ALBANIA REVISED NDC

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ABBREVATIONS

4NC	Fourth National Communication of Albania to the UNFCCC
AFOLU	Agriculture, Forestry and Other Land Uses
ALKOGAP	Albania - Kosovo Pipeline (Project)
AR5	Fifth Assessment Report of the IPCC
ARDA	Agriculture and Rural Development Agency
BAU	Business-as-usual
BOD	Biochemical oxygen demand
C	Carbon
CAP	Common Agricultural Policy of the European Union
CCGT	Combined cycle gas turbine
CCKP	Climate Change Knowledge Portal
CH4	Methane
CMPI5	Coupled Model Intercomparison Project Phase 5
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COD	Chemical oxygen demand
ECCS	Draft Environmental Cross-cutting Strategy
EE	Energy Efficiency
EFFIS	European Forest Fire Information System
EU	European Union
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FNC	First National Communication
FOLU	Forest and Other Land Use
GACMO	Greenhouse Gas Abatement Cost Model
GDI	Gender development index
GDP	Gross Domestic Product
GHG	Greenhouse gas
GWP	Global Warming Potential
Ha	Hectares
HDI	Human Development Index
IAP	Ionian Adriatic Pipeline Project)
ICSP	Integrated cross-sectoral plan for the coastal belt
IMWGCC	Inter-Ministerial Working Group on Climate Change
INSTAT	Albanian Institute of Statistics
IPARD	Rural Development Programme 2014-2020 under the Instrument for Pre-accession Assistance
IPCC	Intergovernmental Panel on Climate Change

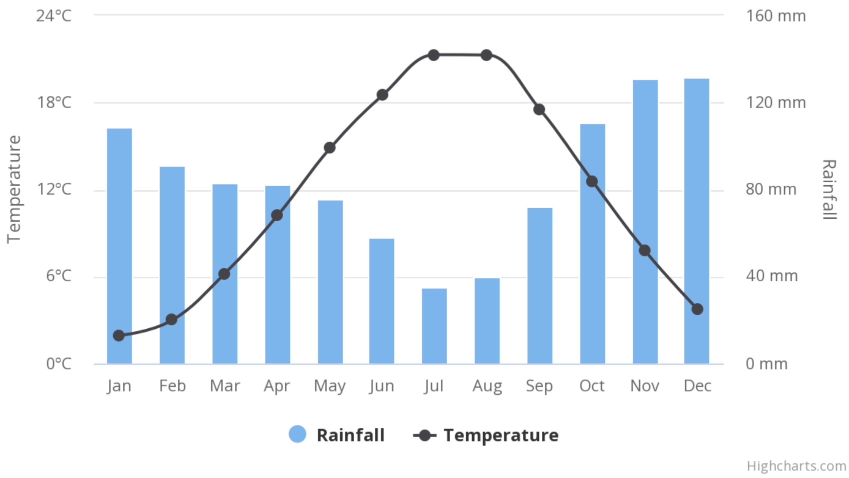
IPPU	Industrial Processes and Product Use
ISARD	Inter-sectoral Strategy for Agriculture and Rural Development
kt	Kilotons
LANFPF	Draft law on the administration of the national forest and pasture fund in the republic of Albania
LEAP	Low Emissions Analysis Platform
LPG	Liquefied petroleum gas
MARD	Ministry of Agriculture and Rural Development
MOTE	Ministry of Tourism and Environment
MSW	Municipal solid waste
N	Nitrogen
N2O	Nitrous oxide
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiencies Actions Plans
NREAP	National Renewable Energy Action Plan
NSCC	National Strategy on Climate Change
NSDI-II	National Strategy for Development and Integration 2015-2020
NSE	National Energy Strategy 2018-2030
NTP	National Territorial Plan
PDFS	On Policy Document of the Forest Sector in Albania – 2030
PPM	Parts per million
RCP	Representative Concentration Pathways
RES	Renewable Energy Sources
SDG	Sustainable Development Goals
SLR	Sea-level rise
SPDBP	Strategic Policy Document for the Protection of Biodiversity
SPEI	Standardized Precipitation Evapotranspiration Index
TAP	The Trans Adriatic Pipeline Project
TCI	Tourism Climate Index
TJ	Terajoules
TNC	Third National Communication of Albania to the UNFCCC
TPP	Thermal power plant
UNFCCC	United Nations Framework Convention on Climate Change

1.NATIONAL CIRCUMSTANCES

The Republic of Albania is a Balkan country in Southeast Europe. It is located to the North of Greece and to the South of Montenegro and Kosovo. To the West, it borders the Ionian (South) and the Adriatic (North) seas, in the Mediterranean Sea, for 450 km. Albania's land area totals 28,748 km^2. The country's average altitude is 700 meters above sea level, as 70% of the territory is mountainous.

Albania has a subtropical Mediterranean climate, which involves mild and humid winters and hot and dry summers, with some continental influence. The mean annual temperature (1901-2016) is 11.5°C, and mean precipitation is 1019.8 mm. **Error! Reference source not found.** below shows the average monthly temperature and rainfall.

Figure 1. Albania's average monthly temperature and rainfall (1901-2016)



Source: World Bank Climate Change Knowledge Portal (CCKP)

Albania is a highly biodiverse country. The mountainous topography, the different geological strata, types of soil and Mediterranean climate with some continental influence contribute to this diversity. About 17% of Albanian territory had protected status in 2016. Albania possesses important water resources. They are an important source of hydropower, producing 90% of the country's energy and providing irrigation for agriculture. Water resources have been polluted in populated areas. Albania also counts with metals and oil.

In 2019, Albania had an estimated population of 2.88 million. Recent demographic developments show that Albania's population is shrinking and heading towards aging. This is due to negative natural growth and most importantly negative net migration. Most studies project that the demographic decline will continue.

Albania is fairly densely populated. In 2018, the average population density was 99.7 inhabitants per km^2. Albania has experienced a strong urbanization process: urban population increased from one-third in the early 1990s to an estimate of almost two-thirds (62%) in 2020. The largest city is Tirana, the country's capital, which had an estimated population of 421,000 in 2020, with a greater metropolitan population of 764,000. The second-largest metropolitan area in Albania is the ancient city of Durrës, only 30 km from Tirana, with an estimated population of 201,519 in 2020. Other major cities include Vlorë, Elbasan and Shkodër. The urban population share is expected to rise.

After 50 years of communist rule, Albania has transformed from one of the poorest countries in Europe in the early 1990s to an upper-middle-income country in 2020. As a result of three decades of remarkable economic growth, in 2019, its GDP amounted to USD 15.3 billion, and its GDP per capita to USD 5,450.

This economic growth has been associated with structural economic changes, with a transition from an economy based on raw materials and agriculture and industry, into a more diverse economy, where the service sector plays a leading role. In 2019, the service sector (represented by the subsectors of trade, transport, commercial activities and telecommunication services) constituted about 50% of the GDP of the country. Industry and construction made up about 20% of the GDP and the agriculture sector contributed about 19% of the GDP. Public debt was over 65% in 2019.

Over the last three decades social indicators have improved in Albania. In 2019 Albania's Human Development Index (HDI) value, which considers life expectancy at birth, education and gross national income per capita, was 0.795— which put the country in the high human development category— positioning it at 69 out of 189 countries and territories[1]. In 2012, the most recent year with official poverty figures, 14.3% of Albanians lived below the national poverty line[2], while 1.1% lived below the international extreme poverty line and 39.1% lived below the upper middle income poverty line. Unemployment reached a historically low 11.4 percent in Q3 of 2019. The latest Gini index was estimated at 33.2 in 2017 (0 representing equality and 100 inequality).

The socio-economic progress of Albania has been recently hampered by two shocks. The country was hit by a devastating earthquake in November 2019. The earthquake, measuring 6.3 on the Richter scale, the strongest in 30 years, caused 51 fatalities, injured at least 913 people and affected over 200,000 people (17,000 people were displaced). It caused extensive damage to physical assets in 11 municipalities, including the two most populous and developed municipalities (Tirana and Durres). Tourism assets and housing were hit the hardest. The earthquake led to losses equivalent to an estimated 7.5% of GDP.

In the midst of the reconstruction efforts, the COVID-19 crisis is putting more pressure on the Government's budget and response, and the country's socio-economic progress, as it forced Albania, as other countries, to put key economic sectors in lockdown. The tourism sector, a key driver of growth, was hit especially hard because of containment measures and travel restrictions. In the second quarter of 2020, employment declined by 3.6% year-on-year. The earthquake and the pandemic are expected to significantly increase poverty, resulting in poverty rates comparable to those in 2005.

Since the early 1990s, Albania has implemented important structural reforms to promote equitable economic growth and improve governance and public service delivery. In a transition from a centrally planned to a market-oriented economy, this has included macroeconomic and fiscal sustainability, financial sector stabilization, energy reform, social assistance and disability reform, and territorial decentralization.

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[1] Between 1990 and 2019, Albania's life expectancy at birth increased by 6.7 years, mean years of schooling increased by 2.3 years and expected years of schooling increased by 3.1 years. Albania's GNI per capita increased by about 183.5 percent between 1990 and 2019.

[2] The national poverty line is set at 60% of national median equalised disposable income (after social transfers). The percentage of Albanians living below the poverty line decreased from 25.4% in 2002 to 12.5 in 2008 and then increased to 14.3% in 2012. The international extreme poverty line is set up at US$1.90 per person per day (2011 PPP). The upper middle income country poverty line is set at 5.5 per person per day, 2011 PPP.

The key national planning document currently in place is the National Strategy for Development and Integration 2015-2020 (NSDI-II), which was adopted by the Government of Albania in May 2016. This strategic document reflects the vision, priorities, objectives and means for social and economic development of the country up to 2020. About 37 sectoral strategies[3] adopted by the Albanian Government (and in three cases, by the Parliament) complement the NSDI-II. The NSDI-II is organized around 13 cross-cutting foundations on good governance, democracy and rule of law, and four main sectoral pillars: i) growth through macroeconomic and fiscal stability; ii) economic growth through enhanced competitiveness and innovation; ii) investing in social capital and social cohesion and iv) growth through sustainable use of natural resources and territorial development. National elections took place in April 2021.

The overarching goal of NSDI-II is the accession to the European Union (EU). After the EU's decision in March 2014 to open accession talks with the country, Albania is advancing the EU integration agenda. As part of the process, the country is transposing and implementing parts of the EU legislation - most national plans or actions, including in the environmental domain, are now designed to take into account policies and directives of the EU. Albania is also considering the EU's strategies and plans for the Western Balkans of which Albania is part[4], such as the EU Economic and Investment Plan for the Western Balkans[5], adopted in October 2020, the EU Green Deal for the Western Balkans[6], adopted in November 2020, and the the Decision Nr. 90, date 17.2.2021 « On approval of National Plan for European Integration, 2021–2023 »among others.

Besides the EU, Albania is an active participant in multilateral organizations and agreements. The Republic of Albania is a signatory Party of the United Nations Framework Convention on Climate Change (UNFCCC), which was ratified by the Albanian Parliament in 1994. In April 2016, Albania signed the Paris Agreement. In December 2017 the Albanian Parliament unanimously approved a resolution confirming the country's commitment to Agenda 2030 and achievement of the Sustainable Development Goals (SGDs).

In line with global and regional commitments and national priorities, Albania has made progress on climate change mitigation and adaptation. In 2014, the Albanian government established the Inter-Ministerial Working Group on Climate Change (IMWGCC), which coordinates all institutions involved in climate change processes and facilitates the integration of climate change into relevant new and existing policies, programs and activities. In July 2019 Albania approved a National Climate Change Strategy and corresponding national mitigation and adaptation plans. The country has implemented several mitigation and adaptation projects and studies.

The Republic of Albania submitted its first NDC in November 2015, with the commitment "to reduce CO_2 emissions compared to the baseline scenario in the period of 2016 and 2030 by 11.5%, or 708 kT CO_2 emission reduction in 2030". Regarding mitigation, the scope was limited

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[3] Including for instance the energy strategy of 2018, the sustainable transport sector plan of 2015 or the national strategy for sustainable tourism development 2019-2023.

[4] In addition to Albania, for the EU the Western Balkans region includes Kosovo, Serbia, Montenegro, North-Macedonia and Bosnia and Herzegovina

[5] This investment plan, which will mobilise up to €9 billion of funding for the region, aims to spur the long-term economic recovery of the region, support a green and digital transition, foster regional integration and convergence with the European Union.

[6] This foresees actions around five pillars: (i) climate action, including decarbonization, energy and mobility, (ii) circular economy, addressing in particular waste, recycling, sustainable production and efficient use of resources, (iii) biodiversity, aiming to protect and restore the natural wealth of the region, (iv) fighting air, water and soil pollution and (v) sustainable food systems and rural areas.

in terms of both gases and sectors. The NDC only covered CO_2 gases - it did not include other relevant gases such as CH_4, N_2O, F-gases; and it only covered energy and industrial processes sectors - it did not include agriculture, Forest and Other Land Use (FOLU) and waste sectors. No references to specific mitigation actions or adaptation were included.

2. MITIGATION

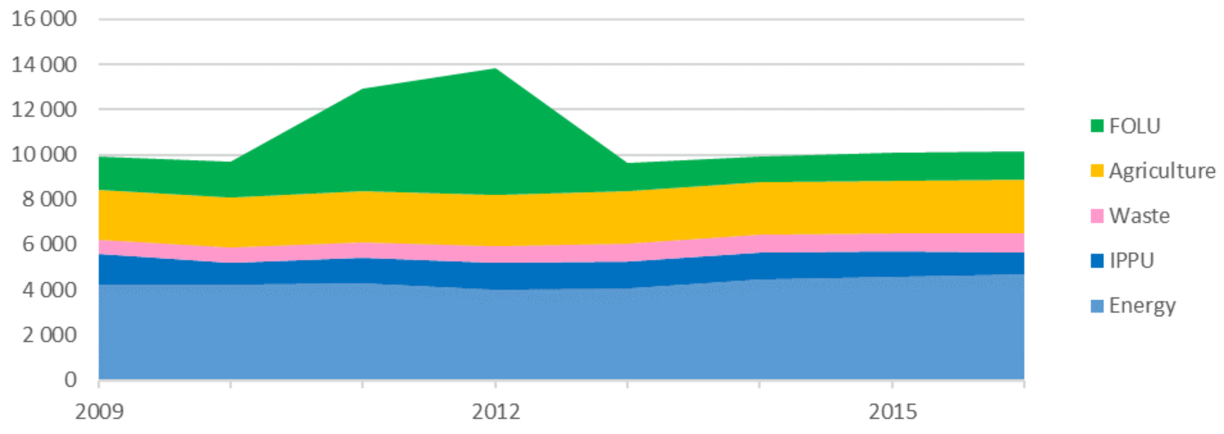
2.1. Situation of the country

2.1.1. Historical GHG emissions trends

Albania's greenhouse gas (GHG) mean annual emissions, according to the national inventory prepared for the 4th National Communication and the final draft of 1st BUR, amounted to 10.8 Mt CO_2e/y in the period 2009-2016. Compared to the rest of Europe, this level of emission is low. While the level of emissions per capita is 8.7 t CO_2e/hab in the EU-27 in 2018, the level of emission per capita in Albania is 3.5 t CO_2e/hab in 2016.

During this period, emissions have increased only slightly: they amounted to 9,925 kt CO_2e in 2009 and to 10,139 kt CO_2e in 2016 (+2.2%). During this period, only important variation in terms of emissions is due to exceptional episodes of forest fires in 2011-2012 that are accounted in the FOLU sector.

Figure 2. Albania's mean annual GHG emissions (kt CO_2e) per sector (2009-2016)



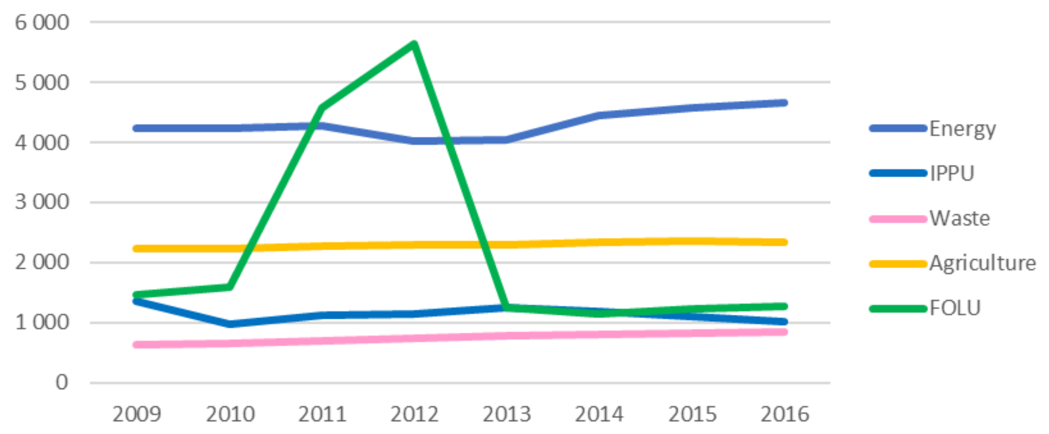
This overall national evolution hides discrepancies between individual sectors:

- Emissions of the Energy sector amounted to 4,243 kt CO_2e in 2009 and to 4,664 kt CO_2e in 2016 (+9.9%).
- Emissions of the Industrial processes and Product Use (IPPU) sector amounted to 1,356 kt CO_2e in 2009 and to 1,020 kt CO_2e in 2016 (-24.8%). This decrease is mainly due to a technology switch in the Iron & Steel sector between 2009 (Direct Reduced Iron Production) and 2010 (Electric Arc Furnace).

- Emissions of the Waste sector amounted to 621 kt CO_2e in 2009 and to 838 kt CO_2e in 2016 (+35.1%).
- Emissions of the Agriculture sector amounted to 2,239 kt CO_2e in 2009 and to 2,344 kt CO_2e in 2016 (+4.7%).
- Emissions of the Forest and Other Land Use (FOLU) sector amounted to 1,467 kt CO_2e in 2009 and to 1,274 kt CO_2e in 2016 (-12.4%). Emissions peaks are caused by the effect of exceptional episodes of forest fires in 2011-2012. However, the fuelwood demand is the important driver of FOLU trends in general and is the main reason why the FOLU is not a net carbon sink during the period as CO_2 emissions from the combustion of wood are reported under the FOLU sector and not under the energy sector.

Specific trends per sector are presented on the figure below:

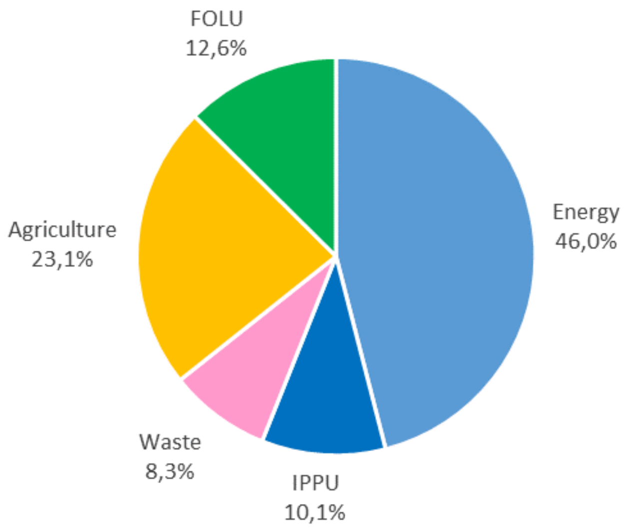
Figure 3. Emission trends (kt CO_2e) per sector (2009-2016)



2.1.2. 2016 GHG inventory

In 2016, according to the national inventory figures from the draft of the first BUR and the 4th National Communication, used as a base for the NDC projections, Albania emitted 10,184 kt CO_2e, 46.0% from the Energy sector; 23.1% from the Agriculture sector; 12.6% from the FOLU sector; 10.1% from the IPPU sector and 8.3% from the Waste sector.

Figure 4. 2016 emissions

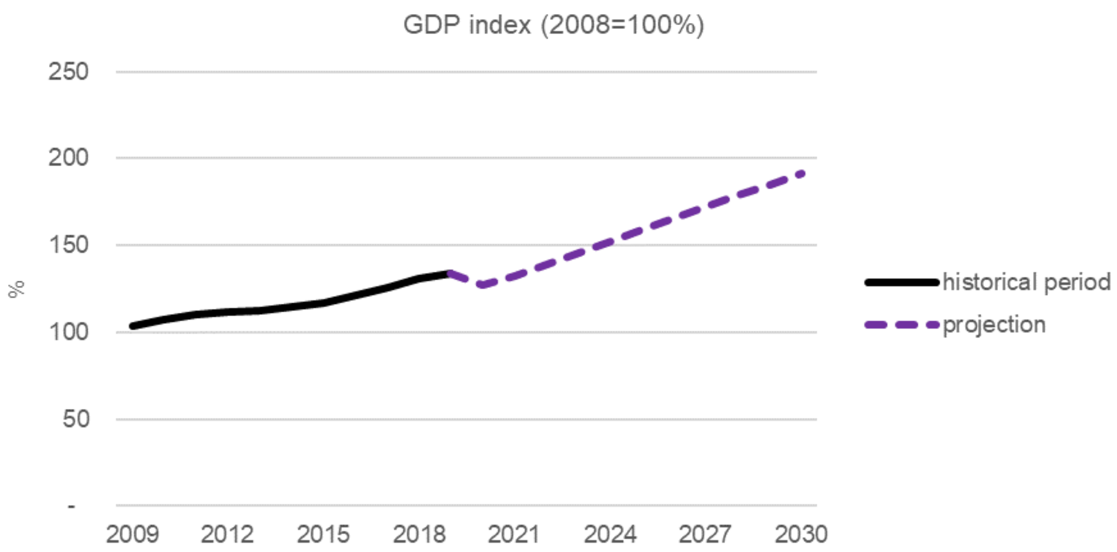

FOLU
12,6%
Energy
46,0%
Agriculture
23,1%
Waste
8,3%
IPPU
10,1%

2.2. Projections

2.2.1. BAU scenario

The NDC relies on the comparison between a Business as Usual scenario (BAU) and a NDC scenario considering mitigation measures. Projections rely on macro-economic assumptions such as GDP and population forecast but also on historical trends, strategies and plans as endorsed at national level. Population is expected to remain constant on the time-series. GDP forecast considered in the assumptions is presented on the figure below.

Figure 5. Historical data and GDP forecast[7]

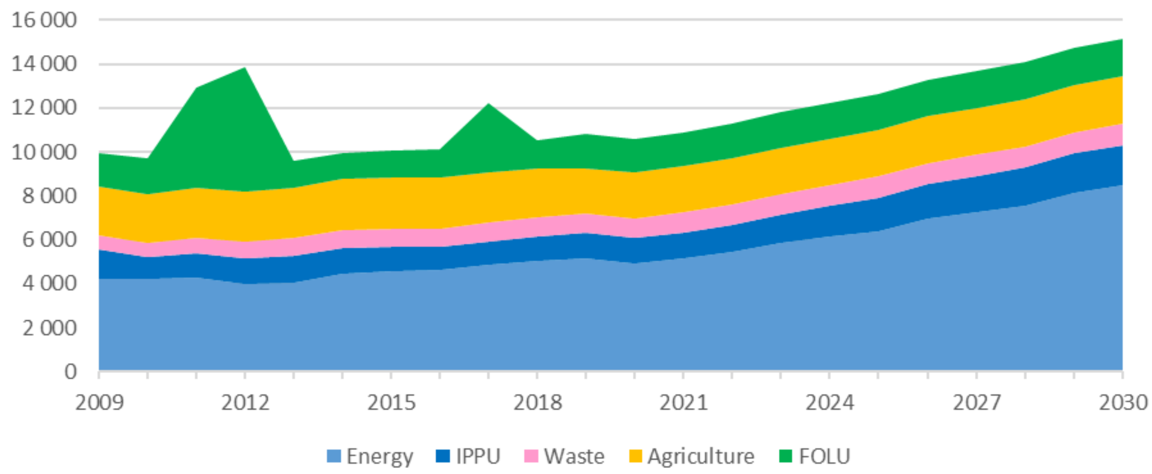


The BAU scenario relies on current trends and future economic development. It considers the national circumstances such as the current energy poverty. No major technology switch is taken into account. The BAU considers only very small scale improvements for Energy Efficiency (energy efficiency based on technology improvement and fleet renewal) and Renewable energy as well as laws adopted before 2016 (increase of biofuels share in the road transport to reach 10% in 2030) and introduction of imported Natural gas in the country around 2023.

The NDC scenario takes into account national strategies and action plans as detailed at sectoral level below (*summary; more details are provided in* Annex 1. Mitigation calculations (details for sectors)).

