present on hydromorphic soils, mid resistance to drought. Endangered species.
<i>Ulmus laevis</i>						Fluttering elm is present on hydromorphic soils, mid resistance to drought. Endangered species.
<i>Carpinus betulus</i>						Hornbeam is present on hydromorphic soils, mid resistance to drought.
<i>Quercus frainetto</i>	+	+	+			Hungarian oak could be used to ranges to 300 m. It shows a moderate resistance to drought. The plant material could be both acorns (direct seed sowing) and seedlings produced in forest nurseries.
<i>Robinia pseudoacacia</i>	++					Black locust is widely present in Vojvodina, with a wide range of resistance to drought. The plant material could be seedlings produced in forest nurseries.
<i>Celtis australis</i>	++	+	+			European nettle tree is widely present in East Serbia, with a range of resistance to drought. The plant material could be seedlings produced in forest nurseries.
<i>Tetradium daniellii</i> var. <i>hupehensis</i>	+					Bee tree has possibilities for afforestation, middle range in resistance to drought. The plant material could be seedlings produced in forest nurseries.

<i>Ostrya carpinifolia</i>	*					European hop hornbeam is present on shallow and dry soils of dominantly East Serbia. Should be considered for Vojvodina.
<i>Fraxinus ornus</i>	*					Manna ash is present on shallow and dry soils of West and East Serbia. Should be considered for Vojvodina.
<i>Sophora japonica</i>	+					Japanese pagoda tree has possibilities for afforestation in lowland according in resistance to drought
<i>Tilia sp.</i>	+					Lime tree species have possibilities for afforestation, in lowland to middle range in resistance to drought
<i>Acer tataricum</i>	++					Tatarian maple is present in lowland forests steppe zone in Vojvodina, with a wide range of resistance to drought. The plant material could be seedlings produced in forest nurseries.
<i>Prunus spinosa</i>						Blackthorn is present in Vojvodina, with a wide range of resistance to drought. The plant material could be seedlings produced in forest nurseries.
<i>Rosa sp.</i>	+	+	+			Rosa species are present in Vojvodina, with a wide range of resistance to drought. The plant material could be seedlings produced in forest nurseries.

Appendix 5: List of Potential Species for FLR on salinated soils in Vojvodina

Species ⁷⁹	Attributes ⁸⁰						Rationale
	DR	RS	SD	SS	TS	FG	
<i>Quercus robur</i>	++	+			+		<p>Pedunculate oak is native to temperate parts of Europe. Its vast range extends from Ireland to the Ural Mountains. It occurs in large numbers in the Danube, Drava and Sava valleys, as well as in Eastern Europe (Gencsi L., Vancsura R. 1992). It is mainly a tree in the lowlands and low hills and is favoured in the plains of the great rivers. In Hungary, it plays a prominent role in the forests of the Great Plain with compacted and salinated soils.</p> <p>It does not tolerate prolonged flooding. Larger mortality caused by pests often causing significant damage is in oak stands.</p> <p>Its wood is used by the furniture industry, construction industry and transport industry. It is one of the most common tree species in other wooded land. It was one of the main tree species of the shelterbelts in the Great Plain.</p> <p>In addition to providing excellent timber, the oaks provide food for many species.</p>
<i>Quercus cerris</i>	++	+			+		<p>Sub-Mediterranean, Eastern Mediterranean tree species. Thus, it is native to south-eastern Europe, southern Europe (south of the Brno-Zvolen line) and Asia Minor (Gencsi L., Vancsura R. 1992).</p> <p>It is one of the most widespread tree species in Hungary, with a total area of 176 000 ha (11.4% of forests in Hungary). Turkey oak is a xerotherm tree species, so it appears mainly on the southern sides. It does not tolerate strong, persistent cold and late frosts. In contrast, it tolerates drought well and lives on shallow skeletal soils, poor gravel and clay. It is very light-demanding, sprouts well and grows quickly at a young age. Several varieties of turkey oak are known, the most common of which is 'Quercus cerris var. cerris and var. Austriaca. The "austriaca" version stands out with better shape and technical properties.</p> <p>It is growing rapidly in young ages. It regenerates perfectly from sprouts. Sensitive to bark injuries. It is drought tolerant and can survive 350 mm of rainfall per year. Its ability to associate with other tree species is good. Its foliage is consumed by few insects. Its most important pest is the gypsy moth (<i>Limantria dispar</i>). Its wood cannot resist the damage of wood-destroying fungi (due to its low tannic acid content). Its wood is used for parquet and furniture, fibreboard production, paper and pulp industry.</p>
<i>Pyrus pyraeaster</i>	++ +	+	++ +		++	+	<p>European wild pear is native to Europe, reaching its optimum in the sunny, warmer plains and hills. It tolerates temperature extremes, prolonged droughts and salt-affected soils, so it plays an important role in the afforestation of the Great Plain. This third-order tree, which reaches a height of 15 m, is one of the most common forest fruit trees. Its fruit is an important forest by-product and excellent game feed.</p>