[7] Study on carbon pricing design for the energy community (ENC,2020)

Figure 6. Historic and projected emissions (kt CO_2e) for all sectors (BAU)

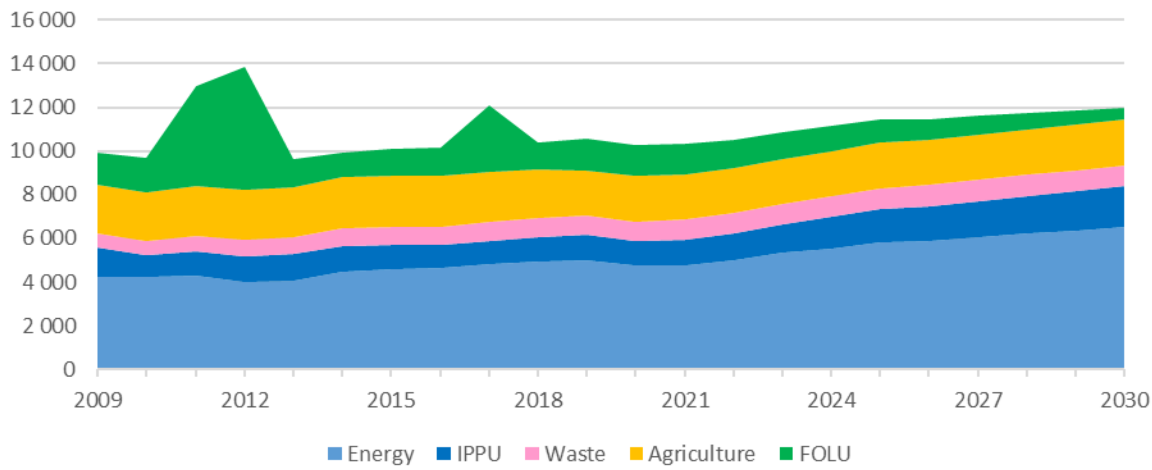


Considering all sectors (including FOLU), emissions for the BAU scenario increase from 10,139 kt CO_2e in 2016 to 15,148 kt CO_2e in 2030, which represents an evolution of +49.4%.

2.2.2. NDC scenario

The figure below presents the projected evolution of emissions for all sectors according to the NDC scenario. The relative contribution of each sector to the total of emissions remains similar to the situation of the reference year, except for the FOLU sector that has a decreasing impact, due to a higher level of absorption by sinks and a lower level of emissions by sources.

Figure 7. Evolution of emissions per sector (kt CO_2e) according to the NDC scenario



The aggregated effect of mitigation actions is presented in the following figure.

Considering all sectors (including FOLU), emissions for the NDC scenario (with mitigation measures) increase from 10,139 kt CO_2e in 2016 to 11,978 kt CO_2e in 2030, which represents an increase of +18.1%. **The difference, in 2030, with the BAU scenario, is -3,170 kt CO_2e, which represents a mitigation impact of -20.9%**.

Overall, the mitigation actions accounted in the NDC scenario could help avoid, in total during the period 2021-2030, 16,828 kt CO_2e compared to the BAU scenario. This is the cumulative effect of the emissions reduction between NDC scenario and BAU scenario.

Figure 8. Evolution of total emissions according to the NDC scenario and difference with the BAU scenario

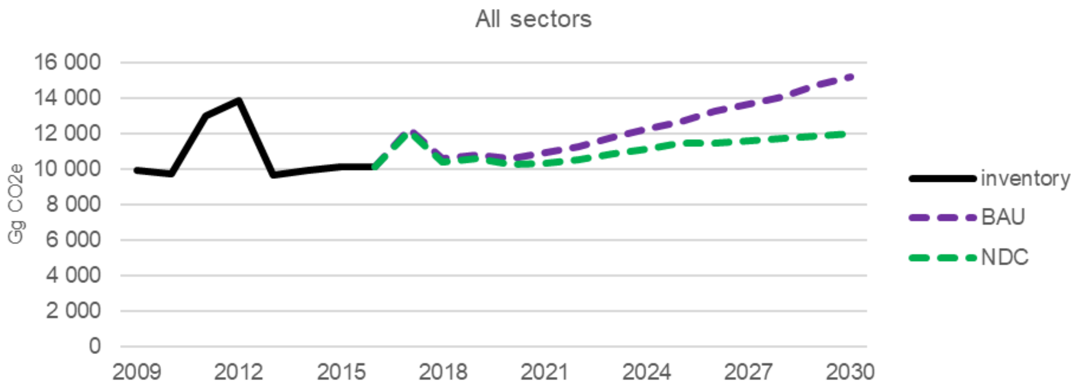


Figure 9. Emission reductions between the NDC and BAU scenarios by sector, in 2030

The % reduction relate on each sector, not on the total GHG emissions as presented in the table below.

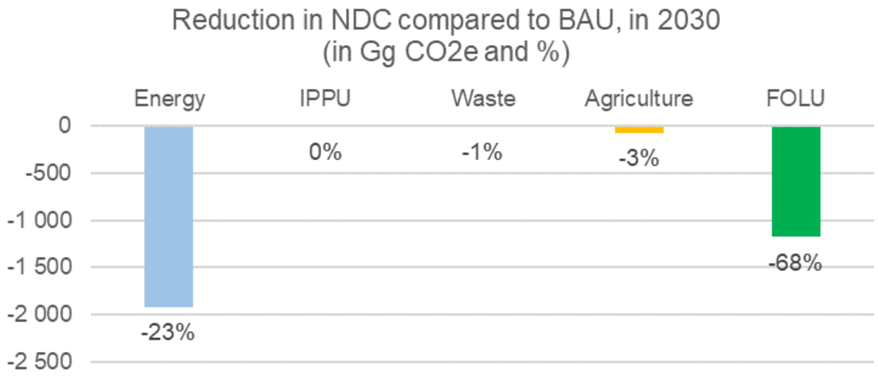


Table 1. Summary of the mitigation reduction in 2030 (NDC compared to BAU scenario)

	2030 BAU	2030 NDC	Reduction in NDC compared to BAU	
	GgCO2e	*GgCO2e*	*GgCO2e*	*%*
Energy	8 466	6 544	-1 921	-23%
IPPU	1 854	1 854	0	0%
Waste	966	959	-7	-1%
Agriculture	2 140	2 071	-68	-3%
FOLU	1 722	549	-1 174	-68%
Total	**15 148**	**11 978**	-3 170	**-20,9%**

2.2.3. Energy

2.2.3.1. Energy supply and consumption (2009 – 2016)

The primary energy supply in Albania is dominated by oil products, hydro and net import electricity, fuel wood and a small amount of coal and natural gas as shown on Figure 12. Final Energy Consumption by energy source for the year 2009 (%) and 2016 (%) Oil products have been reduced from 60.40% (2009) at 58.93% (2016), hydro & net import electricity have increased from 26.69% (2009) to 28.53% and wood has been reduced from 10.04% (2009) to 7.96% (2016). **Error! Reference source not found.** shows the Final Energy Consumption in Albania in 2009 and 2016 respectively, demonstrating that the transport sector consumes the most final energy, followed by households and industry.

Figure 10. Energy supply (ktoe) by energy source for the period 2009-2016

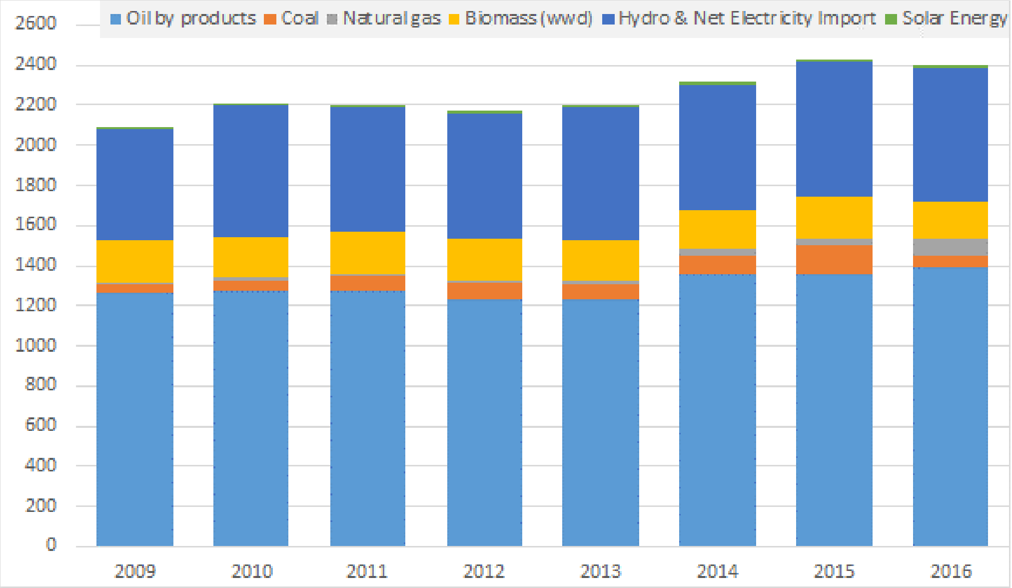


Figure 11. Energy Supply by energy source for the year 2009 (%) and 2016 (%)

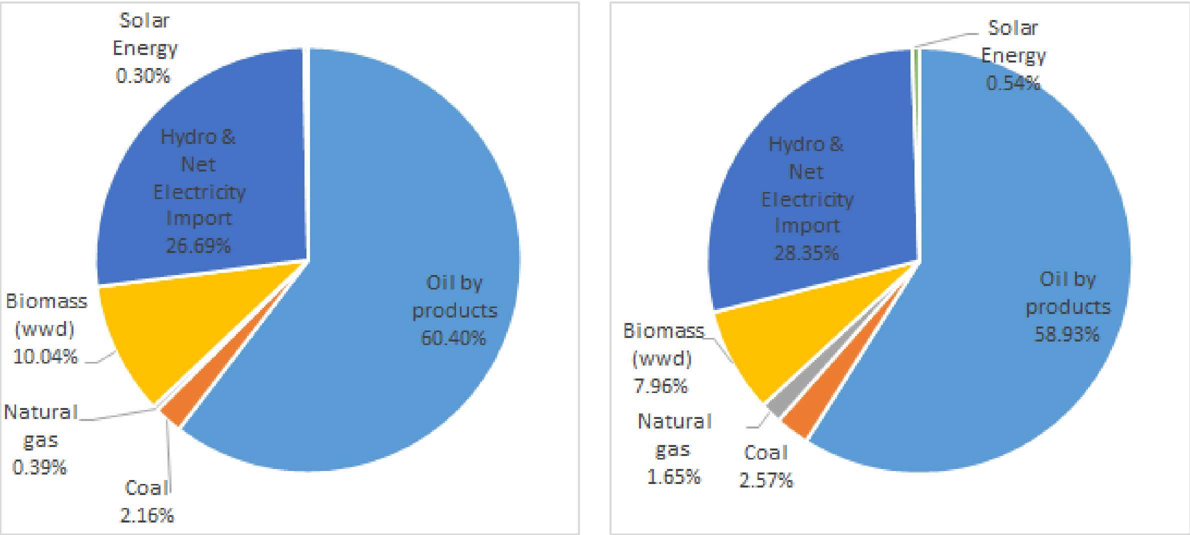
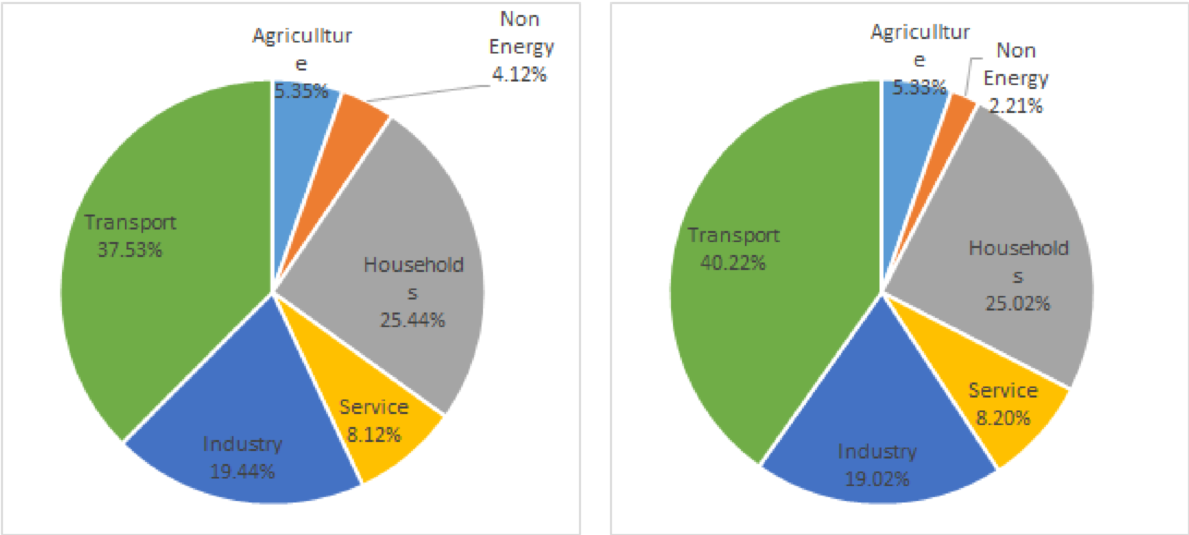


Figure 12. Final Energy Consumption by energy source for the year 2009 (%) and 2016 (%)



Electricity generation has been historically met almost exclusively by hydropower plants, with a total installed power capacity of 2,011 MW at the end of 2016. The country has exploited approximately 50% of its hydropower potential, and future expansion of hydropower capacity is possible mainly along the Drini, Mati, Devolli, and Bistrica rivers. Given that one of the most important natural renewable energy resources for electricity generation in our country is the hydro it is very important that Water Secretariat Responsible for Water Resources Administration should be monitoring all new licenses issued for hydro power plants. Monitoring of water resources should guarantee the protection and preservation of water resources in the country, in accordance with the policies integrated in the field of water resource management.

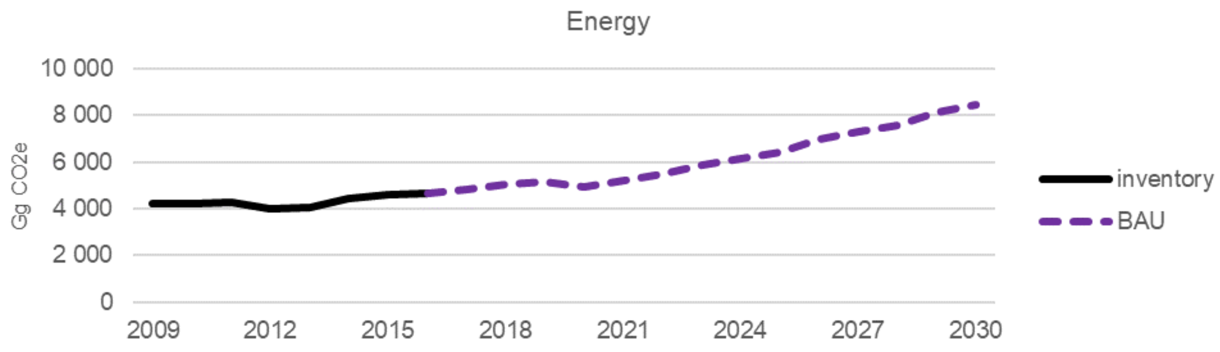
The only thermal power plant, Vlora TPP, is not yet operational, and its conversion to natural gas is foreseen following construction of the Trans Adriatic Pipeline (TAP). Albania imports electricity from neighboring countries, although imports have progressively dropped in the last ten years following the increase in domestic power generation and the reduction of (technical and nontechnical) electricity losses in the distribution system, which have been reduced from 45% in 2013 to 28% by the end of 2016[8] with a clear investment and management plan to reduce them further to 17% by the end of 2022. Albania's electricity market is under transition from a centrally planned to a market-based system. The wholesale power market is dominated by the state-owned, regulated generation company KESh, which supplies to OSHEE the electricity needed for captive customers under regulated "full supply" condition. The competitive wholesale environment consists of independent producers and a small number of large customers supplied through bilateral contracts.

2.2.3.2. BAU scenario in the energy sector

(summary; more details are provided in Annex 1. Mitigation calculations (details for sectors)*)*

In the Energy sector, consumptions are expected to increase rapidly according to economic development based on current technologies. GHG emissions for the BAU scenario increase from 4,664 kt CO_2e in 2016 to 8,466 kt CO_2e in 2030, which represents an evolution of +81.5%.

Figure 13. Projected energy-related emissions



The BAU scenario is based on the most likely evolution of the Albanian energy sector according to the baseline scenario of the National Strategy of Energy approved by the Albanian Government on August 8, 2018 and with no further policy interventions. It was developed accordingly to the National Energy Strategy considering new set of macro-economic drivers such as GDP and population. LEAP was the energy model used for energy demand forecast for baseline and other scenarios for policy makers (see below for further description) taking as base year 2015 and carry out yearly energy demand until 2030.

LEAP is a widely used model-building tool for analyzing energy systems in the medium to long term. LEAP is a user-friendly accounting framework that can be used to analyze the integrated energy and environment results of a baseline and alternative scenarios of the energy system as it grows over time. An Albania-LEAP model has been in use since 1997. A basic characteristic of LEAP models is that the calculation of energy demands is based on a "bottom-up" approach with many decentralized data, such as end-use energy intensities, the efficiency and penetration rates of different equipment and the demand for energy services at the residential, commercial,

[8] Implementation of the project "Recovery of the Power Sector" and the recent revamping work carried out on the transmission-distribution networks during the years 2014-2020.

agriculture, industry and transport sectors levels. Given these sectoral demands, LEAP software calculates the demand for primary energy sources, electricity and all other energy commodities. LEAP also calculates a variety of emissions that are generated from the fuels used.

Nowadays, the Albanian economy is predominantly based on the service sector. Agriculture has also been one of the most important economic sectors in Albania. Nonetheless, during the last decade the Albanian economy has shifted towards industry and service due to increased urbanization and emigration. Consequently, the service sector is today the largest contributor to GDP, comprising around 60% of the total, followed by agriculture and manufacturing industry. All these factors have been incorporated into the Baseline sectoral demand projections.

The main drivers of energy consumption in the residential sector are population and the number of households. Data on the number of persons per household in developed European countries and countries in transition show that household size decreases as the standard of living grows. The decrease occurs due to the aging of the population and the increase in the number of one-member and two-member households. In Albania, the number of persons per household is expected to decrease from 2.92 in 2014 to 2.41 in 2030.

To reflect the various climatic zones in Albania, households were categorized into three zones with respect to their heating and cooling demands. Breakdown between zones is done based on the concept of Heating Degree Days according to the Albanian Energy Building Code (approved by the Albanian Council of Ministers in January 2003). Zone 1 is most of the urban centers in coastal area of Albania with heating degree days lower than 1300 °C, Zone 2 with cities with heating degree days higher than 1300 °C and lower than 2300 °C, and Zone 3 is mountainous areas with heating degree days higher than 2300 °C.

The basic measure of heating standard in the model is heated area. The heated area of the average household was determined based on statistical data and calibrating with the data from the energy balance. The share of heated area in total living area (load factor) is 31% and is the result of the purchasing ability of the population, the availability of firewood, the price of electricity, and life priorities arising from tradition and cultural heritage. Therefore, with standard growth, the further increase of the share of heated area in a total area of housing units is 70% by 2030.

In order to calculate the energy demand, the Service Sector was divided in two branches: Public Service and Private, or Commercial Service. The Public Service Sector is based on the traditional approach to heat demand, mainly using not efficient technologies, installations and organization, although in some recent cases new schemes have been introduced. Commercial Service Sector approach is based on rapid introduction of modern technology, but improvements are needed regarding the efficient utilization. Private Service Sector has inherited some traditional repair-service and small shops/restaurants that have neither possibility nor demand for space heating and air conditioning. Meanwhile, in many services, the private sector has experienced modern and qualitative developments. This service group includes business categories such as hotels, restaurants, banks, tourist agencies, consulting and insurance offices, etc. as well as many parallel services with the public service such as education, culture, health, etc., aiming the maximal comfort. Analysis of the energy demand is based on the general tendency of the previous period. A number of driving factors were taken into consideration as determining factors for the future energy demands. The public service buildings have as a special driving factor the total volume, divided in the heated stock and unheated stock. In order to increase the service quality, improve the working conditions and the comfort for the public administration, was forecasted that until the end of the period 2014-2030, the existing ratio would change in favour of the heated stock in 2030. The GDP growth from the service sector will be accompanied with energy demand increase due to high comfort requirements, the qualitative improvement of the services and changes of the ratio between the urban and rural populations in favour of the former.

The structure of the industry sector in Albania shows that three main industrial sectors are consuming the highest share of energy: food, metal and building materials industries. Each of these industries is represented by its final energy consumption of electricity and other fuels. The growth in GDP is the most influential determinant of energy demand in industry. In addition to overall GDP growth, the value-added structure of the GDP drives the energy consumption for the industry and agriculture sectors. In the early development of a society, agriculture contributes a significant share of GDP. GDP from agriculture has been dominant in the past. As the society develops, GDP from the Agriculture sector will increase in absolute terms, but the sectoral share will remain constant in relative terms while the share of industry grows. GDP from the Service sectors will increase in absolute terms. In developed economies the dominant GDP share belongs to services, followed by industry and then agriculture. The growth in GDP is the most influential determinant of energy demand in industry. For this analysis, given that little structural changes are anticipated in the near-future, the expected contribution from agriculture is expected to remain constant at 22.7%, while the contribution from the overall industry sector to be increased from 14.9% (2014) up to 25% at 2030.

The Transport Sector is the largest energy consuming sector in Albania and plays an important role in the consumption of energy resources. After 1990, there was a significant increase in the number of the transport modes, especially for road transport, which lead to a significant increase of transport activity and fuel consumption, mainly diesel and gasoline. In order to calculate the future transport energy demand, the sector was divided in two sub sectors: transport of freight and passengers. For the transport sector, two main indicators measure the demand for passenger and freight transport: passenger-km and ton-km. It is forecasted that ton-km will increase by 85% in 2030 compared to 2014, while passenger-km will increase by 37%. The vast majority of transport is undertaken by road vehicles. Albania’s transport sector has been increasing rapidly since 2000. The number of vehicles in circulation has increased and infrastructure is being improved, which leads to an ever-increasing total traffic load. The transport sector consumes significant quantities of energy (mostly in the form of diesel and gasoline).

Albania will continue to remain for many years a country where the agriculture dominates. The income increase from the agricultural production, livestock, agro-industry, fishing and forestry remains the main alternative for the economic and social development of the country. The development of the agriculture sector is conditioned by many factors where the most important are: Farms are of minimal sizes and fragmented; Problems exist over arable land property rights; Farm inputs have very high prices and the distribution system for agricultural production is unorganized and inefficient; There is a lack of available agriculture crediting, and Agricultural production is insufficiently mechanized. The organisation of farms brings energy savings in the NDC scenario.

2.2.3.1. Energy NDC scenario

The analysis of the Albanian Energy Sector was performed using the Albania-LEAP model results adjusted according to the latest development of the period 2014-2020, a proven tool used previously by the Albanian Government and commonly used by other countries in the region and globally. The analytical results provided quantitative metrics for assessing the likely outcomes of possible energy scenarios against the goals of this strategy.

Establishment of the NDC scenario for Energy Sector was based mainly on the Albania's Energy Sector Strategy, which is harmonized in terms of goals, energy sector details and timeline with a number of other strategic and legal documents that are in force, adopted or drafted in the same time frame as this document. Building on and complementing these documents has led to synergies in the prioritization of policies and programs and in the development of strategic recommendations. The National Strategy for the Energy Sector (2017-2030) is aligned with the following key documents:

- Obligations under the Energy Community;
- National Strategy for Development and Integration – 2015-2020 (Albanian Council of Ministers, 2017);
- National Programs for Economic Reforms (NPER) 2015-2017 and 2016-2018 Albanian Council of Ministers, 2017);
- Albanian Renewable Energy Source Action Plan (NREAP adopted by the Governmental Decree no.27, dated 20.01.2016);
- 1st National Energy Efficiency Action Plan 2011-2018 (Government Decree no. 619, date 7.09.2011)
- 2nd and 3rd Albanian Energy Efficiency Action Plan 2017-2020 (Government Decree no.709, date 1.12.2017);
- Intended National Determined Contribution (INDC approved by the Albanian Government on September 2015);
- The Decision of the Council of Ministers (DCM) no. 519, dated 13.07.2016 "On the approval of the Market Model of the Power Sector";
- The DCM no. 125, dated 11.02.2015 "On the approval of the financial recovery plan in the power electricity sector";
- Albanian National Gas Master Plan (November 2016);
- Transport Sector Strategy in Albania – Final Strategy & Action Plan (DCM No. 811, dated 16.11.2016);
- Albanian Sustainable Transport Plan (Draft Jane 2016);
- Law on Biofuels No 9876 (2008)
- Law on Power Sector No. 43/2015, dated 30.04.2015;
- Law on Renewable Energy Sources No. 7/February 2017;
- Law on Hydrocarbons No. 6/February 2017;
- Law on Natural Gas No.102/2015, dated 23.09.2015;
- Law on Energy Efficiency No. 124/2015, dated 12.11.2015;
- Law on Energy Performance in Buildings No. 116/2016, dated 10.11.2016;
- Law on Climate Change
- Official Albanian Energy Balance prepared from AKBN for years 2009-2019;
- Official ERE Annual reports related to Power Sector Electricity Balance prepared from ERE for years 2012-2020;

- CENSUS 2011 – Albanian Household Registration (INSTAT website);
- GDP sectorial development 2012-2019 – (National Bank of Albania and the World Bank websites)
- First National Communication of Albania to the UNFCCC (FNC – 2002);
- Albania's Second National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change (SNC – 2009);
- Albania's Third National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change (TNC – 2016);

The following long-term strategic objectives were identified to actualize the Guiding Principles and the current commitments that have been undertaken by the Albanian government.

Improving the reliability and security of energy supply;

Developing the domestic primary energy sources in a sustainable and competitive manner

Improving the cost-effectiveness of energy supply systems;

Achieving the targets for renewable energy sources and energy efficiency established in the second National Energy Efficiency Action Plans and the National Renewable Energy Action Plan;

Developing least cost and sustainable policy for residential heating and cooling

Integrating the Albanian power and natural gas markets with regional Energy Community and European markets; and

Achieving the Nationally Determined Contribution (NDC) targets for greenhouse gas (GHG) emission reductions.

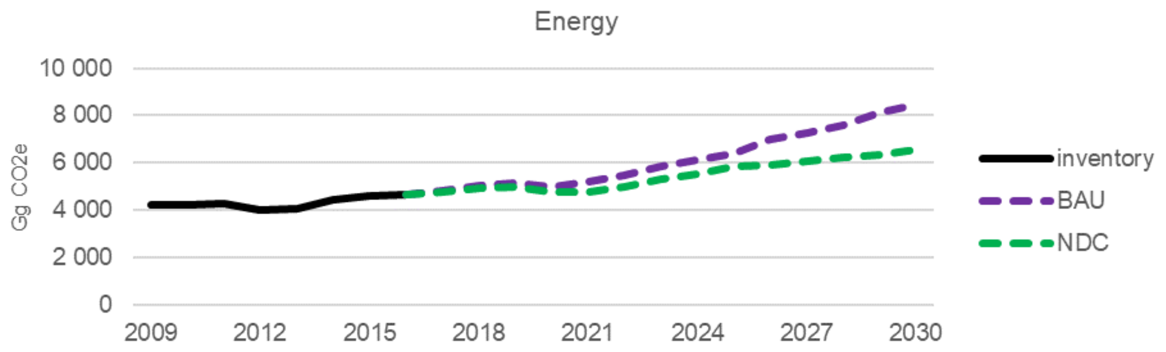
To understand the costs and benefits of these possible policies, the following four other scenarios were developed and analyzed using the Albania-LEAP model.

- **Energy Efficiency (EE)**: This scenario assumes that Albania meets its Energy Community Treaty commitments by implementing the second National Energy Efficiency Action Plan and enforceing the Law on Energy Efficiency (together with improvement of the Law to transpose EED requirements) and the Law on Energy Performance in Buildings. EE target for 2030 has been defined to be 15%.
- **Renewable Energy Sources (RES):** Assumes that Albania meets its Energy Community Treaty commitments of reaching a 38% renewable energy target in 2020 by implementing the Albanian National Renewable Energy Action Plan. RES target for 2030 has been defined to be 42.5%.
- **Natural Gas Promotion**: Assumes maximum possible penetration of natural gas in line with the Gas Master Plan. Natural gas penetration rate of penetration target for 2030 has been defined to be 8-10% (National Natural Gas Master Plan). Natural gas in Albania will be mostly for guaranteeing the security of electricity supply since Albanian power sector is 100% based on the hydro resources and in electricity import.
- **Combined:** Combines the EE, RES and Natural Gas Promotion scenarios. Under this scenario all above mentioned targets have been aggregated and guaranteeing so proper development scenario for development of energy sector until 2030.

The Energy sector NDC scenario is based on Combined – Strategy scenario calibrated with real figures for the period 2015-2019. The NDC scenario takes into account the introduction of natural gas in almost all sectors (including energy industry, manufacturing industry, transport, commercial, residential and agriculture). It also considers the implementation of the different National Energy Efficiencies Actions Plans (NEEAP) to increase energy efficiencies in both supply and demand reaching a 15% gain in 2030. It also takes into account the National Renewable Energy Action Plan (NREAP) with objectives of a share of 38% of renewables in the final energy consumption in 2020 (already almost reached in 2019) and 42% in 2030.

Emissions for the NDC scenario (with mitigation measures) increase from 4,664 kt CO_2e in 2016 to 6,544 kt CO_2e in 2030, which represents an evolution of +40.3%. The difference, in 2030, with the BAU scenario, is -1,921 kt CO_2e representing a mitigation impact of -22.7%.

Figure 14. Projections for energy sector according to BAU and NDC scenarios



The following table presents a summary of the mitigation actions taken into account in the NDC scenario for this sector. The list of measures presented below is based on the list of measures presented under the Energy Strategy and all other strategic documents mentioned above.

Table 2. Summary of the main mitigation actions for the energy sector

N°	Sector	Name	Subsector	Policy context	Description
E1	Energy	**Energy efficiency**	Transport	National Energy Efficiencies Actions Plans (NEEAP), NSE, Action Plan of Transport sector, National Energy Strategy 2018-2030	Efficient transport system: Increasing the share of public transport for passengers and freight (roads, railways and waterways). Up to 2030, 30% of the road transport of over 300 km shall be shifted to other transport modalities, like the rail. Up to 2050 the goal to be achieved is 50%. Energy labelling of new vehicles.
E1	Energy	**Energy efficiency**	Buildings - Residential & Tertiary	National Energy Efficiencies Actions Plans (NEEAP), National Energy Strategy 2018-2030	Improving the energy performance in buildings keeping into account the local and climatic conditions of the country, interior comfort of buildings and cost effective. Renovation of public building stock each year by 2% of the heated /cooled area for buildings that are under administration of, or used by a public authority, or provide a public service, with a view to meeting the minimum energy performance requirements.
E1	Energy	**Energy efficiency**	Power sector (electricity generation, transmission and distribution)	National Energy Efficiencies Actions Plans (NEEAP), National Energy Strategy 2018-2030	Reduction of transmission and distribution losses by promotion of distributed generation.
E1	Energy	**Energy efficiency**	Industry	National Energy Efficiencies Actions Plans (NEEAP), National Energy Strategy 2018-2030	Reduction of emissions from industries based on energy efficiency.
E2	Energy	**Renewable Energy**	Power sector	National Renewable Energy Action Plan (NREAP), National RES Action Plan 2019-2020	Transition process towards diversification away from hydropower and promote alternative sources of renewable energy: By 2030, 42 % of renewable energy in gross final energy consumption.

E2	Energy	**Renewable Energy**	Transport	National Energy Strategy 2018-2030	Renewable energy sources in transport: Goal for the share of the biofuels vs. total fuel consumption in transport sector 10% in 2020, 10% in 2025 and 10% in 2030 as compared to 3.55% in 2015. The share of electrical vehicles (EV) is increasing in the passenger cars fleet (up to 10% of passenger.km in 2030). Bicycle as Passenger travel mode is increasing (up to 5% of passenger.km in 2030).
E3	Energy	**Penetration of natural gas**	Power supply	Gas master plan 2018	Increasing the penetration of natural gas Development of the gas market and services in Albania based on natural gas supplied through the Trans Adriatic Pipeline (TAP Project), as well as potential gas sources discovered and concretized in the country, or even through natural gas pipelines such as the Ionian Adriatic Pipeline (IAP Project) and the Albania - Kosovo Pipeline (ALKOGAP Project). Albania intends to develop an underground natural gas storage site in Dumre, near Elbasan (UGS Dumrea Project). The construction of the pipeline that will link the TAP project near the Fier Compressor Station area to the Vlora TPP and the entire Vlora region, will make it possible to restore the Vlora TPP by using natural gas as fuel.

2.2.4. IPPU

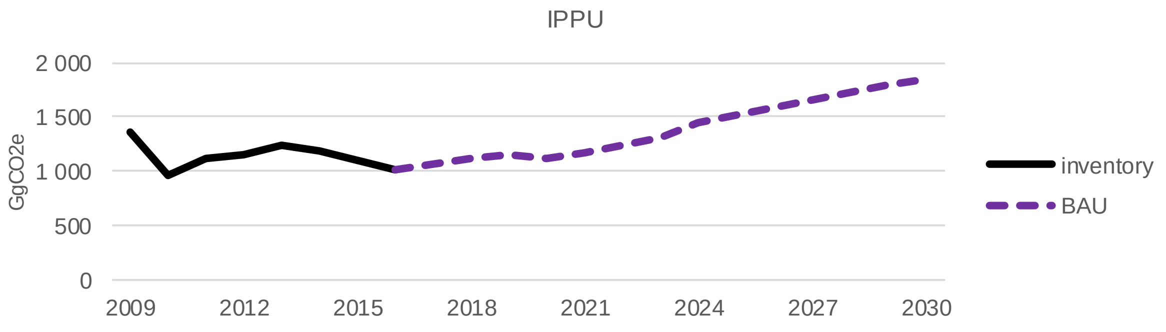
2.2.4.1. Overview of the IPPU sector

Almost 90% of GHG emissions from industrial processes depends on the cement production. Emissions from energy consumption in the manufacturing industry are considered under the Energy sector presented above.

2.2.4.2. IPPU BAU scenario

In the IPPU sector, emissions for the BAU scenario increase from 1,020 kt CO_2e in 2016 to 1,854 kt CO_2e in 2030, which represents an evolution of +81.9%. The BAU scenario is based on the GDP trend for all sub-sectors (as considered in the GHG inventory) of the manufacturing industry except for F-gases. For F-gases, emissions are based on a model considering imports, bank, equipment market, refrigerant market share, equipment production, average characteristics of equipment. Albania has ratified the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, in 2019. The impact is considered in the BAU. In 2030, HFCs are expected to represent about 16% of IPPU CO_2e emissions.

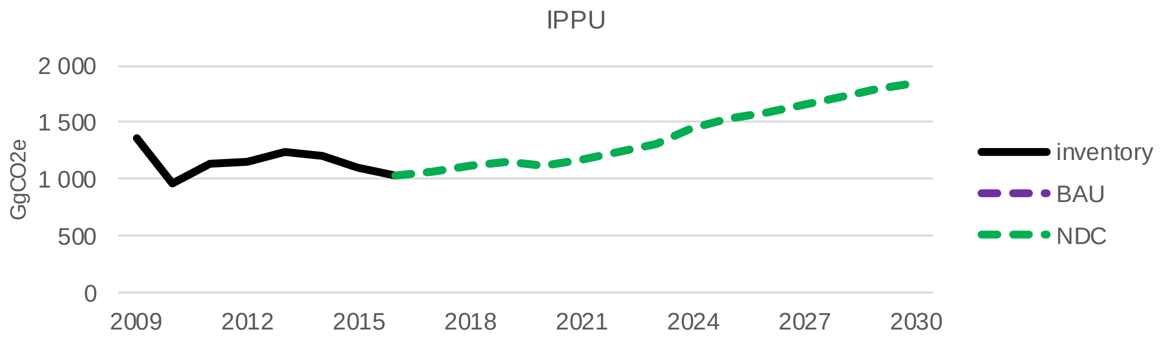
Figure 15. Projected IPPU-related emissions



2.2.4.1. IPPU NDC scenario

For the IPPU sector, no additional Policies & Measure are considered. Impact of energy efficiency (EE) or fuel switch measures in the industry are taken into account in the Energy sector. BAU and NDC scenarios are therefore identical.

Figure 16. Projections for IPPU sector



2.2.5. Waste

2.2.5.1. Overview of the waste sector

GHG emissions of the waste sector are mainly due to landfills (in 2016, CH_4 emissions from landfills represented almost 80% of total waste emissions). The waste degradation being subject to a kinetics, this induces a gap between the maximum of buried waste and the peak of emissions observed.

The second sub-sector in terms of emissions is the wastewater treatment because of N_2O emissions.

In Albania, urban solid waste collection systems are in place in most cities. Little recycling of waste is undertaken. The principal method of disposal is dumping. There are no collection systems in rural areas and small towns. Most of the waste from these areas is disposed of by dumping in ditches, ravines, or at the side of roads where it is washed and blown onto other land and ultimately into water courses.

There are some landfills already functioning in 2010 (Tirana and Shkoder Region), while the others remained at the project level (new landfills of Korce, Pogradec, Sarande, Vlore, and Durres).

Except for Kavaja and Pogradec wastewater treatment plants, there are no other wastewater treatment facilities in the country. These two facilities are relatively small to make a difference and almost all used water is discharged untreated to water bodies.

Albania started the construction of 3 incinerators of urban waste in Elbasan, Tirana and Fier. The first one entered in operation in 2017 to perform tests and all the incinerators should be operational in 2023. There is no segregated waste collection system in place yet, which is required by law since several years now. In the country, there are established waste recycling industries mainly for plastics and metals.

2.2.5.2. Waste BAU scenario

In the Waste sector, emissions for the BAU scenario increase from 838 kt CO_2e in 2016 to 966 kt CO_2e in 2030, which represents an evolution of +15,3%.

Figure 17. Projected waste-related emissions

The BAU scenario assumes a stable level of waste produced per year and per capita, a stable ratio of waste going to landfill, no methane capture installation; an amount of composted, of incinerated and of open burnt waste per inhabitant equal to the mean value of the three recent years and evolves with the population trend. The wastewater treatment forecast is based on industrial production trend (*more details are provided in Annex 1.* Mitigation calculations (details for sectors)).

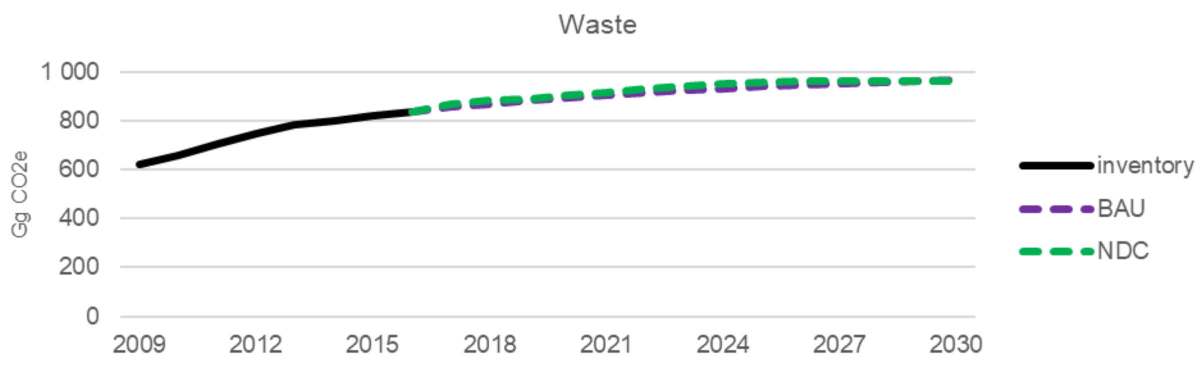
2.2.5.3. Waste NDC scenario

In the Waste sector, emissions for the NDC scenario increase from 838 kt CO_2e in 2016 to 959 kt CO_2e in 2030, which represents an evolution of +14.5%. The difference, in 2030, with the BAU scenario, is -7 kt CO_2e, which represents a mitigation impact of -0.7%.

The small difference observed between the 2 scenarios can be partly explained by the degradation kinetics of the waste sent to landfills. In fact, this kinetics induces a gap between the maximum of buried waste (960 kt in 2010) and the emission peak observed (728 kt CO_2e in 2024).

In parallel, a strong increase of emissions associated with the development of waste incinerators in the country is considered.

Figure 18. Projections for waste sector



The following table presents a summary of the mitigation actions taken into account in the NDC scenario for this sector (*more details are provided in Annex 1*).

Table 3. Summary of the mitigation actions for the waste sector

N°	Sector	Name	Subsector	Policy context	Description
W1	Waste	**Reduction in the amount of waste going to landfill**	Landfilling	Governmental Decree No.418, dated 27.05.2020 (National regulatory text that defines technical and operational requirements for waste and landfills). TNC and communications with national inventory teams	In 2030 the amount of municipal waste going in landfill is reduced to 35% of the total amount (by weight) of biodegradable municipal waste produced in year 2010.
W2	Waste	**Setting up of methane capture installation**	Landfilling	Gacmo-TNC;	Beginning of CH_4 capture in 2025 and linear evolution until the capture of 10% of 1.34 million m^3 of CH_4 in 2030.
W3	Waste	**Increase in the amount of composted waste**	Composting	Albanian Waste National Strategy - Table A5.1 - Waste projection	Increase in the amount of composted waste by 85% between 2009 and 2020 then +3% each year until 2030.
W4	Waste	**Stagnation of the total amount of clinical waste incinerated**	Incineration	. TNC and communications with national inventory teams . Albanian Waste National Strategy - Table A5.1 - Waste projection	Stagnation of the total amount of clinical waste incinerated. From 2017 to 2030, we consider that 0,04 kt of clinical waste are incinerated.
W5	Waste	**Increase of MSW incineration**	Incineration	. TNC and communications with national inventory teams . Albanian Waste National Strategy - Table A5.1 - Waste projection	Start of MSW incineration in 2017 (only for testing) and gradual increase between 2021 and 2030. 2017: start 2017 - 2018: +100% 2018 - 2019: +50% 2019 - 2020: +33% 2020 - 2021: +25% 2021 - 2030: +27 079%
W6	Waste	**Decrease in the amount of waste burned in open fires.**	Open burning	Albanian Waste National Strategy - Table A5.1 - Waste projection	Decrease of waste open burned in proportion to the quantity of waste not collected in the country. 2016 – 2017: -31% 2016 – 2020: -76% 2016 – 2030: -74%
W7	Waste	**Wastewater treatment in rural areas**	Wastewater treatment	TNC and communications with national inventory teams	No evolution regarding wastewater treatment methods in rural areas. Increase of the rate of connection of the urban population to shallow anaerobic lagoons. 2009: 1.63% 2016: 1.71% 2017: 1.73% 2020: 1.76% 2025: 1.82%
W8	Waste	**Wastewater treatment in industry**	Wastewater treatment	TNC and communications with national inventory teams	Increase of the total industry product evolution until 2030 estimated from national data and the GDP growth rate (except for Petroleum Refineries, data provide from energy sector). The following data are respectively about 2016 and 2030.

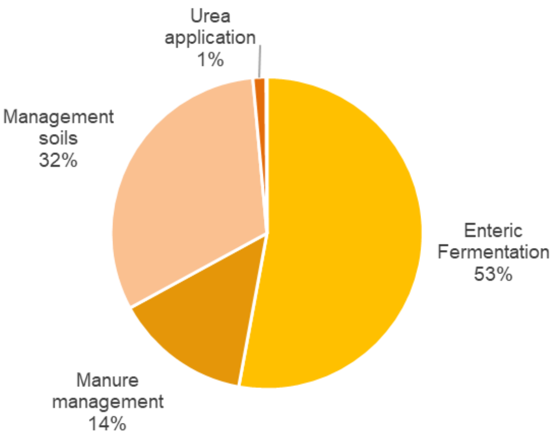
					Beer & Malt (t/yrs): 862 026 - 1 366 209 Dairy Products (t/yrs): 108 988 - 172 734 Meat & Poultry (t/yrs): 159 819 - 253 295 Pulp & Paper (t/yrs): 2 327 - 3 688 Wine & Vinegar (t/yrs): 22 420 - 35 533
W9	Waste	**Increase of protein consumption**	Wastewater treatment	Food and Agriculture Organization of the United Nations (FAO) - Statistics Division (ESS)	Increase of the annual per capita protein consumption estimated from FAOSTAT data. 2016: 35,04 kg/person/yr 2017: 43,11 kg/person/yr 2018: 42,22 kg/person/yr 2019-2030: 40,12 kg/person/yr

2.2.6. Agriculture

2.2.6.1. Overview of the Agriculture sector

Agriculture emissions are mostly driven by the livestock population. The main sources of emissions are methane emissions from enteric fermentation and from manure management. Historical data about livestock population is available, for the period 2009 to 2016, from the national inventory; and for the period 2017 to 2019, from Food and Agriculture Organization of the United Nations (FAO). The decreasing emissions between 2016 and 2020 comes from these data sources.

Figure 19. Share of emission sources of the agriculture sector (2016)

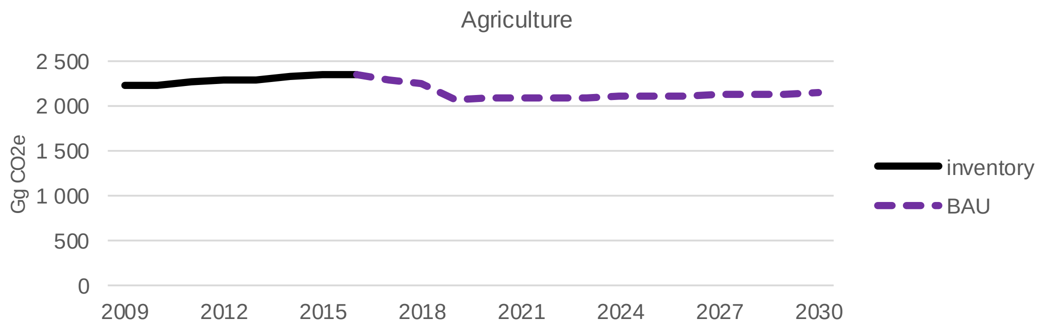


2.2.6.2. Agriculture BAU scenario

The trend between 2019 and 2030 is based on an interpolation between 2030 values used in Albania's Third National Communication (TNC) and the FAO values from 2019. The assumption from the TNC is an increase in most of the livestock populations (except for sheep, goats, horses, mule and asses) in line with the objective of promoting the Albanian agricultural production. It is assumed a constant animals' feeding and associated productivity, and a constant distribution of animals per manure management systems. For the calculation of nitrogen from crop residues, the analysis considers stable areas per types of crops, except for wheat, which is decreasing, and makes hypothesis regarding the increasing evolution of the average yield of these crops. The mineral fertilization projection is based on the evolution of area of total cropland (in line with FOLU sector), assuming that the average nitrogen rate is constant for the BAU scenario. Assumptions of stability have been made regarding other nitrogen inputs. The area of histosols is assumed stable. For crop residues burning, data from the European Forest Fire Information System (EFFIS) are taken into account for the period 2009-2018. Average rate of burning for wheat during this know period (2009-2018) equals 1.3% and is maintained for the whole period (2019-2030). For pasture burning, the average area burnt for 2009-2018 (5,154 ha) has been used for projected years (*more details are provided in Annex 1.* Mitigation calculations (details for sectors)).

In the Agriculture sector, emissions for the BAU scenario decrease from 2,344 kt CO_2e in 2016 to 2,140 kt CO_2e in 2030, which represents an evolution of -8.7%. However, the decreases from 2016 to 2019 is given through FAO datasets, and the projection for BAU considers a small increase from 2020 to 2030, in line with livestock population projected for the TNC.

Figure 20. Projected agriculture-related emissions

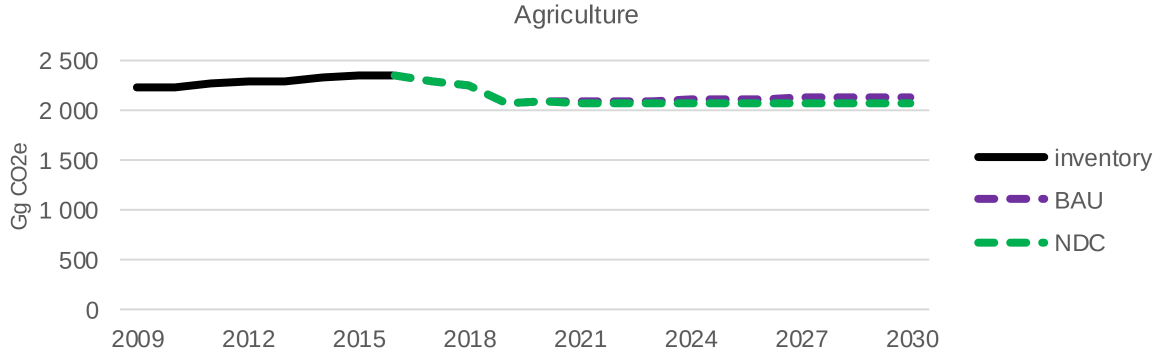


2.2.6.3. Agriculture NDC scenario

As for the BAU scenario, the decreases from 2016 to 2019 is based on FAO datasets, and the projection considers a small increase from 2020 to 2030, in line with livestock population projected in the TNC. Additional mitigation measures considered in Agriculture allow an improvement of fertilization, pasture, and animal feeding practices (see table 3.). However, these actions have little impact considering the importance of livestock population in the emissions. In line with the national strategy, and considering the national economic circumstances, the aim is an increase in production, no decrease of livestock population, and an increase in yields.