⁷⁹ The species names are updated according to the most recent taxonomic updates: (i) The Euro+Med PlantBase (ww2.bgbm.org); (ii) The Plant List (theplantlist.org).

⁸⁰ DR: Drought-resistant; RS: Re-sprouting after fire, browse and cutting; SD: fruit tree attracting seed-dispersal fauna; SS: instable soil stabilization; TS: Tolerated level of salinity; FG: colonizer of forest gaps and open areas

						It is one of the host-plant of the large emperor moth (<i>Saturia pyri</i>). It has fungal parasites. Its wood is easy to carve, fine-textured, sought-after industrial raw material. It can be planted under unfavourable site conditions.
<i>Populus alba</i>	++ +	++			++	<p>White poplar has a fairly large area of distribution, stretching from Central and Southern Europe through Asia Minor and Central Asia to China. The tree grows mainly in the plains and in the areas along rivers. It can be found up to an altitude of 300 m above sea level. Despite its rapid growth, it can reach a very high age. Older trees often rotten, providing nesting opportunities for many nesters.</p> <p>It is a fast-growing tree species with very good vegetative expansion. Its root pieces regenerate well. Raising of seedlings is done from seed, which is a labor-intensive task that requires a lot of care. Drought tolerant, tolerates intermittent flooding. A pioneer species. Less resistant to bacterial and fungal pathogens. In old age, its wood often becomes false heartwood, pit rot caused by fungi. The industrial applicability of its wood is limited (pellet production, fibreboard production, paper production).</p>
<i>Tamarix tetrandra</i>	++ +	++	+	++ +	++	<p>The four-stamen tamarisk (<i>Tamarix tetrandra</i>) is a widely spread, deciduous, 1-3 meter high shrub with curved stems. Its deep-seated roots penetrate to the saturation zone of the soil, i.e., the groundwater, from where they absorb water. Its roots also cope with the highly saline, clayey soils. Bark dark brown, the branches are complimenting, arching downwards. Its scaly leaves reduce the evaporation surface. Their ability to absorb salt is unlimited because they can excrete excess salt through their leaves. Its nectar is liked by bees. The fruit, which ripens in July, is spread with 5-6 mm long pods, its seeds are spread with the help of flying hairs.</p> <p>Tamarisk primarily needs sun and good aquifer soils. Four-stamen tamarisk with its deep penetrating roots and scaly leaves adapts well to the dry, hot climate, frost tolerant. It is salt-tolerant, tolerates air-polluted urban environments, and is therefore planted as a hedge by highways and roads. In barren areas, it regenerates from root fragments left in the soil. It is also excellent for windbreaks.</p>
<i>Ulmus pumila</i> var. <i>arborea</i> cv. <i>Pusztai</i>	++ +	++		++ +	+	<p>Depending on the site conditions, the Siberian elm's height increase is very varied: from the third-order, almost bush-like trunk size, the tree reaches the height increase of the domestic elm. Its tolerance is very wide. It can withstand both dry and heavily variable water management sites, as well as periodically over-wetting (wet to the surface). It can also be planted successfully on salinated soils where, according to our previous knowledge, only shrubby Russian olive could be planted, as well as on dry sandy soils, soils with high lime content, various eroded, degraded, nutrient-poor areas with highly variable water supply. It retains its rapid growth properties in these areas as well, but there can be large differences in the rate of growth. It is a remarkable feature that it can withstand the unfavourable microclimatic environment and polluted air in the city without damage. Its great advantage is that it is still resistant to <i>Ceratocystis ulmi</i>, according to both domestic experience and foreign literature data, even</p>