This explains that emissions for the NDC scenario for this sector (with mitigation measures) decrease from 2,344 kt CO_2e in 2016 to 2,071 kt CO_2e in 2030, which represents an evolution of -11.6%. The difference, in 2030, with the BAU scenario, is -68 kt CO_2e, which represents a limited mitigation impact of -3.2%.

Figure 21. Projections for agriculture sector



The following table presents a summary of the mitigation actions taken into account in the NDC scenario for this sector (*more details are provided in Annex 1*).

Table 4. Summary of the mitigation actions for the agriculture sector

N°	Sector	Name	Subsector	Policy context	Description
A1	Agriculture	**Promoting the Albanian agricultural production and competitiveness**	Livestock and crop production	CAP / EU's Rural Development Policy; NSDI-II; NTP	Increase in production, no decrease of livestock population, increase in yields
A2	Agriculture	**Improving nitrogen fertilization by applying the right rate**	Crop production	CAP / EU's Rural Development Policy; ECCS; NSDI-II; NTP; ISARD; IPARD; TNC	The impact of the actions A2 and A3 is a reduction of the average rate of mineral fertilizer spread on crops. We assume that this average rate will decrease by 10% between 2019 and 2030. This action leads to the reduction of mineral fertilization type through best practices.
A3	Agriculture	**Improving nitrogen fertilization by applying the right source**	Crop production	CAP / EU's Rural Development Policy; ECCS; NSDI-II; NTP; ISARD; IPARD; TNC	Improving nitrogen fertilization by applying the right source of nitrogen, promoting organic amendments and crops residues instead of mineral fertilizers. The impact of the actions A2 and A3 is a reduction of the average rate of mineral fertilizer spread on crops. We assume that this average rate will decrease by 10% between 2019 and 2030. Furthermore, we consider that other mineral fertilizers than urea could be used, thus we consider a reduction of 50% of the urea spread between 2019 and 2030. Complementary to action A3, this action lead also to reduction of mineral fertilizer through alternative solutions.
A4	Agriculture	**Increasing the time spent in pasture**	Livestock	TNC	This action applies only to cattle. In 2016, dairy cows spend 18% of their time in pasture. We consider that in 2030, they will spend 25% of their time grazing. In 2016, other cattle spend 20% of their time in pasture. We consider that in 2030, they will spend 25% of their time grazing. This action increase carbon sequestration in pasture and decreases emissions of N2O.

A5	Agriculture	**Optimizing animal feeding in order to reduce N2O and CH4 emissions**	Livestock	NSDI-II; ISARD; IPARD	Improved feeding techniques for animal in housing (where feeding can be controlled). This action applies only to cattle livestock in housing in 2030, at different application rates. The improved feeding techniques lead to: - A decrease in nitrogen excretion rate (N inputs from feeding fitting better to animal needs). We assume a 10% reduction for improved feeding. - A decrease in enteric CH4 (add of fat in feeding): according to the GACMO tool, this can lead to a reduction of 4% of CH_4 emissions for 1% of fat added.

2.2.7. FOLU

2.2.7.1. Overview of the FOLU sector

In the FOLU sector, emissions (mainly carbon losses from the harvest of fuelwood, wood, and forest fires) are bigger than absorptions (the growth of forest biomass). Therefore, this sector does not represent a net sink. During the historical period, fuelwood harvested quantities did not vary much (around 1 million m^3/y), and forest growth remained stable. On the other hand, there is a large magnitude of variation for forest fires, with one peak in 2011-2012 and another in 2017[9]. While the main driver of the sector and for the projections remains the forest, agricultural land also presents mitigation potential that has been taken into account.

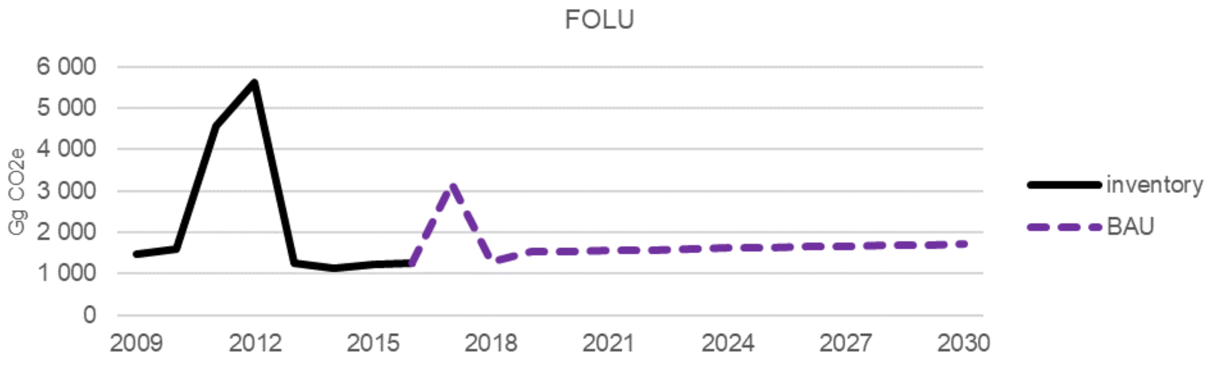
2.2.7.2. FOLU BAU scenario

The BAU scenario for FOLU sector considers the continuation of the situation and trends of the recent decade covered by the inventory, in particular in terms of trends for land-use change areas, wood and fuelwood harvests (stable, as in the 2009-2016 period). For wildfires, EFFIS data is used for 2017-2018, and it explains the second peak in 2017. Forest fires episodes, which happen at irregular times, cannot be projected: only a background level was projected, based on the whole period without considering exceptional episodes. it is assumed an increasing probability of fires for this background level, with a linear increase (*more details are provided in Annex 1.* Mitigation calculations (details for sectors)).

In the FOLU sector, emissions for the BAU scenario increase from 1,319 kt CO_2e in 2016 to 1,772 kt CO_2e in 2030, which represents an evolution of +34.3%.

Figure 22. Projected FOLU-related emissions

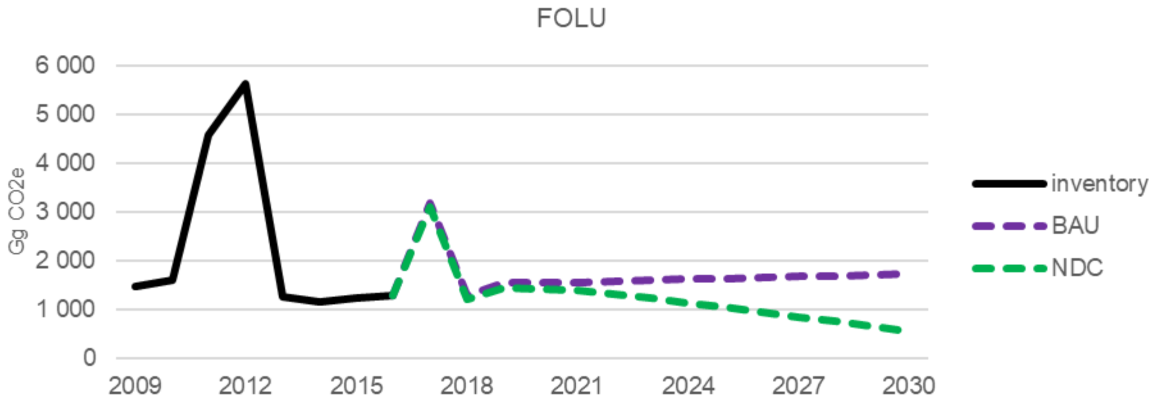
[9] datasets were available outside of the historical period for some subsectors, such as the wildfires for the years 2017-2019. Therefore, in this case, inventory calculations continue after 2016, to 2019, and then projections assumptions start. That is why there are peaks in the period 2017-2019.



2.2.7.3. FOLU NDC scenario

In the FOLU sector, emissions for the NDC scenario (with mitigation measures) decrease from 1,319 kt CO_2e in 2016 to 598 kt CO_2e in 2030, which represents an evolution of -54.7%. The difference, in 2030, with the BAU scenario, is -1,174 kt CO_2e, which represents a mitigation impact of -66.2%. As for the NDC scenario, big forest fires episodes caused the two peaks (2011-2012 and 2017) and such episodes could not be projected. However, it is considered, in line with the national policy (Draft Environmental Cross-cutting Strategy), that an effort is put to avoid such episodes through the improvement of the monitoring system to prevent wildfires. In addition to this action regarding the prevention of wildfires, other mitigation measures are considered in the NDC scenario: the diminution of the use of fuelwood (the assumption on fuelwood consumption being estimated in the Energy sector, so that FOLU and Energy sectors are consistent); new afforestation areas; improved efficiency of fuelwood harvest; improved sustainable management of forests, cropland and grassland to enhance carbon sequestration and protect biodiversity.

Figure 23. Projections for FOLU sector



The following table presents a summary of the mitigation actions taken into account in the NDC scenario for this sector (details in annex).

Table 5. Summary of the mitigation actions for the FOLU sector

N°	Sector	Name	Subsector	Policy context	Description
L1	FOLU	**Energy: changes in fuel mix, reduction of use of fuelwood. Moratorium on fuelwood**	Forest land - fuelwood	ECCS, NSDI-II, SPDBP	The evolution of fuelwood harvest is directly consistent with projections applied in the Energy sector regarding the evolution of fuel mix. The fuelwood consumption increases by 14% between 2016 and 2030 in the BAU scenario, while it decreases by 4% in the NDC scenario. In 2030, the application of this measure allows a reduction of the annual emission estimated at -314 kt CO_2e compared to the BAU scenario.
L2	FOLU	**New afforestation areas**	Forest land	ECCS, NTP, ISARD, TNC	Based on national circumstances, and considering the current trends, potential for afforestation areas is estimated at 300 ha per year. In 2030, the application of this measure allows a reduction of the annual emission estimated at -7 kt CO_2e compared to the BAU scenario.
L3	FOLU	**Improved management and monitoring to prevent wildfires**	Forest land - disturbances & biomass burning	ECCS	While it is not possible to predict future episodes of wildfires, the improvement of monitoring and management of forest fires will help reduce this risk. While the BAU scenario considers a mean risk of forest fires at 10 000 ha / year (less than bigger episodes but slightly higher than the other years to represent an increasing risk), the NDC considers a progressive reduction of 5% of this risk. In 2030, the application of this measure allows a reduction of the annual emission estimated at -251 kt CO_2e compared to the BAU scenario. Exceptional events that cannot be predicted are excluded from the calculation. A background level is calculated, in line with the way Natural disturbances are treated in the Kyoto Protocol or the EU FOLU regulation. Albania pledge to continue efforts to reduce the scope and intensity of wildfires. This exclusion of big events from the projection is made for both BAU and NDC scenario so it does not lead to a discrepancy between the NDC and the BAU. Moreover, in the NDC scenario, the prevention of wildfires for the background level is progressive and only reaches 5% in 2030 (compared to the BAU scenario).
L4	FOLU	**Improving efficiency of fuelwood harvest**	Forest land - fuelwood dumpings - disturbances	NSDI-II, NEEAP, TNC	Improving the efficiency on use of fuelwood results in a decrease in wood dumpings. In 2030, the application of this measure allows a reduction of the annual emission estimated at -145 kt CO_2e compared to the BAU scenario.
L5	FOLU	**Improved sustainable forest management**	Forest land - growth	ECCS; NSDI-II; NTP; IPARD; LANFPF; SPDBP; PDFS	Improved forestry management, applied progressively on 5000ha per year, allows a higher growth rate for the tree biomass in these areas. In 2030, the application of this measure allows a reduction of the annual emission estimated at -18 kt CO_2e compared to the BAU scenario.
L6	FOLU	**Improved sustainable grassland management to enhance carbon sequestration and protect biodiversity**	Grassland	ECCS; LANFPF; NCCS	In the NDC scenario, grassland soil is improved by additional inputs from agricultural management (livestock management, more inputs, as seen in Agriculture sector). In 2030, the application of this measure allows a reduction of the annual emission estimated at -202 kt CO_2e compared to the BAU scenario.
L7	FOLU	**Improved sustainable cropland management**	Cropland	ECCS; NSDI-II: NCCS	Development of agroforestry is projected to be progressively increasing to 100ha in 2030. Improvement of agricultural soil practices help storing carbon in soils in areas that increase progressively to 20% of cultivated cropland in 2030. In 2030, the application of this measure allows a

					reduction of the annual emission estimated at -167 kt CO_2e compared to the BAU scenario.

3.ADAPTATION

The projected changes in temperature, rainfall and sea-level (see section 4.2 below) will affect every Albanian region and every socio-economic sector in a specific way, depending on its own characteristics. On adaptation, this document focuses on the Albanian coastal area and the capital Tirana, which comprises a significant proportion of the population, as well as key infrastructure and is the main touristic destination in the country. Indeed, while within the Albanian coast climate change will affect every socio-economic sector, on adaptation this document focuses on settlements, populations and tourism. More specifically, on settlements the document considers the infrastructure and the built environment, water and energy; on populations, it considers lives and livelihoods and health; and on tourism, it considers changes in the touristic season and the touristic conditions. In addition, the Albanian agriculture, forestry and other land use (AFOLU) sector is analysed in great detail.

Building on section 1 on national circumstances, this section on adaptation is structured in the following way. Section 4.1 introduces the Albanian coast and agriculture. Section 4.2 presents climate variability and change in Albania regarding temperature, precipitation and sea level rise. Section 4.3 analyses climate risks, impacts and vulnerability for the four priority sectors, namely settlements, populations, tourism and AFOLU. Finally, section 4.4 categorizes and prioritizes climate change adaptation measures.

3.1. The Albanian coast and AFOLU sector - background

3.1.1. The Albanian Coast

3.1.1.1. Overview

The main part of the coastal area (the Adriatic coast and the most southern part of the Ionian coast –that belong to the Zone A in Map 1) is located in the Mediterranean field climatic Zone. The other part of the Ionian coast, in Zone B in Map 2, belongs to the Mediterranean Southern Mountainous climatic Subzone. Overall, the coast is warmer than the interior of the country. In the coastal area, maximum temperatures average 21.8°C in the summer and 14.6°C in the winter.[10] The centre of the coast gets less rain than the North and the Southwest (with the Southeast being the least rainy).

Albanian coasts are rich with sandy and rocky shores and include important ecosystems. Although the number of protected areas in the coast has increased over the years (there are

[10] World Bank Climate Change Knowledge Portal, accessed January 2020 and 4NC

currently eleven protected areas including a marine protected area), the coastal ecosystems are still facing significant risks and pressures, including:

- Deficiencies in waste management (waste from tourism facilities is reaching the coastal waters, and plastic litter accounts for more than 90% of the total solid waste found on beaches);
- Unplanned tourism development and urbanization, and unmanaged urban population increase;
- Not integrated coastal zone management by local authorities; and
- Climate change impacts, which are further described in section 4.3 below.

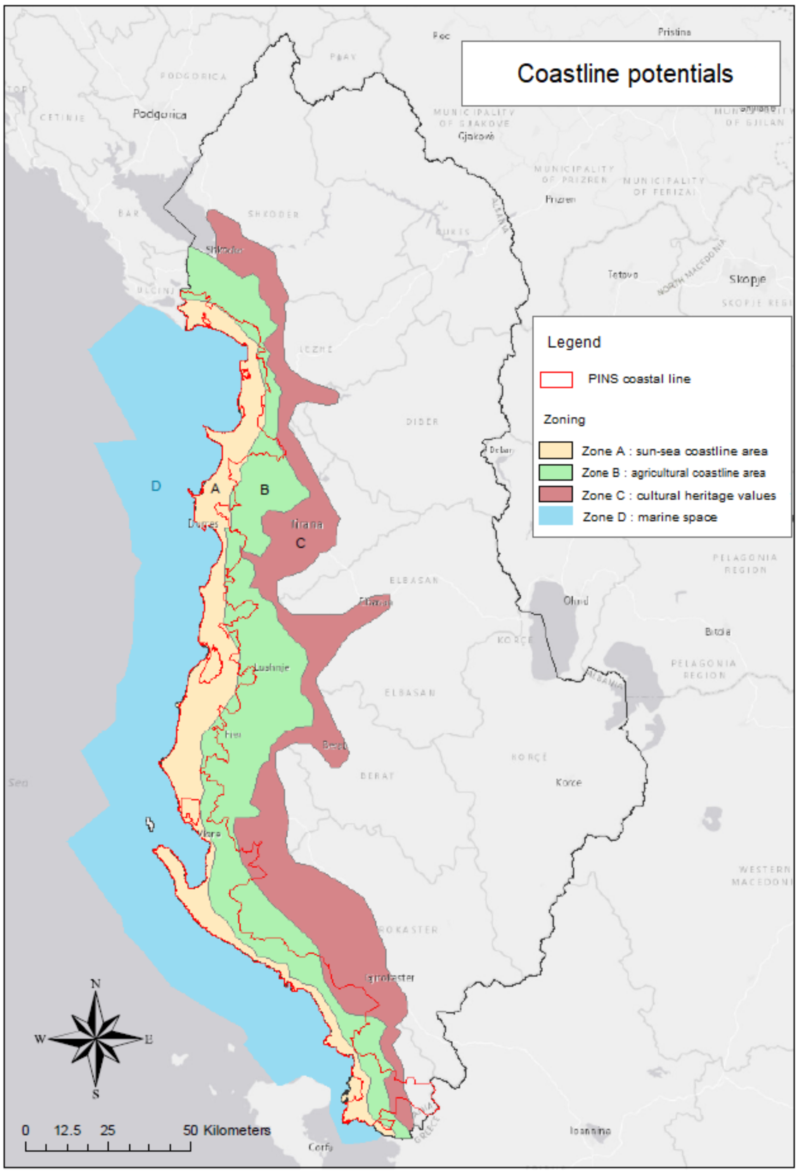
According to the Integrated cross-sectoral plan for the coastal belt, coastal rivers are significantly polluted: water quality was poor or bad in 45% of the 22 water quality monitoring stations in the coast.

3.1.1.2. Coastal settlements & demography

The coastal region occupies 36.7% of the surface area of the country and has 39.3% of the population. The Integrated cross-sectoral plan for the coastal belt (ICSP) identifies the four following coastal spatial belts, as shown in **Error! Reference source not found.** below:

- The first belt, Zone A, is characterised by its urban development and tourism infrastructure and is known as "sun-sea belt". The cities composing this zone are Durres, Vlora, Lezha, Saranda, Velipoja, Himara, Ksamili and Divjaka. Although technically not a coastal city, Tirana is sometimes considered as such, given its proximity to the coastline and the functional links with coastal city of Durres, which constitutes the main port of the country. The Tirana – Durres region comprises 8.4% of the territory and accommodates 37% of the country's population. In 2015, this region generated 48% of the national GDP and represented the region with the highest income per capita, which is 1.32 times more than the national average.
- The second belt, Zone B, can be defined as the agricultural belt, includes vast field areas and low hills, and is composed of cities of secondary importance regarding the coastline (such as Shkodra, Fushe-Kruja, Tirana, Kavaja, Lushnja, Fieri and other smaller areas). Agricultural land represents 24% of the coastal territory. Farmers traditionally produce vegetables, potatoes, and fruits (olives, citrus, grape vines, etc). In some areas, production is possible all year long.
- The third belt, Zone C, includes cities and residences that are more in depth of the territory, that have important cultural, heritage, folkloric, polyphonic, music, arts values. Cities of this zone are Kruja, Elbasan, Berat, Tepelena, Permet and Gjirokastra; and
- The fourth belt, Zone D, which is the maritime space. rich in flora and fauna, underwater resources of the bottom of the sea, including beaches, ports and their terrestrial territories, lagoons, estuaries, lakes, water, which communicate with the sea.

Map 1. The four coastal belts



Source: Integrated Cross-sectorial Plan for the Coast, NATP, 2015

The coastal zone has faced a chaotic development since the 1990s following an important immigration from the rest of the country (east to west). The coastal population density increased significantly for the last 2 decades, with about 1 million more residents in the period. This development resulted in many challenges including unemployment and poverty in rural areas; overpopulation in and expansion of coastal cities; habitation development conflicting with common urban, natural and cultural areas and with agricultural land; weak transport, water, sanitation and energy infrastructures; and limited provision of/access to services.

Currently, water supply is available in almost 80% of the urban areas and 50% in the rural areas (national level). Wastewater coverage is approximately 80% for the urban areas and 10% for the rural ones. At the national level, all energy supply is from hydropower, which covers 80 to 90% of the internal demand for energy, with 95% from 6 plants. However, 40% of the energy is lost in the distribution network, because of distance and poor state of the infrastructure. Only 35.4% of the hydro potential is being used, and the potential for solar energy and others is not yet exploited.[11]

3.1.1.3. Tourism

According to the National Tourism Strategy (2019), in 2017 tourism directly contributed to 8.5% of the GDP (2017), and indirectly (multiplier effects) to 26.2%. It is growing and is projected to reach 9.3% of GDP by 2028. It employed 7.7% of total labour force in 2017, and possibly 8.8% by 2028[12]. The different tourism locations along the coast are illustrated in Map 3 in Annex 2. Adaptation

Tourism is however an underdeveloped sector in Albania in view of its potential, hindered by its limited infrastructure and accommodation capacities, standards and quality of services, tourism offer and products, and cooperation and coordination among the players who are or could be an integral part of the industry.

Being dependent from summer tourism (starting from June-July, with a maximum number of visitors achieved in August and with an immediate decline in September), the majority of hotels and accommodations in the coastal areas are faced with seasonal functioning difficulties and as such, the phenomena of seasonal migration of habitants of coastal areas, especially in the South regions, is still evident.

Even though archaeology and cultural heritage is not the main drive to attract foreign or domestic visitors, these are identified as priorities in developing the tourism sector in the country and the coastal zone[13].

3.1.2. AFOLU

Crops

Agriculture accounts for about one-fifth of the gross domestic product. 50% of rural population is engaged in agriculture. The agriculture sector is dominated by small and family farms, with an average farm size of about 1.2 ha. A high level of agricultural land fragmentation remains one of the major challenges in the sector.

The climatic conditions of the country allow the cultivation of cereals, fruits, vegetables, and fodder crops. About 35% of the arable land is cultivated for cereals, 8 % for vegetables, 50% for fodder crops and 7 % for other types of plants. In the last ten years the area under wheat has decreased by about 22% and the average yield stayed at the same level. The yields of maize, vegetables, fodder, fruits and grapes have increased by 8-12%.

Despite the favourable climatic conditions and abundant water resources, the crops sector in Albania remains relatively underdeveloped and faces a number of challenges, including low productivity; limited area of cultivation; highly fragmented land ownership; low level of

[11] Albania's Integrated cross-sectorial plan for the coastal belt, 2015
[12] Albania's National Tourism Strategy 2019-2030 (p. 5). The date for the contribution to employment is uncertain – the document says "currently", so it can be assumed it was in 2019.
[13] Albania's National Tourism Strategy 2019-2023.

mechanization; negative climate impacts, especially flood and drought conditions; and low level of phytosanitary controls that limits agricultural export.

Livestock

Livestock production contributes more than 50% of the agriculture production value. Within the livestock sector, the primary output is cow milk followed by bovine meat. With regard to milk and dairy products in Albania is almost self-sufficient (at the level of 95%), while the eggs production has a surplus and eggs are exported to Italy, Croatia and Kosovo. At the same time, about 40% of meat consumed is imported. Livestock population is differently distributed across the country: in the lowland areas, cattle are the dominant livestock type, while in hilly and mountainous areas, small ruminants (sheep and goats) dominate. From 1997 to 2019 the number of ruminant species has declined, and the population of swine and poultry remained almost stable.

The barriers towards more efficient livestock sector include small farm size; land fragmentation; broken rolling relief; poor infrastructure; limited availability of rural credit to farmers, processors and other small rural businesses; and inadequate rural institutions, especially extension services.

Forests

Forests cover around 36% of the land area in Albania with “high” forests covering 32.4%, coppice 46.2% and shrubs 21.4% of the forest area. The total forest area has declined since 1938, from 1.385 million hectares to 1.051 million hectares in 2018. During the last decades, forests have experienced significant changes in their area and standing volume. During 2007-2019, the forest volume was reduced from 73.641 million cubic meters in 2009 to 57.7 million in 2018 or by 22%. The main negative factors are a lack of forest management capacity, illegal logging, and forest fires. During 2007-2019 about 337,800 ha of forests were burned, which constitutes around 33% of the national forest area. Almost all the forest fires have anthropogenic origin. Also, such species as black pine, chestnut, plane, oaks and box-tree are suffering from the damages caused by diseases and pests.

Firewood is an important commodity for Albania because it is used for heating many households. In rural areas it is also used for cooking and water heating. Albanian forests have uneven age structure with predominantly young stands, which leaves limited timber volume to harvest. There are some limited areas of old-growth forests (mainly beech), but they are part of protected areas, where harvesting is prohibited. The Albanian forest age is relatively young and there is a strong need for improved forest management.

Currently, 96% of the forest is owned by municipalities and the National Agency of Protected Areas and the rest is privately owned. In 2016, the Government of Albania transferred forest management (except protected areas) to 61 municipalities. Also, since 2016 there is a moratorium on forest harvesting with exception of harvesting by local governments to meet the needs of households and large public building users.

Pastures and Meadows

Pastures are defined as areas larger than 0.5 ha with herbaceous and dwarf species. The total pasture area in Albania is about 480,800 ha. The pasture area per capita varies widely among the districts from 0.009 ha/capita for Durres to 0.83 for Kolonje. About 50% of the pastures are owned by private individuals, about 44% by the state and only 6 % by local communities. There are about 60% summer pastures and 40% are winter pastures. The vast majority of the pastures are natural pastures; only a single pasture is defined as cultivated. A high percentage of the pastures are located on steep or very steep slopes (almost 80%) and only about 20% are on undulating terrain, posing some limitation on the management of the pasture resources. Most of the pasture areas show erosion signs with about 60% overutilized. About 50% of the pastures are at an altitude of less than 1000m, 50% are above 1000m. The grazing intensity has a definite influence on the sustainability of grazing, depending on carrying capacity and pasture conditions. More than 73% of the pastures are grazed moderately and 23% -- are being grazed heavily. Water supply is important for providing drinking water for the animals. Only 25% of pastures have a water source closer than 1 km, for almost 30% the closest water supply is more than 3 km away.

Lagoons and Wetlands

Wetlands and lagoons are an important element of Albania’s ecosystem diversity. Most of them are located along the coastal area of Adriatic and Ionian seas (Viluni, Kune Vain, Patok, Karavasta, Narta Orikum and Butriknti lagoons), as well as along the big lakes (Prespa, Ohrid and Shkodra Lakes). Many lagoons and wetlands a part of the Protected Areas Network, which covers 524,322.70 ha, or 18.24% of the total territory.

Albania has four Ramsar sites: “Lagoon of Karavastasë-Pisha e Divjakës”, “Kanali i Çukës-Butrint-Kepi i Stillos”, “Lake Shkodra-Buna river”, “Lake of Prespa” with a total of 98180 ha. In Adriatic coast Divjaka and Karavasta lagoons are located, comprising the most important protected area along the Albania’s coastal space. The Karavasta Lagoon ranks among the lagoons of great importance providing habitat of over 20,000 wintering birds. The lagoon is known for the large colony of the curly pelican (Pelecanus crispus), the only coastal nesting point of Albania. Uncontrolled hunting remains the major risk factor for rare birds. Periodic hunting ban has led to a noticeable increase of the colony of pelicans, even flamingos (Phoenicopterus roseus) in Narta and Kune Vain. Coastal waters and lagoons as well as freshwater ecosystems have additional economic value as recreational fishing and hunting spots.

Aquaculture and Fisheries

Albania is rich in water resources, with a coastline of 476 km, where fishing activities take place in the 12 miles zone. Fishing activities are mainly concentrated on the continental shelf (on the Adriatic side in the north extends to 25 miles and 2–4 miles in the Ionian Sea). There is a gradual increasing trend of the average annual per capita consumption of fisheries and aquaculture products from 4.9 kg/year in 2010 to 5.3 kg/year in 2016. Today fisheries (including capture fisheries and aquatic organisms farming) take an important place in the Albanian economy, even though the contribution of the sector to the Gross Domestic Product (GDP) is relatively low (0.3%).

The sector has a good growth potential to be exploited through formulation and adoption of appropriate policies sustained by efficient investments. Marine fisheries (represented by Large Scale Fisheries - LSF) provide more than 52% of the catch and 61% of the value with coastal areas, lagoons and inland waters (Small Scale Fisheries – SSF) yielding respectively 21% of the production, but only 13% of the value. The aquaculture sectors have been increasing in importance with 27% of the production and 26% of the value. The total full-time employment in the fisheries and aquaculture sector is estimated at more than 4200 persons with a significant number of women employed by the processing industry and ancillary services. The fish processing industry is represented by almost 20 companies involved in processing seafood mainly for the EU markets. The export of fish and seafood is quadrupling in comparison to 2013, while for instance in 2019 the value of Albanian fish exports reached 100 million euros and during the first six months of 2020, it was recorded a further increase of 24.5%. The development of the aquaculture sector has followed the domestic consumer demand, especially for marine finfish products. Nevertheless, the import of marine aquaculture products (European sea bass and gilthead sea bream) is still insufficient to cover the domestic demand. The main problems faced by aquaculture sector are related to a lack of national inputs. For instance, the fish feed is mainly imported from Italy, France, Germany and Turkey.

3.2. Climate variability and change

The climate change projections presented in this document are based on a set of scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) for their Fifth Assessment Report (AR5, 2014) using data from the Coupled Model Intercomparison Project Phase 5 (CMPI5). The four scenarios used are called the “Representative Concentration Pathways” (RCPs) and are based on different emission pathways. This goes from RCP2.6 which assumes a peak of 490 parts per million (PPM) CO_2 equivalent before 2100 (followed by a decline), which corresponds to what is known as the “2°C world”, to RCP 8.5, which involves more than 1370 PPM CO_2 equivalent by 2100 and continued increase, also known as the “4°C world”. The reference period for the projections is 1986-2005.

The projections used in the document come mostly from the following sources:

- Annex 4.3 to Albania’s Third National Communication (2016), which provides temperature and precipitation projections for 2050 and 2100 based on RCP 2.6, 4.5 and 8.5 using SimClim2013.
- The World Bank’s Climate Change Knowledge Portal (CCKP), which provides temperature and precipitation projections until 2100. Data used is for an ensemble of models.
- Other sources[14], also based on the AR5 methodology, are used as relevant.

Graphs, figures and maps pertaining to this section are available in Annex 2. Adaptation, section 7.6.

3.2.1. Temperature

Temperature records since 1901 indicate that average yearly temperatures for Albania remained between 11 and 12°C for most of the century. Since 1998, the rolling average has remained above 12°C, and is in a clear increasing path, with 2016 average at 12.72°C.

Projected trends indicate that the **mean annual temperature in Albania will increase** between 1.3°C and 2.2 °C by 2050 and between 1.2°C and 4.4°C by 2100 from the 1986-2005 baseline of 11.8°C. The most significant increases would take place between June and September (5.8°C under RCP 8.5) (**Error! Reference source not found.**), bringing[15] mean summer temperature around 27°C by 2100. **Error! Reference source not found.** illustrates the distribution of average maximum and minimum temperatures, across the country.

In the Albanian Coast, **annual average temperatures are expected to increase for all seasons**. As shown in the 4NC and **Error! Reference source not found.** below, in summer months, maximum temperatures would increase between 1.5°C (RCP 2.6) and 6.4°C (RCP 8.5)

[14] These other sources are cited in footnotes when relevant. They include specific studies on the Vjosa Basin or the Driji-Mati delta, for example.
[15] World Bank CCKP, 2020.

by 2100. In winter months, minimum temperatures could increase between 0.9°C (RCP 2.6) and 3.8°C (RCP 8.5). The mean summer temperature in coastal areas could therefore be above 25°C by 2050 and around 30°C by 2100.[16]

Table 6. Changes in mean temperatures, annual and seasonal for Albanian coast

	Scenarios	2050	2100
Year	RCP2.6	1.2 (0.7-1.8)	1.2 (0.7-1.8)
	RCP4.5	1.5 (0.9-2.2)	2.1 (1.2-3.1)
	RCP8.5	2.0 (1.2-3.0)	4.9 (2.9-7.3)
Winter	RCP2.6	0.9 (0.5 -1.5)	0.9 (0.5 -1.5)
	RCP4.5	1.2 (0.7-1.9)	1.6 (1.0-2.7)
	RCP8.5	1.6 (1.0-2.6)	3.8 (2.3-6.3)
Spring	RCP2.6	1.0 (0.5-1.5)	1.0 (0.5-1.5)
	RCP4.5	1.3 (0.7-1.9)	1.8 (0.9-2.7)
	RCP8.5	1.7 (0.9-2.6)	4.2 (2.2-6.3)
Summer	RCP2.6	1.5 (1.0-2.1)	1.5 (1.0-2.1)
	RCP4.5	1.9 (1.3-2.8)	2.5 (1.6-3.9)
	RCP8.5	2.8 (1.7-3.8)	6.4 (4.1-9.2)
Autumn	RCP2.6	1.2 (0.7-1.7)	1.2 (0.7-1.7)
	RCP4.5	1.5 (0.9-2.2)	2.1 (1.3-3.2)
	RCP8.5	2.1 (1.2-3.1)	5.1 (3.0-7.4)

Source: TNC

The **frequency of extremely high temperatures is expected to increase**, as a significant decrease in return periods for maximum temperatures is also projected, meaning that temperatures of 38.1°C that occurred every 100 years in Tirana would be occurring every 9.2 years (RCP 2.6) or 3.6 years (RCP 8.5). In Fier (centre), the return period for 3 consecutive days with extreme temperatures above 40.5°C is expected to decrease from once every 30 years (approx.) to once every 6 to 8 years. Inversely, the return periods for extremely low temperatures is expected to increase. In Lezhe (North), average annual maximum temperatures are projected to increase from 29°C to 31°C (RCP 2.6) to 37°C (RCP 8.5) by 2100[17].

An increase in the number of tropical nights (>20°C) is also projected, from a median of 1.3 tropical night/year between 1986 and 2005 to between 10 (RCP 2.6) and 70 (RCP 8.5) by 2100 [18].

As a consequence, the number and duration of heat waves is expected to increase. As illustrated in **Error! Reference source not found.**, the Warm Spell Duration Index, which measures uninterrupted sequences of six days with temperatures above the 95th percentile of the 1986-2005 baseline, is expected to increase significantly by 2050 according to all scenarios, with a median between 20 and 41 days, up from 2.5 days.

3.2.2. Precipitation

Mean precipitation levels have remained relatively stable since 1901, although with a slight decreasing trend. By 2050, precipitation for Albania is expected to decrease between 2.1% (RCP 2.6) and 4.3% (RCP 8.5) from the 1986-2005 baseline of 929.7 mm. By 2100, in a 2°C world,

[16] TNC, 2016.
[17] *Ibid.*
[18] World Bank CCKP, 2020.

precipitation would have decreased by 1.8% (less than by 2050), while under a 4°C world, it would have decreased by 12.2%.[19]

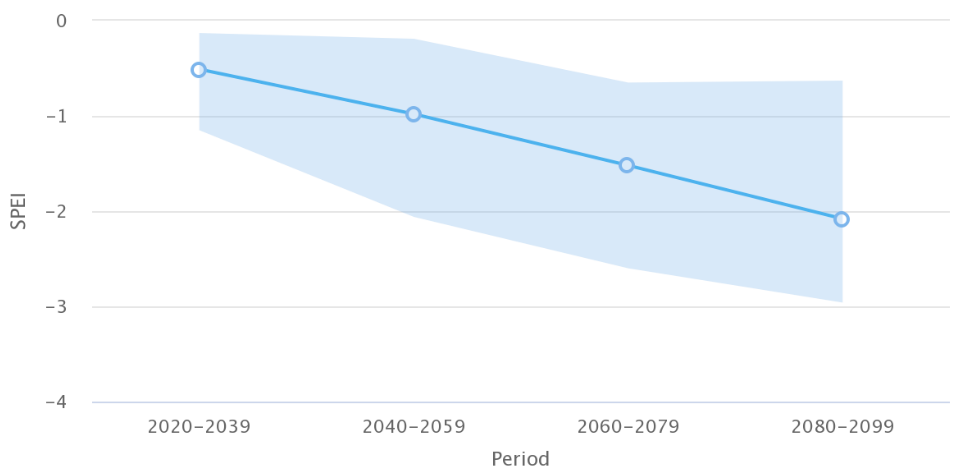
Annual precipitation in coastal Albania is expected to decrease between 1.6 to 2.9% by 2050, and by 1.6 to 7.1% by 2100. Precipitation is expected to decrease the most during summer months (8.7 to 38.1% by 2100). However, precipitation would increase during winter months, between 1.8 to 3.2% by 2050 and between 1.8 to 7.8% by 2100. Combined with warmer temperatures, this increase means that more precipitation will be in the form of rain rather than snow, causing **river flows to increase in the winter and decrease in the spring, summer and fall**.[20]

Variability of precipitation is expected to increase in the Albanian coastal area, with an increased frequency and intensity of heavy rainfall events. Return periods for such events are expected to decrease (all scenarios), with events involving rainfall of 161 mm that occur every 100 years expected to occur every 60 to 75 years in Tirana. **These could cause floods, especially during fall, winter and spring months.**

During summer months, the combined increase in heavy rainfall events and the decrease in rainfall averages indicate that **the frequency of droughts is projected to increase**. For Albania, the Standardized Precipitation Evapotranspiration Index (SPEI), which considers changes in the mean of 12-month cumulative water balance, taking into account evapotranspiration, is expected to decrease by a median of 0.34 to 2.08 by 2100, indicating negative and worsening water balance conditions, especially in the South of the country (**Error! Reference source not found.**).[21]

[19] World Bank CCKP, 2020.
[20] TNC
[21] World Bank CCKP, 2020.

Figure 24. Projected change in SPEI for Albania (median and range) (RCP 8.5)



Source: World Bank CCKP, 2020.

3.2.3. Sea-level rise (SLR)

Global mean sea level is rising increasingly fast as a result of climate change. Sea level anomalies registered since 1993 reveal a trend for an increase in sea level for the coast of Albania. SLR projections for the whole Albanian coast are not available. Projections for the Drini-Mati River Delta (North) indicate that sea level could increase anywhere from 45 cm (RCP 2.6) to 60 cm (RCP 8.5) by 2100, while projections for the Vjosa basin (South) indicate increases between 25 and 105 cm by 2100. Globally, there is medium confidence that an increase by 2°C of global temperatures would lead to an increase of 0.3 to 1.00 m of the global mean sea level relative to 1986-2005. By 2100, 70% of coastlines worldwide should experience SLR within +/- 20% of the global range.[22]

3.3. Climate change risks, impacts and vulnerability

3.3.1. Overview

The current and projected changes in climate will have effects on meteorological and environmental conditions in Albania, as described in **Error! Reference source not found.**. While mean temperature increases, decrease in precipitation and SLR will have several effects in the long term. These changes will also result in increased frequency and intensity of weather-related disasters.

Table 7. Summary of climate changes and related effects/risks by 2100

Factor	Area	Change	Extent (by 2100)	Effects/Risks
Temperature	Albania	Increase in mean annual temperature, especially	+1.2-4.4°C (Summer: +1.-5.8°C)	Increased evaporation Increase in cooling

[22] IPCC https://www.ipcc.ch/sr15/ Section 3.3.9

		for summer months		degree days
	Albanian coast	Increase in minimum and maximum temperature (all seasons)	Summer max: +1.5-6.4°C Winter min: +0.9-3.8°C	Increased proportion of winter precipitation in the form of rain (instead of snow)
	Albanian coast	Increase in the frequency of extremely high temperatures	Decrease in return period from 100 years to 9.2 – 3.6 years (Tirana example)	Increased frequency of droughts
	Albania	Increase in the number of tropical nights	From 1 to 10-70/year	
	Albania	Increase in the number and duration of heat waves	+17.5 – 38.5 days (by 2050)	
Precipitation	Albanian coast	Decrease in annual precipitation, especially for summer months	-1.6 to -7.1%	
	Albanian coast	Increase in precipitation for winter months	+1.8 to +7.8%	Increased occurrence of floods, especially during winter, but also during fall and spring months
	Albanian coast	Increased variability of precipitation, with increased frequency and intensity of heavy rainfall events	Decrease in return period from 100 years to 60-75 years (Tirana example)	
	Albanian coast/ Albania	Decreasing 12-month cumulative water balance (SPEI)	-034 to -2.08	Increased frequency of droughts Decreased annual river runoff (Vjosa basin)
SLR	Albanian coast	Increase in sea level	Vjosa basin: on average +45 cm (RCP 4.5) to +60 cm (RCP 8.5)	Salinization of coastal aquifers Increased vulnerability of coastal areas to floods from storm surges and erosion

3.3.2. Risks to and vulnerabilities of settlements

Infrastructure and built environment

Projected changes in precipitation patterns during winter, fall and spring months increase the risk of river floods. In the Seman-Vjosa area (Vjosa basin), embankments and pumping stations installed to prevent floods have already been overcome in recent years, causing catastrophic damages to settlements.[23] Due to their flatness, coastal areas are not only vulnerable to the projected increased floods from rivers, but also those from storm surges due to SLR. The size and magnitude of floods and of erosion of coastal areas are expected to increase, affecting disproportionately beaches, river mouths and lagoons[24] and causing landslides. According to the FNC, shoreline could regress between 7.5 and 15m by 2100. In the Vjosa mouth, coastal erosion

[23] Laçi, E. Draft report for V&A assessment for population, settlements and tourism sectors, 4NC, 2021.
[24] Ibid

will be enhanced by the interruption of the supply of fine sediments from the river, once (and if) the projected hydroelectric dams are constructed upstream.[25]

A significant portion of Albania's infrastructure is located in its coastal area and could therefore be affected, including:

- Housing: as of 2016, there were 41,625 dwellings currently built within 0.5 meters above sea level[26]
- Public infrastructure: bridges, roads, medical centres, schools, power plants, sewage plants, waste treatment plants
- Industrial and commercial buildings: banks, factories, warehouses, mills
- Historic and cultural sites (including UNESCO World Heritage sites)
- Agricultural land

Table 8. Types of risks facing coastal municipalities

Municipality	Seawater intrusion	Coastal erosion	Coastal floods	River floods	Landslides
Shkodra	X				X
Lehze	X	X	X	X	
Kurbin		X	X	X	X
Durres		X	X	X	X
Kavaja		X			X
Rrogozhina				X	X
Divjaka					X
Fier	X	X	X	X	
Vlora	X	X	X	X	X
Himara	X	X			X
Saranda		X			X
Konispol		X			X

Source: Integrated Cross-sectorial Plan for the Coast, NATP, 2015

Error! Reference source not found. identifies areas that are vulnerable to floods, to coastal erosion, and to landslides. The Adriatic coast, and the Drini and Mati River Delta in particular are identified as "critically vulnerable" to climate change.[27]

Coastal infrastructure is made vulnerable. The population growth in coastal cities has increasing number of people "living in poor-quality, highly exposed housing in disaster-prone areas". In addition to this uncontrolled urbanization, other factors contribute to infrastructure vulnerability, including landscape degradation, uncontrolled modifications to river beds, water, air and land pollution, etc.[28] The ICSP identifies a number of coastal municipalities that are already

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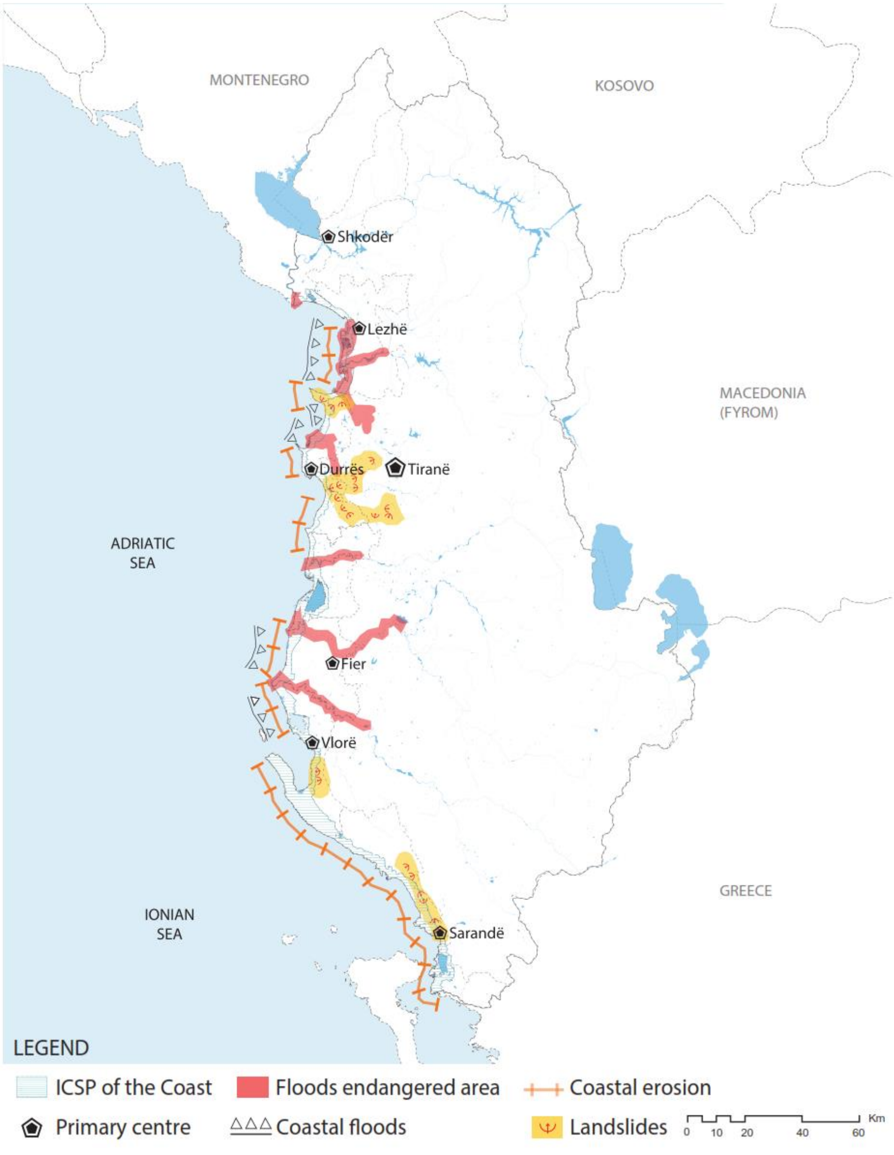
[25] Ndini, M. Draft report on Expected impacts of climate on water resource and adaptation measures, 4NC, 2020.
[26] TNC
[27] UNDP-GEF Project Synthesis Report ""Identification and implementation of adaptation response measures in the Drini- Mati River deltas"
[28] Deda, M. Draft Report on Climate Related Disaster Risks and their Management for the Vjosa River Basin, 4NC and First Biennial Update Report, 2020.

considered as "endangered areas" because of coastal erosion, coastal and/or river floods, saltwater intrusion, or landslides. Climate change will worsen these risks.

In Tirana, transport, electricity, and water supply infrastructure as well as small scale industry are highly vulnerable to heavy precipitation and floods.[29]

Map 2. Map of risked areas



Source: Integrated Cross-sectorial Plan for the Coast, NATP, 2015

Water

Water supply infrastructure is among at-risk infrastructure from climate change, as floods and storm surges could affect the existing network and treatment plants. Furthermore, SLR is projected to increase the water level of rivers, flooding riversides and increasing salinization of

[29] City of Tirana, Adapting our City to a Changing Climate: Vulnerability Assessment and Adaptation Action Plan for Tirana, 2015.

coastal aquifers. While water availability has not been an issue in Albania due to its ample freshwater reserves, salinization of coastal aquifers adds on to water losses in the water supply system (due to its maintenance state).

Projected increases in temperature will lead to increased evaporation, especially in the summer which is when temperature increases the most. Water availability will be further affected by the projected decrease in precipitation projected to be strongest during summer months, resulting in decreased river runoff. As an example, in the Vjosa basin, annual runoff is expected to decrease between 3.4% (RCP 2.6) and 10.9% (RCP 8.5) by 2050 and between 3.15% (RCP 2.6) and 13.5% (RCP 8.5) by 2100. Runoff decrease is expected to be more important for other river basins.[30]

On the other hand, water demand is expected to increase. This is largely related to increased access to water supply and increase in personal use of water for well-being, as well as challenges to water governance.[31] Although the marginal effect of climate change is difficult to project, heat waves and droughts are likely to lead to high peaks in demand.