						<p>under extreme conditions. To date, we have no knowledge of any other specific species of disease. Suitable for protective forests, shelterbelts and greening urban areas. It can be used for the recultivation of opencast mining, quarries and various waste dumps, eroded areas, damaged areas bordering the settlements (e.g. former clay pits). In urban areas, its big advantage is that it can withstand the dry and polluted air of city streets, which is preferably accompanied by its rapid growth and decorative foliage (stem-forming prunings are needed). It has a very high drought tolerance and can survive 250 mm of precipitation per year.</p>
<i>Fraxinus pennsylvanica</i>	++	+		++	++	<p>As a neo-arctic species, the Green ash is native to the eastern North American flora of the Atlantic-North American region, but due to its advantageous properties it is planted in many parts of the temperate zone. It is an invasive species in Hungary.</p> <p>In Hungary, it was planted mainly in the saline oak groves and in the lowland floodplain groves in mixed stands, as due to its high light demand, the purely ash forests are extinct. A big advantage over other ash species is that the game does not harm it. It is also highly resistant to plant pests that are widespread in Europe. It grows rapidly in the first years, but only on soils rich in nutrients. It regenerates quickly, therefore, unlike the ash species native to Hungary, the soil under it does not get weeding. It naturally regenerates well even on saline soils.</p> <p>It tolerates prolonged flooding well. Pests and game avoid it due to its high coumarin content.</p>

Note: +: to a small extent, slightly

++: to a large extent,

+++: to a very large extent

Appendix 6: Climate Change Analysis

Appendix 7 – Working Paper Forestry Sector

Appendix 8: Energy Working Paper

Appendix 9: Fuelwood Inventory 2022

Appendix 10 – Fuelwood Inventory 2023

Appendix 11 – Contribution of the proposal to the main national strategies, policies and international commitments

Appendix 12 – Working Paper Decarbonization

End Notes

ⁱ The analysis of [Forzieri et al. \(2022\)](#) concluded that "tropical, temperate and arid forests underwent a decline in resilience probably related to the concomitant increase in water limitations and climate variability."

ⁱⁱ In particular, pest and diseases outbreaks have increased steadily with recurrent picks when the gipsy moth, favoured by drought, spread in Serbian forests [NAP, 2015; GoS, 2020].

ⁱⁱⁱ Reportedly [World Bank, 2017], the Serb population is currently exploiting up to 99% of the annual forest growth increment, mainly for energy production and for industrial purposes.

^{iv} Recent surveys showed that due to delayed purchase of low-quality biomass, more than 60% of HH in Vojvodina and more than 40% of HH in Eastern Serbia utilize fuelwood with an inefficient moisture content (>30%). Firewood purchase by households in Vojvodina is unsatisfactory because only 40% of the urban and 36% of other households purchase firewood early enough before the heating season so that it can dry to an energy-efficient moisture content (below 30%). In Eastern Serbia only 47% of Urban households purchase firewood with energy-efficient moisture content. The situation is better outside urban areas in this region: 57% of the households' purchase firewood early enough for the wood to dry and to reduce the moisture content below 30% (Glavonjić, B, 2021. Inventory of wood energy consumption and GHG emissions from wood fuels in Vojvodina and East Serbia. In 2023, the study was extended to other regions: Overall firewood purchase by households was considered satisfactory in Belgrade region and Eastern Serbia only, because 59% i.e. 52% respectively of the fuelwood users purchased wood on time to dry and to reduce the moisture content below 30%. The other regions: Vojvodina, Central, Western and Northern Serbia presented significantly lower numbers (Glavonjić, B, 2023 "Inventory of wood energy consumption and GHG emissions from wood fuels in SERBIA")

^v This has significant impacts on final consumption as exemplified by studies in Serbia highlighting that average efficiency of local appliance can decrease from 39,7% (with air-dried wood) to 24,8% (when wet wood fuel is used), depending on the quality of the energy carrier [E4tech, 2014]. Moisture content of wet woodfuel in the study defined as 45%; air dried wood has a moisture content of 23% [E4tech, 2014]

^{vi} Includes next to solid biofuels from forests among others also municipal waste since the Total Energy Supply balances of the IEA indicate for Serbia in 2020 the category "Biofuels and waste" with a share of 10.8%.