Projections for the Vjosa River Basin indicate that during drought periods in the months of July, August, and September, under RCP 8.5, there could be an unmet demand between 3 and 4.5 million m^3 per year by 2050.[32]

Energy

Given the high reliance of the country on hydropower and the poor state of related infrastructure, the energy supply is vulnerable to climate change. The ICSP states that "seasonal fluctuations can have a negative effect in securing energy supply from these hydro power stations", mentioning that "in the recent years, the water levels in reservoirs have sometimes been very low levelled, forcing the domestic operators to purchase energy from neighbour countries to cope with the need for energy supply."

The projected decrease in annual river runoff will worsen this situation. Indeed, the National Climate Change Policy (2019) estimates that "by 2050, annual average electricity output from Albania's large hydropower plants could be reduced by about 15% and from small hydropower plants by around 20%". Even the projected new dams in Poçem on the Vjosa river will have to address significant streamflow reductions in the summer months, and moderate yearly streamflow reductions.[33]

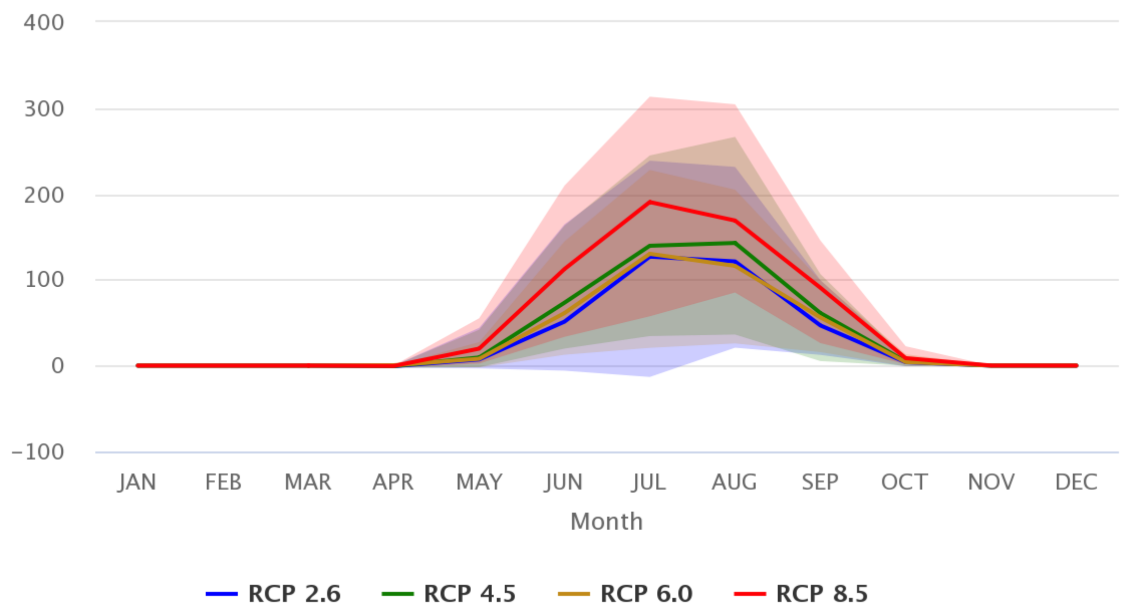
Hydroelectricity infrastructure could also be damaged during heavy rainfall events, which tend to cause unusually high amounts of sediments to flow into the rivers and dams.

On the demand side, increased temperatures will cause an overall increase in cooling degree days between May and September, which will reflect on higher demand for electricity. **Error! Reference source not found.** illustrates this for Albania, but the coast usually has more cooling

[30] Ndini, M. Draft Report on Expected impact of climate on water resource and adaptation measures, 4NC, 2020.
[31] Ndini, M. Draft Report on Expected impact of climate on water resource and adaptation measures, 4NC, 2020.
[3232] Ndini, M. Draft Report on Expected impact of climate on water resource and adaptation measures, 4NC, 2020.
[33] Ndini, M. Draft Report on Expected impact of climate on water resource and adaptation measures, 4NC, 2020.

days than the rest of the country[34]. During winter months, the number of heating days should decrease, along with related energy demand.[35]

Figure 25. Projected change (median and range) in Cooling Degree Days (°C) for Albania 2040-2059



Source: World Bank CCKP, 2020.

The energy network is thus exposed to increased demand precisely at the time of the year where its supply is expected to be the lowest. This should not be an issue in winter months, as river flows are expected to increase, but drier summer months, with higher evaporation and more frequent droughts will affect the level of the reservoirs in summer months.

3.3.3. Risks and vulnerabilities of population

Lives and livelihoods

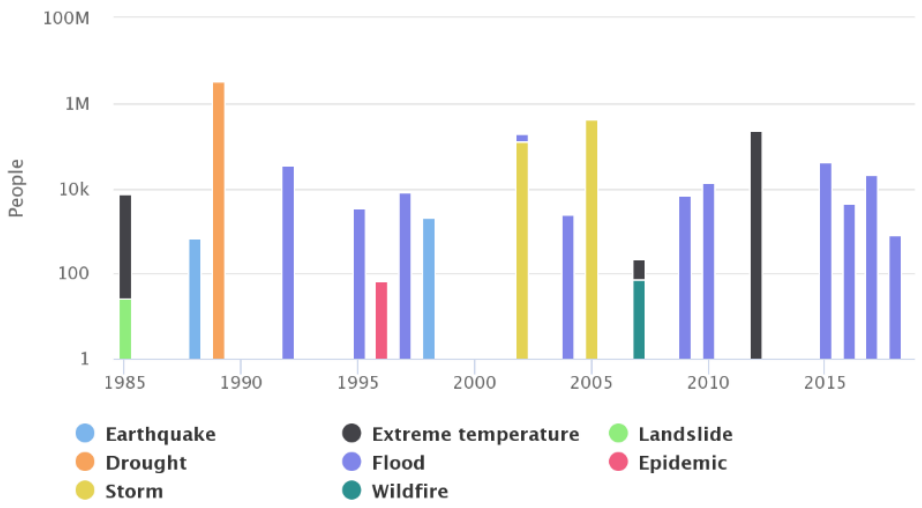
Above mentioned climate-related disasters and their consequences on settlements will also affect the coastal population. **Error! Reference source not found.**23 illustrates the types of natural disasters that had affected the Albanian population from 1985 to 2018. Destruction of infrastructure is likely to adversely affect coastal residents by:

- Damaging or destroying their homes
- Hindering their access to services, such as health, education, electricity, phone, internet, clean drinking water
- Damaging or destroying their livelihoods, across the tertiary, secondary and primary sectors. Disasters may affect means of production, such as offices, industrial production and processing plants, storage facilities and roads to transport products. Tourism, a major livelihood in the region, will also be affected, as discussed next. Agriculture would

[34] Bruci, E. Draft Report on Climate vulnerability and expected climate changes for the Vjosa River Basin.
[35] World Bank CCKP, 2020.

also be affected as a lot of marshlands below the sea level or at a low elevation have been turned into agricultural lands since the 1950s. [36]

Figure 26. Number of people affected by natural hazards 1985-2018 in Albania



Source: World Bank Climate Change Knowledge Portal

The increased frequency and intensity of heat waves and droughts is likely to increase the number of fires, especially forest fires, which threaten the natural environment, but also livelihoods, settlements, and lives. Data for the Vjosa basin demonstrates an increasing trend in the number of forest fires since 1990.[37]

Health

Climate-related disasters will increase the risk of injury and preventable death among population, and especially among vulnerable groups.[38] Floods have been the natural hazard affecting most people between 1985-2019, and this trend has increased in recent years (**Error! Reference source not found.**). In addition to direct physical and mental health consequences from floods, water-borne and vector-borne diseases like salmonellosis, leishmaniasis and leptospirosis, to which infants and children are the most vulnerable.[39]

Projected temperature, precipitation and sea-level changes are also expected to affect health on various fronts:

- The decreased water availability, increased floods, and overall temperature increase will adversely affect the quantity and quality of drinking water and favour the spread of diseases.[40]
- Increased temperatures will likely affect people's lives and health, as adaptation of the human organism is not immediate. The increased number of heat days is expected to adversely affect Albania's population. More tropical nights mean that people are less able to cool down at night and recover from the day's heat.[41] Heat-related diseases and death

[36] TNC, 2016.
[37] Deda, M. Draft Report on climate related disaster risks and their management for the Vjosa River Basin, 4NC, 2020.
[38] TNC
[39] TNC
[40] Ylli A., Draft report for V&A assessment for health sector, 4NC, 2020.
[41] World Bank Climate Change Knowledge Portal

(such as strokes, ischemic heart diseases, myocardial infarction, and chronic pulmonary diseases) are expected to increase proportionately with temperature rise. This will especially affect the older adults and the elderly, and other vulnerable groups of population,[42] whose numbers are expected to increase in the coming years. Cases of skin burning are expected to increase, along with related skin diseases.[43]

- Air quality is expected to deteriorate in major cities, due to increased temperatures and less precipitation and may cause an increase in respiratory and cardiovascular diseases, especially in Tirana.[44]
- Changes in climate are also favouring the expanded presence of tick and parasite vectors, making the country increasingly vulnerable to tropical disease outbreaks.[45]
- As noted, health facilities could be damaged by climate-related changes, such as SLR, heavy rains or extreme temperatures.
- Although the growing season is projected to become longer, the Albanian agricultural sector is vulnerable to climate change because of its dependence on water resources, the increased risks of drought and extreme temperatures, and floods and erosion due to SLR. This could affect food security.
- All of the above will create an additional burden on the health system.

3.3.4. Risks and vulnerabilities of the tourism sector

The burgeoning tourism sector should be affected both favourably and unfavourably by projected climate change.

Changes in touristic season

The “sun and sea” tourism prevalent in the coastal area currently takes place essentially in the months of July and August, as these present the best temperature and precipitation conditions for this type of tourism. Changes in these variables will favour an extension of the touristic season, as described in **Error! Reference source not found.**.

Table 9. Projected evolution of the Tourism Climate Index (TCI) for the Vjosa River Basin coastal area

TCI		Baseline	2030	2050
Good conditions	60-70	mid-March to mid-October	early March to early November	mid February to early November
Very good conditions	70-80	end March - beginning of October	mid March - mid October	Mid March to early October
Excellent conditions	80-90	mid April - end September	early April - beginning of October	Beginning of April to end September

Source: E. Bruci. Draft report Climate vulnerability and expected climate changes for the Vjosa River Basin, FNC, 2021.

[42] City of Tirana, Adapting our City to a Changing Climate: Vulnerability Assessment and Adaptation Action Plan for Tirana, 2015.
[43] Ylli A.., Draft report for V&A assessment for health sector, 4NC, 2020.
[44] TNC
[45] TNC

However, extreme temperatures and rainfall events will increasingly hinder the attractiveness of Albania's coast during key summer months (June to September), regardless of the climate scenario.

Touristic conditions

The tourism sector will be affected by the same elements that affect Albanian coastal population and settlements.

- Climate-related disasters will damage touristic infrastructure (e.g. hotels, villages, recreation parks, conference and fair centres, yacht harbours). They may also affect the much-needed increase in accommodation capacities and other touristic infrastructure that may be developed in order to support the projected growth of the sector.
- They will also damage supporting infrastructure such as airports, roads and ports, as well as the capacity to provide consistent energy and quality drinking water. It should be noted that, as of 2017, 81% of foreign visitors arrived to the country by land.[46]
- Tourists will be exposed to some of the shorter-term health effects of the changed climatic conditions, such as heat strokes, skin burns, and vector-borne diseases.

Other factors may affect the attractiveness of Albania's coast to tourists.

- Loss of beach area due to SRL and erosion[47]
- Damage to cultural heritage
- Destruction of biodiversity and natural landscapes, both marine and coastal

The National Tourism Strategy 2019-2023 identifies climate change among the risks to the industry. The recent vulnerability assessment of the Vjosa region also projects that the growth of the sector will be limited by loss of beach area and limits to their carrying capacity.[48]

Anthropogenic pressure

Tourists will bring additional anthropogenic pressure on water resources, on energy demand and on the natural environment. They may therefore contribute to further enhance the projected effects of climate change in the coastal area.

Tables 8 and 9 summarize the analysis developed above. Table 8 summarizes the potential effects of changes in climate-related variables on settlements, populations and tourism sectors in the Albanian coast, while Table 9 summarizes the vulnerabilities and risk of these sectors with regards to the projected changes in climate-related variables.

Table 10. Summary of potential effects of changes in climate-related variables on settlements, population and tourism sectors in the Albania coast

Factor	Effects/Risks	Effects on sectors
Settlements		
Temperature	• Increased evaporation • Increase in cooling degree days	• Increased demand for electricity to cool down houses/buildings
		• Increased demand for drinking water in the summer
		• Decreased water level in hydroelectric reservoirs

[46] Government of Albania, National Tourism Strategy 2019-2023
[47] Laçi E., Draft Report for V&A assessment for population, settlements and tourism sectors, 4NC, 2021.
[48] Laçi E., Draft Report for V&A assessment for population, settlements and tourism sectors, 4NC, 2021.

Factor	Effects/Risks	Effects on sectors
Precipitation	• Increased frequency of droughts	• Decreased water level in hydroelectric reservoirs and in the water supply system
	• Increased occurrence of floods, especially during winter, but also during fall and spring months	• Destruction of settlements, infrastructure and natural environment
SLR	• Salinization of coastal aquifers • Increased exposure of coastal areas to floods from storm surges and erosion	• Decrease availability of freshwater • Destruction of settlements, infrastructure and natural environment from floods and shore line regression in low lying coastal areas and river beds • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas
Population		
Temperature	• Increased evaporation • Increase in cooling degree days	• Increased demand for electricity to cool down houses/buildings
		• Increased demand for drinking water in the summer
		• Increased occurrence of heat waves
Precipitation	• Increased frequency of droughts	• Decreased water level in the water supply system
	• Increased occurrence of floods, especially during winter, but also during fall and spring months	• Destruction of settlements, infrastructure and natural environment
SLR	• Salinization of coastal aquifers • Increased exposure of coastal areas to floods from storm surges and erosion	• Decreased availability of freshwater • Destruction of settlements, infrastructure and natural environment from floods and shore line regression in low lying coastal areas and river beds • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas
Tourism		
Temperature	• Increased evaporation • Increase in cooling degree days	• Increased demand for electricity to cool down buildings, including hotels, restaurants
		• Increased demand for drinking water in the summer
		• Increased occurrence of heat waves
Precipitation	• Increased frequency of droughts	• Decreased water level in the water supply system
	• Increased occurrence of floods, especially during winter, but also during fall and spring months	• Destruction of settlements, infrastructure and natural environment
SLR	• Salinization of coastal aquifers • Increased vulnerability of coastal areas to floods from storm surges and erosion	• Decreased availability of freshwater • Destruction of settlements, infrastructure and natural environment from floods and shore line regression in low lying coastal areas and river beds • Destruction of settlements, infrastructure and natural environment related to erosion and landslides in coastal areas

Table 11. Summary of the vulnerability to and risks from changes in climate variables of settlements, population and tourism sectors in the Albanian coast

Sector	Sectoral vulnerability factors	Risks for the sector
Settlements	**Infrastructure and built environment** • Flatness of coastal area • Density of housing, buildings, infrastructure, agricultural land and historic/cultural sites on the coast • Occupation of particularly flood and erosion high-prone coastal areas • Limited flood prevention infrastructure • Poor maintenance of flood prevention infrastructure • Erosion related to limited sediments from dammed rivers	**Infrastructure and built environment** • Disasters cause settlements to lose access to essential services such as shelter, electricity, drinking water, transport, health and educational facilities, industries, touristic infrastructure, etc. • Loss of life and livelihoods from climate-related disasters • Loss of land for future development
	Water • Important losses in current water supply system • Demand is naturally increasing	**Water** • Diminished capacity to provide water to the population and industry / unfulfilled demand for water in the summer
	Energy • High dependence on hydropower • Poor maintenance of energy infrastructure / High rate of loss in distribution network	**Energy** • Diminished capacity to provide power to the population and industry / unfulfilled demand for power in the summer
Population	**Lives and livelihoods** • High population density in coastal areas, including in high-prone risk areas • Vulnerability of settlements (detailed above)	**Lives and livelihoods** Climate related disasters may cause: • Loss of life and injury • Destruction or damage to homes • Limited access to services (water, electricity, health, education, etc.) • Loss and/or disruption of livelihoods resulting from climate-related disasters directly (e.g., flooding of plants) or indirectly (e.g., loss of access to essential services like electricity or transport)
	Health • Health infrastructure constructed in vulnerable areas and overall unprepared to projected climate changes • Vulnerability of settlements (detailed above)	**Health** • Loss of life and injury related to climate-related disasters, especially floods • Mental health consequences from climate-related disasters • Increased prevalence of water-borne and vector-borne diseases • Decreased availability and/or quality of water and food • Increased prevalence of heat-related diseases and death • Deterioration of air quality causing respiratory and cardiovascular diseases • Decreased access to health infrastructure and services • Increased burden of all of the above on the health system

Tourism	• Limited development of the tourism sector • Touristic season concentrated in the months of July and August • Touristic infrastructure (hotels, parks, etc.), supporting infrastructure (airports, roads, etc.) built in low-lying areas • Vulnerability of settlements (detailed above)	• Decreased attractiveness of June-September due to high temperature • Destruction or damage to touristic infrastructure (hotels, cultural sites, etc.) • Destruction or damage to supporting built environment (airports, roads, etc.) • Exposition of tourists to short term health effects (heat strokes, etc.) • Loss of beach area • Damage to cultural heritage • Destruction and degradation of biodiversity and natural landscapes

3.3.5. Risks and vulnerabilities of the AFOLU sector

3.3.5.1. Current impacts of climate change

Crops

Crop production in Albania is highly exposed and influenced by the effects of climate change that have occurred during the last decades. In recent decades, serious disturbances in climatic parameters have been observed and, this has been more evident in the precipitation regime in the country.

It is quite significant that during the period 2010-2020, the western lowlands of the country have been flooded many times, causing serious damage to agricultural production. However, based on the data obtained from various studies on climate change in the country, the annual precipitation has been decreasing, while the distribution of the precipitations during the year, has changed significantly, causing, heavy rainfall during the winter months, and long periods in summer without rainfall.

As a result of these changes, in the last decade, many floods have been observed. From these floods, about 10,000 ha of wheat, 15.000 ha of fodder crops, 1000 ha of fruit tree, and over 1500 ha of vineyards have been destroyed. The biggest damages were caused in the northwest (Shkodra and Lezha regions). Based on the estimates made by agricultural experts the resulting damages from floods to agricultural production were about 100 million USD. On the other side, it has been noticed that in the last decades, the summer season is becoming drier with rising average temperatures. The effects of these climate changes have led to an increase in the demand for irrigation water, as well as the demand for chemical treatments to protect plants from diseases and pests.

Livestock

As a result of floods, in addition to the loss of fodder crops some poultry have been also lost. The biggest damages were caused in the northwest (Shkoder and Lezha regions). Higher temperatures during summertime and lower precipitation strongly affect grazing systems because of their dependence on climatic conditions and limited adaptation opportunities[49]. There could be far-reaching consequences for animal production through the effects on forage and

[49] IFAD. www.ifad.org/lrkm/index.htm

range productivity. The small ruminant animals, sheep and goats in Albania are mainly kept in extensive pasture system and they are more vulnerable to climate change, including higher temperatures and shortage of forage.

The direct impacts of climate change are likely to be more limited in non-grazing systems mostly because the housing of animals in buildings allows for greater control of production conditions[50]. The most productive animals, dairy cattle, laying hens, broilers and pigs are managed and housed in good conditions in Albania and the impact of climate change on them will be less than farm animals in the semi-intensive or extensive system. The surface planted with alfalfa, which makes the main forage used in ruminant animals feeding, is still stable with a slight increase. The high temperatures during the last few summer seasons may have affected the laying hens and dairy cattle production, but no data are available to quantify this impact.

The worst effect has been noticed in the area of diseases spread out in farm animals, because of high temperatures. Seven years ago, Albania had experienced the case of bluetongue diseases in cattle and then in sheep as climate change allowed its spread. Bluetongue disease is a non-contagious illness of ruminant animals that is transmitted through insects (Culicoides. Sp). In general, 900 head of cattle were infected, from which 175 died. Then the illness was spread out in small ruminant animals that infected 28,176 heads of sheep and 663 heads of goat from which were dead respectively 6379 and 142 Head of animals[51]. These are the main financial losses without taking into account the losses from the low productivity of animals. Another disease that is affected by climate change is Krime-Kongo hemorrhagic fever (CCHF) that is present in Albania and causes death in human being but affect animals. The warmer winter season helps the survival of larvae and rays spread out of CCHF. The same situation has happened with horses infected with the West Nile virus spread out by *Culex pipiens* mosquito that is adapted to high temperatures. In the year 2011, 22% of horses were infected.

Forests

Climate change directly affects the frequency and intensity of forest disturbances such as insect outbreaks, the increased presence of invasive species, fires, storms, etc. Also, rising temperatures, heat waves and reduced rainfall cause stress to trees, directly affecting the productivity of forests.

To date, there is no specific studies regarding the impact of climate change on Albanian forests. However, some impacts of those changes are already evident and consist of:

1. Damage to the coastal belt of Mediterranean pine forests (mainly *Pinus halepensis*). This damage occurred in two main areas:
    a. In Kune-Vain (Lezha municipality), where a forest belt of Mediterranean pines of about 80 ha has disappeared during 1985-2020 as a result of coastal erosion. The belt has a length of about 4 km and a maximum width of up to 400 meters. Coastal erosion in combination with a rising sea level has caused the loss of a significant amount of forest land in this area with an average extinction rate of about 2.3 ha/year.
    b. In Velipoje (Shkodra municipality), due to coastal erosion, a forest area of 34 ha with riparian forests was lost in the period 1985-2020. The rate of forest area of loss there has been about 1 ha/year.

[50] FAO. "The State of Food and Agriculture: Livestock in the Balance, ." 2009
[51] Blue tongue Bulletin, ISUV 2014

2. Changes have been observed in the vertical migration of forest areas. This has been observed to occur in the upper forest belt of Bosnian pine (Pinus heldreichii) and Macedonian pine (Pinus peuce) where those forests are moving to the areas of alpine pastures. In some areas, a vertical shift of forest vegetation between 50-100 meters has been observed.
3. The high temperatures and heat waves that have invaded the country have led to substantial damage of forests by massive forest fires. The frequency of fires and the damage caused by them has increased in recent years. During the period 2011-2019, about 760 forest fires were identified, burning an area of 337,800 ha of the Albanian forests. The deforestation rate due to fires caused the 22% of forest area reduction over 12 years.
4. New pests and diseases are becoming more frequent and causing massive damages to forest fund. Especially the forests of black pine, chestnut, plane, oaks, and box-tree are suffering from the damages caused by diseases and pests. Thus, some of the diseases and pests have appeared that were not previously in our forests are Box tree moth, Chestnut gall wasp and plane trees canker stain. On the other hand, diseases and pests have increased the rate of their spread and intensity of infection of forest trees (The Pine processionary moth, Oak processionary moth, Box tree moth, Chestnut gall wasp, Chestnut blight etc.). In total, it is estimated that the rate of forest impact by pests and diseases is spread over an area of about 200,000 ha or 20% of the total forest area of Albania.

Pastures and Meadows

After 1990, pastures in Albania are not actively maintained due to lacking human and financial resources, resulting in changes in the vegetation and pasture degradation. Pastures at altitudes 1500-1800 m are turning to shrublands domination by Juniperus. Pastures at higher elevations, above 1800 m do not show significant change.

The analyses of digital photographs show a decrease of cover vegetation at 5 % of the alpine grasslands in Nemërçka Mt from 2004 to 2010[52]. On the other hand, overgrazing of the alpine pastures led to increased presence of thorny and pioneer species like Centaurea sp. Cirsium sps. or so-called “resistant” species like Sesleria tenerrima etc. The same study refers that higher presence of invasive and pioneer species that has changed the structure of alpine grasslands mostly observed in Wide and Nemërçka Mts.

Climate change effects on pastures were evident since the late 1990s, more precisely since the snowless winter of 1997. Since 1997, winters in Albania have become shorter and milder, whereas summers have become longer and hotter. Droughts in summer and sometimes even in autumn, and then sudden floods, have become more frequent. The climate change effects have increased the number and the intensity of fires in Albania negatively affecting grassland and pasture ecosystems.

Lagoons and Wetlands

Coastal lagoons are formed and maintained through sediment transport processes, which are affected by climaticchanges. Sediments carried by rivers, waves, currents, wind, and tides

[52]Shuka L., Malo S., Vardhami I. (2011) : The impact of global warming in southern Albanian grassland ecosystems, Conference: International Conference of Ecosystems (ICE), 4-6 June 2011, Tirana, Albania https://www.researchgate.net/publication/283211420

accumulate in the river and tidal deltas, on marshes and flats where submerged aquatic vegetation slows currents, and on wash over fans. The process of sedimentation which can eventually fill in lagoons is interrupted in rivers such as Drini heavily affecting the sediments on the Adriatic coast[53]. Therefore, lagoon barriers in Shengjin and Patok area are constantly eroded by climate change related waves and wind, requiring continuous sediment deposition to maintain them.

Water quantity and quality in the lagoons is influenced by the rate at which the lagoon loses or gains water from evaporation, precipitation, groundwater input, surface runoff, and exchange with the sea[54]. Lagoon–sea exchange is driven by tides and wave action and is often the largest component of lagoon water balance[55]. Some of the lagoons such as Kune – Vain, Orikum have almost lost communication with the sea as the most of communication channels are closed. Rising temperatures lead to increased eutrophication and change in water quality and salinity.

There is observed and monitored change in the phytoplankton and zooplankton composition, as well as an increase of alien species population such as the blue crab *Callinectes sapidus*, competing will the local crab populations.

Strong human pressures and inappropriate management practices have significantly reduced the natural system's adaptability and resilience. Climate change is an added stress for wetlands and will highly influence the nature and function of specific wetlands, in particular the hydrological regime and the biodiversity. Climate change in combination with human-induced pressures is likely to become increasingly important factor leading to wetlands degradation and loss.

Aquaculture and Fisheries

Albanian coast is part of the Mediterranean basin, which is warming 20% faster than the rest of the globe as a whole[56]. Anticipated changes (increased sea surface temperature (SST) and salinity, greater frequency of heat waves, sea-level rise, decrease in precipitation and changes in oceanographic circulation[57], are expected to have a strong impact on habitats and ecosystems in general, and on fisheries and fisheries resources in particular. For instance, in the Adriatic Sea, the sardine, mackerel and anchovy respond to salinity changes, which are modulated by the climate oscillations, as described by the pressure differences between the mid-north Atlantic and the southeast Mediterranean. This behaviour change can be attributed to ongoing climatic changes, which change the migration patterns of pelagic fish in the Adriatic. Due to meridionalization and tropicalization several non-native species started to appear along the coasts of Albania during the last 2 decades. Those include blue fish, blue crab and silver-cheeked toadfish.

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53 Nichols, M.M.; Boon, J.D. (1994). Sediment transport processes in coastal lagoons, in: Kjerfve, B. (Ed.) Coastal lagoon processes. Elsevier Oceanography Series, 60: pp. 157-219. hdl.handle.net/10.1016/s0422-9894(08)70012-6

54 Abigail A. et al. (2009) : Coastal Lagoons and Climate Change: Ecological and Social Ramifications in U.S. Atlantic and Gulf Coast Ecosystems. www.researchgate.net/publication/263008875

55 Smith, N. P. 1994. Chapter 4. Water, salt, and heat balances of coastal lagoons. Pages 69-101 *in* B. Kjerfve, editor. *Coastal lagoon processes.* Elsevier, Amsterdam, The Netherlands

56 MedECC. 2020.

57 Hidalgo, M., Mihneva, V., Vasconcellos, M. and Bernal, M. 2018.

3.3.5.2. Future impacts of climate change

Crops

The future climatic changes in Albania are expected to have major effects on the crop production. Specifically in lowland areas it is predicted that the yield of maize will decrease by 17%, and the yield of tomatoes and watermelon will decline by 6-11%. In the agricultural areas with limited irrigation opportunities or no irrigation at all, it is expected that the yield of alfalfa will decrease by 6%, the yield of grapes -- by 17-23%, the yield of olives -- by 11 - 20%, while the yield of wheat is expected to increase by 4 - 5%.

Albania's statistical data on the yield and agricultural production in recent decades suggests that the level of inputs (chemical fertilizers, quality seeds, pesticides) as well as the level of modernization (irrigation, harvesting technologies, etc.) have been growing at very low rates, compared to the European Union countries. In these conditions, taking into account the expected effects of climate change on agriculture the Albania's gross domestic product, will potentially lose 800-900 million USD of income from crop production by 2050 (expert assumption).

Table 12. Summary of the vulnerability to and risks from changes in climate variables of agricultural crops.

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Temperature	• Low technological flexibility and productivity rates • Low level of irrigation infrastructure development • Low level of phytosanitary controls • Crop area fragmentation and reduction due to a decrease in optimal farming conditions (the area cultivated with wheat has decreased by about 22%, while production has decreased by 13%.	• Increased risk of drought and water scarcity[58] • Increased irrigation requirements • Increased risk of agricultural pests, diseases and weeds (the amount of pesticides used has increased significantly, which indicates an increase in the level of infections, and treated areas, to combat diseases and pests). • If we analyse the structure of production in the last ten years, we will notice that the area cultivated with wheat has decreased by about 22%, while production has decreased by 13%.
Precipitation	• Low level of irrigation infrastructure development	• Massive flooding, every 3-4 years (floods led to the loss of about 10.000 ha of wheat, 15.000 ha of fodder, 1000 ha of fruit tree, and over 1500 ha of vineyards) The biggest damages were in the northwest (Shkodra and Lezha regions)

Livestock

According to the World Bank study, the main projected climate changes that could impact the livestock sector are: (1) temperature increase and (2) precipitation becoming more variable. (3) damaging effects of severe floods. For some feedstock crops, the future climate impacts will be positive and for some other negative. The temperature stress effect on livestock will be gradual over time. The extensive and intensive livestock production systems will be affected differently by

[58] In the last ten years, there have been very hot summers, and periods that have lasted almost two months, without precipitation. Such critical periods, there were in the summer season, during the years 2016-2018.

climate change and, thus, different adaptation strategies must be implemented. The impacts of climate change on livestock production are represented by:

- Direct impacts of increased temperatures and frequency and intensity of heat waves on animal production, reproduction, health, and mortality
- The indirect effects linked to alteration of the availability and the quality of feedstuffs and drinking water as well as survival and redistribution of pathogens and/or their vectors.

Temperature affects most of the critical factors for livestock production, such as water availability, animal production, reproduction and health. Forage quantity and quality are affected by a combination of increases in temperature, CO2 and precipitation variation. Livestock diseases are mainly affected by an increase in temperature and precipitation. Livestock in higher latitudes will be more affected by the increase of temperatures than livestock located in lower latitudes because livestock in lower latitudes is usually better adapted to high temperatures and droughts. Heat stress negatively affects milk and meat production as well as its quality, resulting in the alteration of cheese making properties and the merchandise value of milk. These changes result in significant, negative economic impacts for producers and consumers. High-producing dairy cows are more sensitive to heat stress. Negative effects can be noticed on beef breeds resulting in lower daily gains. In Albania, there are no pure beef breeds of ruminant animals, (cattle or sheep and goats). Meat production is based on young female animals not designated as overhaul animals and males or offspring of crosses between milk breeds with the semen of meat breeds. High temperatures have a negative impact on monogastric animals, pigs and poultry. According to literature (different authors) reduced and inconsistent growth, decreased feed efficiency, decreased carcass quality, poor sow performance, decreased reproductive performance (male and female), increased mortality, (especially in sows and market hogs), and morbidity is the main economic losses associated with heat stress in the swine industry. The poultry industry may also be compromised by low production at temperatures higher than 30ºC. The climate impacts may vary by agro-ecological zone (Table 12).

Table 13 Climate change impact on livestock production in different agroecological zones (AEZ)

Livestock/zone	Intermediate zone	Lowland zone	Northern mountains zone	South highlands zone
Beef production	Slightly negative	Slightly negative	Slightly positive	Positive
Milk production	Medium negative	Medium	Slightly positive	Positive
Pig production	Medium negative	Slightly negative	Medium negative	Medium negative
Egg production	Medium negative	Slightly negative	Medium negative	Medium negative
Poultry production	Medium negative	Slightly negative	Medium negative	Medium negative

Table 14 Summary of the vulnerability to and risks from changes in climate variables of livestock

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Temperature	Low productivity and reproductive performances of farmed animals.	• Heat stress risks targets can be categorized into feed nutrient utilization, feed intake, animal production, reproduction, health, and mortality. The heat stress will be felt more in grazing system in mountainous areas where the animals, mainly small ruminant animals, regardless they are local breeds, they are not adapted to heat stress. • In the lowland and intermediate zone, the heat stress will be more severe but most of the livestock are kept in stables being rather protected from heat stress. • The effect of heat stress on meat production will be linked with scarcity of fodder production, lower

		feeding value and the increase of production cost. More concentrated feedstuffs will be used for feeding. • Pig and poultry production will be affected also more in the lowland area from high temperatures.
	Feed quantity and quality	• An increase of temperature especially in the lowland zone will increase the early lignifications of fodder crops, reducing their digestibility and degradability in ruminant animals and will increase the need to use more concentrated feedstuffs in their feed rations. This will increase the cost of milk and meat production.
	Increased risk of drought and water scarcity	• Water availability and quality issues will influence the livestock sector, which uses water for animal drinking, feed crops, and processing of animal products. The animals in the grazing system will be more affected by water shortages, because of limited water pins and their poor maintenance. • Water availability will affect the proper hygiene during the different process of animal husbandry with consequences on their health and the quality and security of their products.
	Diseases	• Vector-borne diseases could be affected by higher temperatures and changing rainfall patterns, which could translate into the increased spread of existing vector-borne diseases and macro parasites, accompanied by the emergence and circulation of new diseases. In some areas, climate change could also generate new transmission models. • In the case of extreme heat stress, we will have elevated mortality rates. • Local and rare breeds could be lost as a result of the impact of climate change and disease epidemics.
	Biodiversity of livestock	• Most of the small ruminants, sheep and goats, are local breeds in Albania farmed mainly in the grazing system and they will be more vulnerable on climate change in Albania. From ten sheep breeds, three of them are at risk of extinction and from 17 goat's breeds, 10 are at risk of extinction. Climate change will affect negatively their level of risk
Precipitation	Rainfall	• Forage quantity and quality are affected by a combination of increases in temperature, CO2 and precipitation variation. The effect of climate change will be different according to AEZ, rainfall precipitation and temperatures. • In irrigated areas: The production of irrigated alfalfa will increase in all AEZ from 6-13 % with the highest value in the south highland zone. The maize production will decrease from 3 up to 11 % with the highest value in Northern Mountain zone. In the south highland zone, the effect of precipitation on maize production will be slightly positive. • In rain-fed areas: The production of alfalfa will decrease by 2-6 % especially in the Intermediate zone. In Southeast highland, the impact of climate change will be positive, with 7% higher production.
	Floods	• Regional floods have been accompanied with animal losses and fodder shortage

Forests

In addition to problems caused by lack of capacities and support for the forestry sector, lack of law enforcement and forest fires, forests are expected to be significantly affected by future climatic changes. Forests on sites with the coldest conditions could experience, on average, an increase in productivity, while forests on the warmest sites may show a productivity decline. Additionally, pest and diseases will be more present, affecting more forest area and species in Albania.

Considering the situation of the Albanian forests and management capacities, the vulnerability assessment shows that some forest types are most at risk from climate change. Those forest types are: sweet chestnut forests, Mediterranean and Anatolian fir forest, Alpine Scots pine and Black pine forest, Coastal forests with Mediterranean pines, Riparian forests, Mediterranean and Anatolian Black pine forest. Other forest types that will be affected are: Boxtree forests, Illyrian mountainous beech forest, Plantations of site-native species with black pine, Mediterranean evergreen Oak forest, Mountainous Moesian beech forest and some other forest types (birch, floodplain forests, European spruce etc.).

Based on existing literature (Albanian National Communications to UNFCCC), some of the expected effects of climate changes on forests are:

- In general, evergreen species and oak forests are expected to enlarge, while the area of beech forests, which are more important to produce wood, would reduce.
- The deciduous forest area (Fagetum) is likely to decrease from 32.4 % in 2000 to 16.7 % by 2100.
- The common spruce forest is expected to disappear (after 2025) while the alpine pasture on the top of high mountains would be limited in the area.
- The species that resist high temperatures and severe long dry seasons would be able to survive. For those that need moisture (silver fir, etc.), the danger of being limited in distribution or disappearing does exist.
- The Mediterranean alpine pasture area is expected to reduce more than ten times from 22.3 % in 2000 to 2.2 % by 2100.
- The species that produce many small seeds and have a high distribution potential (Pinus etc.) would be able to survive.
- Forest fires will be more frequent
- Erosion will increase.

Table 15 Summary of the vulnerability to and risks from changes in climate variables of forests

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Temperature	• Low management capacity of forestry authorities • Unsustainable forest structure • Illegal logging	• Decline in forest productivity • Increase of forest productivity in case of drought tolerant species. • More pests and diseases will be causing more damages • Reduced trees' ability to produce sap • There will be species migration, especially towards non-forest areas (e.g., alpine pastures) • More forest fires • Reduction in forest areas for some species (fir, spruce, scot pine etc.) • Fragmentation of forest areas • Coastal forests will extinct or will suffer from salt waters, erosion and fresh water ability
Precipitation	• Less rainfall will negatively affect forest productivity	• Decrease of forest productivity in case of species less drought

	• Increased temperatures alter the timing of snowmelt, affecting the seasonal availability of water	tolerant. • Water stress will reduce forest productivity • Extreme precipitation will cause flooding in the western part of the country and along with coastal areas.
CO_2 increase	• Atmospheric CO_2 increase will improve the ability of trees to increase their growth rates (if this is not affected by high temperatures and limited rainfalls).	• Elevated CO_2 may have positive effects on forest productivity. • CO_2 may enable trees to be more productive, which may change the distribution of tree species.

Pastures and Meadows

With the average annual temperature across the country increased between 0.8 – 1.0°C by 2025 and 2.9 – 5.3°C by 2100, shifts in the timing and frequency of climate extremes, such as drought and heatwaves, can generate sustained shifts in pasture and meadows function with important ecological and economic impacts, including a reduction of productivity. As the average annual precipitation across the country is expected to decline 2.6-3.4% by 2025 and 5.9-6.3% by 2050 this will result direct yield response. As described by PACE experiment[59] on the Pastures and Climate Extremes using a factorial combination of elevated temperature (ambient +3°C) and winter/spring extreme drought (60% rainfall reduction) resulted in productivity declines of up to 73%. Functional group identity was not an important predictor of yield response to drought. Cool season drought translates into significant reductions in annual biomass production for four species/mixtures, ranging from 33% to 70%. Many species recover rapidly once the drought ends, although there were carry-over effects on warm season (summer/autumn) growth on specific species/mixtures, spanning all functional groups.

Table 16 Summary of the vulnerability to and risks from changes in climate variables of pastures and meadows

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Temperature	• Elevated atmospheric eCO2, may enhance photosynthesis, however, it may be restricted by variations in rainfall and temperature. • Decrease in soil organic carbon. • Heat and moisture stress	• Changes in forage quality • Changes in the composition of plant communities • Reduction in productivity due to decline of soil nutrients • Seasonal duration of grazing could be extended by at least 2.5 months.
Precipitation	• Less rainfall and declined	• Damage in perennial plants Longer and slower recovery of grasses.
Non-Native Species	• Invasion of new habitats by non-native grasses • Expansion of perennial grasses over shrubs in areas frequently burned may become a critical issue.	• Biological diversity can be threatened/declined in various ways. • Reduced genetic variations • Eroding of gene pools • Extinction of endemic species • Altered habitat and ecosystem functioning. • Altered cycle and composition of soil nutrients.

[59] Curchill et al (2020): Pastures and Climate Extremes: Impacts of warming and drought on the productivity and resilience of key pasture species in a field experiment doi: https://doi.org/10.11012020.12.21.423155

		• Fragmentation of native ecosystems

Lagoons and Wetlands

Among other potential impacts, sea-level rise is projected to reduce the amount of available freshwater, as seawater pushes further into underground water tables. This is also likely to lead to much more saltwater intrusion into bodies of freshwater, affecting the water quality in lagoons and wetlands. It will also affect biodiversity in coastal habitats, and the natural services and goods they provide. Many wetland areas will be lost, threatening unique bird and plant species, and removing the natural protection these areas provide against storm surges.

According to Lefebre (2019) simulation of the future evolution of water balance, wetland condition and water volumes in 229 localities around the Mediterranean basin[60], the future projections of the relevant climatic variables under two Representative Concentration Pathway scenarios are considered, assuming a stabilization (RCP4.5) or increase (RCP 8.5) of greenhouse gases emissions. Similar increases of water deficits at most localities around 2050 under both RCP scenarios are found. By 2100, however, water deficits under RCP 8.5 are expected to be more severe and will impact all localities. Simulations performed under current conditions show that 97% of localities could have wetland habitats in a good state. By 2050, however, this proportion would decrease to 81% and 68% under the RCP 4.5 and RCP 8.5 scenarios, respectively, decreasing further to 52% and 27% by 2100.

The studies for the Mediterranean basin including Albanian coastal lagoons suggest that wetlands can persist with up to a 400 mm decrease in annual precipitation. Such resilience to climate change is attributed to the semi-permanent character of wetlands (lower evaporation on dry ground) and their capacity to act as a reservoir (when higher precipitation will occur during winter).

Although Albania, is not listed among the countries of higher risk of wetland degradation and loss, some specific areas such as Kune Vain, Patok and Orikum are more vulnerable due to very dynamic coastal shore. Degradation of wetlands with emergent vegetation will negatively affect their biodiversity and the services they provide by eliminating animal refuges and primary production.

Table 17 Summary of the vulnerability to and risks from changes in climate variables of lagoons and wetlands

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Temperature	• Sea level raise causes migration landwards of the water and changes in habitats • Species composition (e.g., algae blooming, reduction of fish stock) • Abiotic (e.g., oxygen solubility) components of ecosystem functions as the water temperature in the wetland area increases several times more than in the open estuaries. • Increase in frequency and duration of summer	• Habitat loss and reduction in productivity • Reduced dissolved oxygen adversely affects aerobic biota, with benthic communities expected to be the most severely stressed.

[60] Lefebvre G. (2019): Predicting the vulnerability of seasonally-flooded wetlands to climate change across the Mediterranean Basin. Science of the total environment, Volume 692, 20 November 2019, Pages 546-555

	heatwaves.	
Precipitation	• Storms affect lagoons through over-wash events and by erosion from wind and waves • Increased frequency of droughts • The increased amount of extracted water in aquifer for irrigation purposes	• Reduced amount of freshwater run-off from the water basin or brought in by rivers, leading into a higher level of salinity • Inland wetlands risk of drying out, therefore resulting in habitat loss for birds and other species.
Non-Native Species/IAS	• The stabilized population of alien species competing with local ones. • Increased susceptibility to the colonization of invasive species that may thrive in warmer waters.	• Reduced local biodiversity due to competition with alien species and changes aquatic communities (like *Callinectes sapidus*).

Aquaculture and Fisheries

The vulnerabilities for pelagic and demersal fisheries in the Adriatic sub-region seem nearly identical regarding wider society/economy implications, fisheries resources and community and livelihood relatives impacts, respectively[61]. In the case of fishing operations impacts comparisons, in the Adriatic sub-region, the demersal fisheries will be more severely impacted in comparison to the pelagic fisheries.

The comparison study has been conducted between the SST anomalies for RCPs near (2016-2050) and distant (2066-2100) projections and the relative vulnerability index of Albanian marine fisheries[62]. In the most severe scenarios, the difference between the two projections (near and distant) SST anomalies become less evident, which means that it should be implemented an urgent and strategic plan of measures to tackle the effects coming from the SST anomalies. In the near projections, the vulnerability is decreasing in comparison between the less and more severe scenarios, while in the distant projections, there is no difference between the vulnerability index of RCP4.5 and RCP8.5. Probably this is because in the distant projections the effects of climate change on marine fisheries will be devastating, which would have required drastic measures to save the remaining marine fisheries sectors (as result these would be less vulnerable). Another important used tool[63] by Bakiu, represented by DDS of the Aquaculture in Greece (developed in the frame of ClimeFish project implementation), showed that regarding the production/biological simulations in the two scenarios (RCP4.5 and RCP8.5), there is a higher growth rate in the first scenario, while the feed consumption (kg/weeks) is considerably higher than the second scenario – it probably creates a higher cost to support the growth of the European seabass by the farmers in the Vlora Bay. Furthermore, the total biomass for the same time seems to be lower in the second scenario – this is supported by the fact that the European seabass is considered to be highly vulnerable to SST increase in the Adriatic Sea. Other relative predictions showed an increase of heatwave days in each considered years for both scenarios, which could be considered as an alert signal regarding mussels farming and freshwater species in the Albanian territory. The temperature and the heatwave day's number increase represent the climate change factors, which together with the factors indirectly linked to climate change can further enhance the impact of CC effects to the aquaculture sectors (marine and freshwater aquaculture).

[61]FAO. 2020. The State of Mediterranean and Black Sea Fisheries 2020. https://doi.org/10.4060/cb2429en
[62]Blasiak, R., Spijkers, J., Tokunaga, K., Pittman, J., Yagi, N. and Österblom, H. 2017
[63] In DDS Aquaculture Greece software, the economic model calculates the business economics of the farm for the site selected climate scenario and management options based on the input values for the various prices and costs; in the biological model, individual growth and reproduction was modeled with the application of the Dynamic Energy Budget (DEB) theory by the ClimeFish team

Table 18 Summary of the vulnerability to and risks from changes in climate variables of fisheries and aquaculture

Sector	Sectoral vulnerability factors	Risks/Impacts for the sector
Fisheries		
Temperature	• Biological (e.g., microbial activity, metabolic rates) components of ecosystem functions • Abiotic (e.g., oxygen solubility) components of ecosystem functions • Changes in abundance, survival, growth, fertility/ reproduction, migration and phenology • Increase in frequency and duration of summer heatwaves • Higher growth rate and better reproduction season for warm water species • Migration of cold water species to colder areas, either horizontally (north, south, east, or west) or vertically (to deeper levels)	• Pelagic fish (small and big) dropping due to reduction of primary production • Prevent shellfish breeding and consequently low abundance during bivalve mollusc species fishing • Inevitably impact employment levels in the fisheries sector as well as consumer options.
Acidity	• On bivalve mollusc species - lower development rate of seed (spat), increased adult mortality and difficulties on byssus attachment	• Prevent shellfish breeding and consequently low abundance during bivalve mollusc species fishing.
Non-Native Species/IAS	• A serious problem for fisheries and trophic relationships in coastal areas	• Extinction of some species that may be preys of these generalist fish species (like blue fish and mullet example); • Damage to fishing gears and health of fishers • Bring new diseases in the territorial water and coastal areas • Socio-economic negative impact mostly to small-scale fisheries.
Aquaculture		
Temperature	• Biological (e.g., microbial activity, metabolic rates) components of ecosystem functions • Abiotic (e.g., oxygen solubility) components of ecosystem functions • Increase in frequency and duration of summer heatwaves • Stimulate the growth, transmission and survival of aquatic parasites (mostly salmonids/trout)	• European seabass farming has encountered problems due to warmer water in the Mediterranean Sea and Albania (according to simulations higher feeding rate, lower growth rate and biomass biomass) and the associated susceptibility to disease • Necessitate the shift of farming species with the better tolerance to warmer temperature, such as gilthead sea bream • European seabass cages to be moved to colder zones or deeper nets - increase the costs of European seabass production. • Affect human health through the consumption of

		contaminated seafood and the ingestion of water-borne pathogens – negative impact on relative aquaculture products marketing
Acidity	• On bivalve mollusc species - lower development rate of seed (spat), increased adult mortality and difficulties on byssus attachment	• Warming and lower precipitations increase the vulnerability to produce qualitative Mediterranean mussels • Expected increased mortality of Mediterranean mussels in the Lagoon of Butrinti
Precipitation	• Increased frequency of droughts	• The apparent rise in temperature, combined with lower precipitation levels, which lead to unexpected fluctuations in river flows and to unpredictable ecological degradation • 40% of fish species in Mediterranean rivers are endangered, because of the reduction in river flows – with impact to inland fisheries

3.3.6. Gender distribution, gaps and structural barriers

Women and men are legally equal under Albanian law, and its gender development index (GDI) in 2019 was high (0.967) and above the World average of 0.943.[64] However this is not sufficient to ensure gender equality, as women face many obstacles in enjoying their equal rights, including:

- They have a more limited access to assets, which translates into an inferior economic position. This gap encompasses salaries, property ownership, pensions, inheritance, and land;
- More women are employed in the informal sector or at lower-paying jobs;
- They are underrepresented among owners of important companies in technical sectors such as energy and transport;
- They usually do not own land, even though they constitute the majority of the agricultural workforce;
- Their representation in Parliament is low (28%), which is representative of their difficulty in taking part in decision-making processes. [65]

3.3.6.1. Main gender differentiated vulnerabilities to climate change

Currently available analysis on how climate change affects men and women differently in Albania is limited and focuses on the agriculture sector. This is relevant given that agriculture is a labour-intensive sector highly dependent on environmental conditions. The different vulnerabilities in this

[64] UNDP, 2020 Human Development Report. The GDI is the ratio of female to male Human Development Index values. http://hdr.undp.org/en/countries/profiles/ALB
[65] TNC

sector depend to a large extent on the differentiated roles of women and men in the agricultural value chain.