^{vii} P. 30, Energy Balances Bulletin 2019, Statistical Office of the Republic of Serbia.

^{viii} Estimation from Al Jazeera based on OEC data (2022)

^{ix} Both this issues are currently addressed by the Republic of Serbia via investments in [wind and solar power parks](#) (investors will be able to participate in 1.5 GW auctions until 2025) and improving the efficiency of irrigation technologies / practices and mainstreaming CC adaptation into its water policy framework. With regards to the latter, the Republic of Serbia is currently engaged in upgrading and climate proofing its Irrigation Program with the support of the EBRD and FAO.

xWorld Bank, Commodity Markets Outlook. April 2022. <https://openknowledge.worldbank.org/bitstream/handle/10986/37223/CMO-April-2022.pdf>

^{xi} Statistical Pocketbook of the Republic of Serbia, 2022 and 2018.

^{xii} [Public consultation on Serbia's national energy and climate plan: Coal use to be cut 25% by 2030 \(balkangreenenergynews.com\)](#)

^{xiii} Private forest owners are partially grouped into 30 local associations, of which 18 are currently active [Georgieva et al., 2021].

xiv

Size of Private forests	# of Owners	%
01-1 ha	638,322	72.3%
1-10 ha	233,846	26.5%
10-20 ha	8,372	0.9%
20-30 ha	1,516	0.2%
> 30 ha	426	0.0%
Total	882,482	100%

^{xv} The project will ensure informing each woman owner reported in the official online cadastre and will guarantee the conditions for all to apply to project activities. Being participation voluntary and demand driven. Given the results of a 2020 study done by FAO in the Western Balkans, Serbia disposes of high levels of guarantees of gender equality in land ownership and/or control in the legal framework [FAO, 2020]. In the region the average land ownership of women is below 30%.

xvi

Data	Value	Rural	Urban
Total Population	6,664,449.00	2,534,763.00	4,129,686.00
Share of total population (%)	100%	38%	62%
Share of Female (%)	51%	50%	52%
Avg. HH Size	2.55	2.75	2.44
Total Number of Households (HH)	2,614,226.26	921,732.00	1,692,494.26
Percent of HH heating via fuelwood (FW)	47%	77%	29%

Number of Individuals heating via FW	3,126,193.26	1,949,232.75	1,176,960.51
People Living under USD 2.15	0.2%	5,069.53	8,259.37
People at risk of poverty	25%	633,690.75	1,032,421.50

Source: Statistical Office of the Republic of Serbia and Census of Population, Households and Dwellings, 2022.

^{xvii} Radojević et al, 2015

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^{xx} Adaptation deficit in the context of the project is defined as follows: Lack of technical and knowledge capacity, economies of scale and access to finance to adapt in efficient manner to challenges of climate change.

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^{xxii} Forest Monitoring System (NFM) and System for measurement, reporting, and verification (MRV) of GHG emissions

^{xxiii} The project will have a positive impact on households that will be expected to face a lower unit cost for energy produced by fuelwood. This lower unit cost of energy will enhance affordability of energy for the poorest segments of the population. In Serbia, households currently spend more than 10% of their average expenditure on energy. Coupled with environmental / energy efficiency awareness campaigns to avoid increase of consumption of fuel wood, lower fuel costs will also imply a lower share of overall spending going toward energy, freeing up resources for other household needs.

^{xxiv} Activities will follow specific protocols that will guarantee the use of local and species that will be selected based on the characteristics of existing forests. The project will not negatively impact ecosystems

^{xxv} Converting degraded agricultural lands that have been abandoned into biomass forests, will allow the lands to maintain value and produce income and for the soil to recover and gradually recover sufficient quality to sustain again agriculture. Furthermore, the activity will protect soils from erosions and will contribute in mitigation the adverse impacts of winds.

^{xxvi} The AE is still discussing with SerBio about their specific engagement in the project.