According to a survey conducted for the Fourth National Communication (4NC), 39% of respondents believe there are differences in men's and women's ability to react to climate change, and among them, 53% believe men are more able to address climate change challenges.[66]

Lives

Following the 2015 floods in the Southeast of the country, UN Women documented the following consequences of floods on women:

- Increase of the workload by four hours on average, to clean up and due to lack of energy supply
- Increase in violence against women, both domestic and outside the home, with women heads of households facing a greater risk
- Decreased income
- Loss of access to services that helped alleviate women's workload (e.g., kindergarten, schools, etc.)[67]

The increase in violence against women and that of time use for main household chores were also identified as the main impacts of climate change on women's living conditions in the FNC survey. The survey does not identify significant gender differences regarding the effects of increased conflicts in settlements or in reactions of hopelessness and sense of loss.[68] They survey also identified significant differences in access to information about adaptation to climate change.[69]

Health

According to the 4NC survey, women reported a more significant increase in health, physical and emotional problems than men following climate-related disasters. This is reported to intersect with ethnicity and location (especially in areas with more vulnerable populations), poverty or migration status.

Exposure to high temperatures has adverse effects on pregnant women (teratogenic effect). Following floods, they can develop bronchitis or infections as they cleanup damp houses. Pregnant women are disproportionately more affected by healthcare access disruption following a disaster.

Energy

No studies are available on the effects of climate change on gender in the energy sector in Albania. According to UN Women, it is very likely that energy supply, use and consumption affect men and women differently, and intersects with factors such as location, age and financial status. Energy is considered to be a male topic, but household management is a women responsibility.[70]

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[66] Zhllima.E, Draft report on Climate change and gender equality, 4NC, 2020.
[67] UN Women, The Gender Impact of the 2015 February Floods in Southeast Albania, 2016
[68] Zhllima.E, Draft report on Climate change and gender equality, 4NC, 2020.
NC
[70] UN Women & UNDP (2016). Gender Brief Albania 2016. Prepared by Monika Kocaqi, Ani Plaku and Dolly Wittberger. UN Women, Albania.

Energy poverty may thus be worsened by climate change, as it affects energy consumption, means of heating, health and overall quality of life, including during winter, all topics typically falling under women's purview.

3.3.6.2. Overview of measures and barriers

Albania has signed a number of international binding and non-binding commitments with regards to addressing gender equality:

Table 19. Albania's international obligations with regards to gender equality

Binding obligations	Non-binding obligations
• Council of Europe's 2011 Convention on Preventing and Combating Violence against Women and Domestic Violence ("The Istanbul Convention") • Convention on the Elimination of all Forms of Discrimination against Women (CeDaW)	• UNFCCC • Beijing Platform for action • Kyoto Protocol • Copenhagen Accord • Paris Agreement, • 2030 Agenda for Sustainable Development (SDGs)

The country has taken initial steps to mainstream gender in its climate change policies and programs. This included guidelines on mainstreaming gender in climate change mitigation and adaptation programs and plans in the 4NC. However, this has not been reflected in any of the recent climate-related policies and laws, none of which systematically address gender issues. This includes:

- The Cross-Sector Strategy on Environment 2013-2020
- The Intended National Determined Contribution to the global efforts for GHG emission reduction (DCM No. 762 of 16.09.2015)
- National Strategy on Climate Change (NSCC) and its two annexes, the National Action Plan on Mitigation (NAPM) and the National Adaptation Plan (NAP) (DCM 466, date 3.07.2019)
- National Integrated Energy and Climate strategy, as an engagement of the Republic of Albania at the Ministerial Meeting of the Energy Community (Dec 2017).
- Law "On climate change" on (DCM No.499, date 17.07. 2019).
- Law no. 45/2019 "On civil protection" approved on 18/07/2019.

Neither do gender-related strategies, such as the Third National Strategy on Gender Equality (NSGE) and its Action Plan 2016-2020, consider climate change issues. In contrast, climate change is identified in five Municipal Council's Gender Equity Local Action Plans 2018-2020.[71]

Progress is hindered by the limited availability of data. Only a few studies on the effects of climate change on gender in Albania are available, and most focus on the agriculture sector. Disaster Risk Management and Environment, Energy Poverty and Climate Change were identified by UN Women as largely undocumented gender issues.[72] The Albanian Institute of Statistics (INSTAT) has increased the use of gender indicators and added gender equality sections to some of its reports. Only a few ministries collect gender disaggregated data on issues related to climate change. This includes the Ministry of Agriculture and Rural Development

[71] Zhllima.E, Draft report on Climate change and gender equality, 4NC, 2020., 2020.
[72] UN Women & UNDP (2016). Gender Brief Albania 2016. Prepared by Monika Kocaqi, Ani Plaku and Dolly Wittberger. UN Women, Albania.

(MARD) and its Agriculture and Rural Development Agency (ARDA) but not the Civil Protection Units. Uptake is greater at local level, where municipalities are establishing gender indicators in their budget monitoring systems.

The limited presence of women in key decision-making spheres is also a barrier to progress on this issue.

On the other hand, the 4NC identifies four driving forces for change:

- The various conventions ratified
- The existence of national binding rules for updating the majority of strategies related to gender equality
- The pressure of the Albanian Government to align to requirements brought by the European Integration process
- The education system

Section 4.4 includes the four objectives identified in the Gender Action Plan included in the 4NC.

3.4. Adaptation measures

3.4.1. Overview of adaptation measures

Albania has developed and implemented a large number of adaptation related policies, strategies, plans, programmes, project and actions. Among others, the country has identified priority adaptation actions in the National Strategy on Development and Integration 2015-2020, the Third National Communication, the National Climate Change Policy and the NSCC and its National Adaptation Plan, the Adaptation Plan for Tirana, the national tourism strategy 2019-2023, the national forest policy 2019-2030, the integrated cross-sectoral plan of Tirana-Durres area and the Green Climate Fund Country Programme that was developed in a participatory manner based on the previous documents. These documents identify a very large number of adaptation actions. These are categorized and summarized in tables below[73]. In tune with the Paris Agreement’s adaptation objectives, these actions will enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2 of the Paris agreement.

[73] To develop this table, three steps were followed. In the first step, for each sector (settlements, population and tourism) a list of actions was produced including all the actions indicated in the above-mentioned documents, presenting these actions exactly as they were presented in those documents. This resulted in very long lists (121 actions for settlements, 90 for tourism and 85 for populations) with a lot of duplication and some actions that were too general. In the second step, i) broad adaptation categories were defined taking into account a taxonomy that has been widely used internationally, and ii) actions were arranged per sector according to these broad categories. These involved merging and reformulating some of the actions that were included in the lists produced in step 3. The second step produced shorter list of actions for each sector. In the third step, the sector lists were triangulated to produce the table presented in this document. It is worth noting that given the cross-sectoral nature of coastal settlements and populations and the strong links between these sectors and between them and the coastal tourism the sector lists were very similar to each other, with significant coincidences (sometimes only the order changed).

3.4.2. Prioritization of adaptation measures

Considering that all the actions identified have significant potential to contribute to adaptation in Albania's coastal area, the prioritization exercise focused on two main aspects, namely:

- Co-benefit potential of the actions, which refers to the probability and the extent to which said actions can also generate (i) socio-economic development and (ii) mitigation benefits.
- Ease of implementation, which seeks to identify actions whose implementation is easier to achieve. This aspect considers the complexity of (i) the institutional and (ii) technical requirements and (iii) the magnitude of costs (financial aspects) as inversely proportional to the ease of implementation, i.e., a very expensive measure is less "easy to implement" considering that a large budget needs to be mobilized. Feasibility was not analysed as all of the actions are considered both feasible and necessary.

Each sub-category was rated as "low", "medium" or "high", and ratings were weighted and cumulated, leading to an overall priority rating.[74] Detailed ratings are available in Annex 2. Adaptation

Several measures related to policy and governance are rated as very high, largely due to their potential important development co-benefits and limited technical complexity and costs. These include developing sectoral adaptation plans and disaster risk management plans as well as mainstreaming adaptation into spatial/territorial and sectoral planning and legislation. Measures pertaining to enhancing technical capacity and awareness raising also have a very high priority as they have important co-benefits and are simple to implement.

All measures pertaining to adapting the supporting natural environment are considered as having very high priority, given the extent of both mitigation and development co-benefits they could generate, and their limited institutional complexity and relatively low costs. Water and energy efficiency, and rainwater harvesting are the measures to prioritize in terms of adaptation of the supporting built environment. All measures related to promoting gender equality in relation to adaptation should also be considered as having very high priority. Gender-related measures are meant to be structuring in the sense that they are meant to ensure gender is mainstreamed across all the other measures, including for example sectoral adaptation plans.

Several measures that are very important for adaptation, such as those related to generating scientific evidence in support of decision-making, to climate-proofing infrastructure, or to disaster risk management are not highlighted as having a "very high priority" mainly due to their high technical complexity and costs.

It is important to highlight that while this prioritization exercise highlights the "low hanging fruits" in terms of adaptation, that can be enacted rapidly and can generate multiple benefits, Albania acknowledges the importance of planning, budgeting for and implementing more complex, costly and specific adaptation measures as well.

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[74] The weights for co-benefits are 0.8 for development and 0.2 for mitigation. For ease of implementation, weights are 0.3 for institutional, 0.3 for technical, and 0.4 for financial. For each category, ratings of low, medium or high were associated respectively with 1, 2 or 3 points. The total weights equally consider the co-benefits and the ease of implementation criteria. The final priority level identifies as "Very high" the actions with a rating of >4.5 points, as High those with 4.5>x>4.0, and with Medium priorities those with a rating <4.0 (the maximum number of points an action could get is 6).

3.4.2.1. Adaptation measures in the Albanian coast

Table 20. Summary of planned adaptation measures and priority level for settlements, populations and tourism in the Albanian coast

Adaptation measures				Priority level
Strengthening the enabling environment	Policy and governance	Strengthen the institutional framework (e.g. coordination)	Institutional and organisational strengthening of governmental structures in providing interconnection between planning authorities and other inter-sectoral bodies that play a role in adapting against climate changes.	High
		Strengthen the policy framework: development and enactment of laws, policies, regulations and plans, including action plans, and mainstreaming.	Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan), specific regions (the 4 that were prioritized) or cities	High
			Development of sectoral climate change adaptation plans for the 3 main sectors prioritized and the supporting sectors (water, energy and agriculture/forestry/fisheries)	Very high
			Development of risk management plans	Very high
			Mainstreaming climate change adaptation into national cross-sectoral development planning legislation, regulations, procedures and tools	Very high
			Mainstreaming climate change adaptation into spatial/territorial development planning legislation, regulations, procedures and tools, including building codes (orientation of constructions in areas protected by floods and marine erosion)	Very high
			Mainstreaming climate change adaptation into sectoral development planning legislation, regulations, procedures and tools (including building codes and standards for housing and other infrastructure)	Very high
			Enforcement of (revised) national, territorial and sector level legislation and regulations (building codes, water resources…)	High
		Increase funding for climate change adaptation: financing and fiscal planning	Mobilization of financial resources for climate change adaptation (DR preparedness, including for relocation) / Explore and find the means of accessing Albania's public budget for financing NAP implementation	Very High
			Fiscal preparation, including an emergency fund for disaster risk response, recovery and reconstruction	High
			Establishment of incentives and subsidies for climate smart practices (e.g. climate proofing buildings, energy efficient technologies)	Very high
			Developing insurance schemes and social protection systems for climate change-related disasters	Medium

	Scientific, technical and societal capacity	Generating scientific evidence to support decision-making on CCA	Support research on and monitoring of physical, biological and social aspects, including climate-related variables (including sea level and extreme weather events), the erosion of the coast, coastal and marine ecosystems, vector-borne diseases, natural resources (e.g. water and food quantity and quality, air quality), the built environment (e.g. location, density) and socio-economic and demographic aspects, including the modernization of monitoring equipment and systems	Very High
			Monitor vulnerability (conduct vulnerability assessments and develop risk maps, at the territorial and sectoral levels (including infrastructure))	Very high
			Ensure effective communication of monitoring information to relevant sectoral and territorial actors, including through the development of end-to-end, people-centred and multi-hazard early warning (MHEW), including on floods	Very high
			Monitor and assess the implementation and results of adaptation programmes, projects and actions, ensuring the engagement of women in this process	Very high
		Enhancing technical capacity	Capacity building (e.g. training, best practice exchange, development of guidelines) on climate change, its impacts (e.g. ecosystems, buildings, water and energy infrastructure, health) and the design, implementation, monitoring and evaluation of adaptation actions of key stakeholders (e.g. policy and decision makers, planning authorities, implementers, including the private sector)	Very high
		Awareness raising	Public information and awareness raising (e.g. awareness raising campaigns) on climate change, its impacts and the design, implementation, monitoring and evaluation of adaptation actions (e.g. heat related, resources efficiency, reclying)	Very high
Climate proofing residential and productive infrastructure, touristic accommodation and assets and health (and other social) facilities	Climate change delivery	Climate proofing coastal buildings and facilities to prevent further damage and degradation	Determining (green and blue) buffer zones in risk-prone areas (in the coast and in-land)	Very high
			Construction and maintenance of protective infrastructure (e.g. sea defences/concrete gates, increasing the level of river beds (desilting, widening channels)	Medium
			Climate proofing buildings (covering of buildings' walls and roofs with thermoisolating materials, the using of double glass windows and doors, green roofs, natural ventilation, fire evacuation routes and fire protection systems)	High
Adapting the supporting built environment		Water	Integrated water basin and watershed management (e.g. protection of forest in the upper areas of watersheds)	Very high
			Protection of ground water (e.g. strengthening and modernization of evacuating system of salty waters, in order to impede their penetration deep in the land and their mixing with fresh waters)	High
			Construction and maintenance of rainwater harvesting infrastructure, including water reserves	Very high
			Construction and maintenance of desalination plants	High
			Climate proofing existing water infrastructure (e.g. pipes)	High
			Increase the efficiency of water use, with a focus on infrastructure	Very high

		Energy	Promote additional renewable energy infrastructure to diversify source of power generation	Very high
			Developing capacity to access energy from neighbouring countries (incl. integration in ENTSO network)	Medium
			Promote energy efficiency, including the reduction of power losses in the distribution network	Very high
			Climate proofing energy infrastructure	High
		Transport	Climate proofing transport infrastructure	High
		Telecommunications	Climate proofing telecommunications infrastructure	High
Adapting the supporting natural environment		Adopt integrated, ecosystem-based approaches (EbA) and/or nature based solutions (NbS)	Protection and restoration of existing forest/vegetation, reforestation	Very high
			Managing/restoring river beds (embankments) and reforesting river sides to increase water retention	Very high
			Protection and restoration of coastal wetlands	Very high
			Green approaches to the built environment (green roofs, streets, corridors and open spaces/ water open spaces)	Very high
		Protected areas	Strengthen the system of protected areas, including coastal and marine ecosystems, for effective conservation and sustainable use	Very high
		Promote climate-smart and sustainable agriculture, forestry and fisheries		Very high
Strengthening disaster risk management			Strengthening capacity of civil defence/emergency units to respond to extreme weather events (e.g. medical assistance during summertime)	Very high
			Displacement and relocation of high-risk infrastructure (particularly residential and social infrastructure) in safer territories	Medium
Promote gender equality in terms of climate change adaptation			Promote gender equality in decision making on climate change policies on central levels of policymaking and strengthen capacities of institutions to integrate gender considerations in climate change policies, including through the use of gender-responsive budgeting	Very high
			Conduct gender analysis at sectoral level and integrate their findings and recommendation by updating the relevant national and local strategic documents in order to integrate best practices and information with gender and climate change issues taken into consideration	Very high
			Develop and pilot gender-related climate change adaptation projects with demonstration and awareness focus on AFOLU as well as energy at local level	Very high

3.4.2.2. Adaptation measures in the Albanian AFOLU sector

Table 21 Summary of planned adaptation measures and priority level for Agricultural Crops Sector

Adaptation measures in the Agricultural Crop Sector			Priority level
National level	Construction of a new irrigation system and rehabilitation of existing irrigation infrastructure	Construction of new irrigation system and rehabilitation and modernization of existing irrigation systems to restore irrigation on 360.000 ha arable land , which could potentially be irrigated	Very High
		Gradual transition from classic forms of gravity irrigation to modern forms of irrigation (sprinkler and drip irrigation)	High
		Strengthening water use associations for the management of the irrigation water and raising the awareness of the farmers for the payment of the irrigation fee	Medium
	Construction of a new drainage system and rehabilitation of existing drainage infrastructure	Construction of new drainage systems and rehabilitation of the existing drainage infrastructure	Very High
		Increase by at least 50% of the current number of excavators and machinery needed for the maintenance of drainage infrastructure.	Very High
		Increase the financial support for municipalities, to undertake the necessary interventions in the secondary and tertiary drainage canals.	High
	Increase flood protection capacities	Increase the flood protection capacities. From a total of 850 km of river and sea embankments, about 300 km of the need urgent repairs.	Very High
		The update of the river management plans (river Buna, Drin, Mat, Shkumbin and Vjosa), and assessment of the additional interventions, needed for flood cases in the areas with a medium and high degree of risk	Medium
	Policy and organization measures	Application of subsidy schemes for farmers, for the introduction of new technologies in agricultural production	Very high
		Financial support for the application of agricultural crop insurance schemes, for the harmful effects of climate change	Very High
		Increase institutional capacity, to monitor climate indicators, as well as indicators related to the effects of climate change in agriculture	Medium
		Raising the awareness of farmers, and agricultural specialists, on the risk posed by climate change in agriculture, as well as necessary measures to adapt to these climate changes.	Medium
Farm-level	Soil related measures	Introduction of new cultivation techniques, such as direct planting, (no-tillage systems) as well as, soil mulching techniques	Medium
		Application of agroforestry practices, combining the growth of crops accompanied by forest trees, and construction of hedgerows and windbreaks on the fields planed with crops	Medium
	Farm management	Reduction as much as possible of chemical inputs in agriculture and Introduction of new cultivation technologies	High
		Promotion of organic farming and application of precision farming systems	Medium
		Introduction of pest and disease resistant cultivars as well as improvement of pest monitoring and information system	High

		Application of crop cultivation in protected environments, increasing the area of greenhouses, tunnels and hail protection systems	High
	Crop related measures	Promoting plant breeding programs, which are focused on the development of new cultivars adapted to climate change. (drought and cold resistant)	Medium
		Application of crop rotation practices, in the plain areas of the country, as well as the planting of perennial crops, in hilly and mountainous areas	Medium
	Increased financial resilience	Diversification of crops, cultivated on farm and diversification of farm activities altering agricultural production with agroprocesing , agr-tourisem etc .	Medium

Table 22 Summary of planned adaptation measures and priority level for Livestock Sector

Adaptation measures in the Livestock Sector				**Priority level**
National level	Policy and institutional measures. (Strengthen the coordination between different institutions and programs for agriculture and rural development to support the livestock sector)		Development of livestock sectoral climate change adaptation plans	Very High
			Development of National Strategies and Action Plans for Agricultural Genetic Resources	Medium
			Increase institutional capacity, to monitor climate indicators, livestock data, regarding the number, level of production in different seasons for respective AEZ	Very High
			Establishing of a weather alert system to enable livestock farmers to protect animals. Improve the capacities of livestock farmers and herders to understand and cope with risk posed by climate change in livestock.	Very High
			Application of subsidy schemes to farmers, for the introduction of new technologies in livestock husbandry, diversification and processing activities.	Very High
			Financial support for the application of livestock insurance schemes, for the harmful effects of climate change.	Very High
			Strengthening capacities of national veterinary service to protect animal health and wellbeing.	Very High
			Improving the livestock sector's environmental sustainability. Increasing efficiency of natural resources use.	High
	Breeding strategies		Capacity building of Institutions and farmers associations to plan and implement appropriate breeding programs to improve animal production and their resilience to climate change	High
			Capacity building of farmers for conservation and sustainable use of local genetic resources, as more resistant and adapted to changes in climate environment	High
			National cryo-bank establishment or enhancing collaboration with international gene banks for cryo conservation of most vulnerable local farm animal genetic resources	Very High
	Production adjustments	**Grazing system**	Increasing efficiency in resource use, fodder and water, improving the sector's environmental sustainability	High
			Diversification, intensification and/or integration of pasture management, crop production and agroforestry practices for extensive system of livestock husbandry.	Medium
			Increasing the efficiency of pasture management through sustainable grazing practices like as rotational grazing, adjusting the frequency and timing of grazing to match the livestock's needs with the availability of pasture resources. Establish and maintain water points for livestock in grazing areas and shelters to protect animals to hot seasons.	Medium

			Implementation of mixed livestock farming systems, such as stable -fed systems during winter and pasture grazing, in the spring-autumn period. Better use of alpine pastures, during summer especially for fattening animals to avoid overgrazing near villages.	Medium
			Diversification of farm animal species because they exploit different feed resources. They can be affected differently from the outbreak of diseases. They have different reproductive rates and can contribute differently to rebuild livestock holding after drought, disease or natural disasters.	Medium
			Increasing livestock mobility, the traditional strategy of transhumant herders; in the winter period from mountainous regions to low land regions and vice versa during summertime	Medium
			Applying agroforestry as an integrated approach for extensive grazing system of livestock	Medium
		Landless livestock systems	Improve the environment inside housings/application of efficient cooling equipment like fans, water sprinklers to minimize heat stress. Planting trees around stables	Medium
			Improve management of water resources through the introduction of simple techniques for localized irrigation (e.g., drip and sprinkler irrigation), accompanied by infrastructure to harvest and store rainwater, such as tanks connected to the roofs of houses and small surface and underground dams.	Medium
			Reduction of livestock numbers – a lower number of more productive animals leads to more efficient production	Low
			Improving animal husbandry through activities that ensure proper nutrition and appropriate feeding and reproductive strategies	Medium

Table 23 Summary of planned adaptation measures and priority level for Forestry Sector

Adaptation measures in the Forestry Sector			Sectors	Priority level
Institutional Adaptation	Strengthen the institutional framework	Support the capacities of the National Forestry Agency and the municipalities on including forests in the development plans, and climate change adaptations of forests.	Forestry	High
	Strengthen the policy framework: development and enhancement of laws, policies regulations and plans, including action plans	Draft a national plan for afforestation based on ecologic settings	Forestry	Very High
		Improve politics and financial instruments to make the forestry sector efficient	Forestry	Very High
		Approximate and implement EU regulations relevant to forestry	Forestry	High
		Implement national strategy and action plan for climate changes	Forestry	High
	Improve forest management	Improve capacities on monitoring of forest health	Forestry	High
		Improve capacities in all forest management aspects	Forestry	High
		Improve capacities on pests and diseases management	Forestry	High
		Introduce new technologies in afforestation and forest management	Forestry	High
		Capacity building on forest fire protection and management	Forestry	High

		Improve research and innovation in the forestry sector	University	High
		Introduce new technologies in afforestation and forest management	University and NFA	High
Livelihood Adaptation	Strengthen the coordination and management framework within and between the Forestry sectors: at national and local levels	Supporting populations dependent on the forestry	Forestry	Medium
		Monitoring of vegetation shifts and species composition	Forestry	Medium
		Management of Invasive and Alien Species	Forestry	Medium
Risk Reduction and Management for Resilience	Early warning measures	Improvements on fire detection, pests and diseases capacity about the future status of forest resources	Forestry	High
	Preparedness and Response	Protect and preserve forests through ecosystem-based management.	Forestry	Medium
		Strengthening research capacities in the field of ecosystem services.	Forestry	High

Table 24 Summary of planned adaptation measures and priority level for Pastures and Meadows Sector

Adaptation measures for Pastures and Meadows			**Sectors**	**Priority level**
Institutional Adaptation	Strengthen the institutional framework	Strengthen the capacities of the newly established Forestry Agency and the Forestry Unit at Municipality level on developing including pastures and meadows in the regional development plans, including designating specific role and responsibilities in adapting against climate changes.	Forestry and Pastures	High
	Strengthen the policy framework: development and enhancement of laws, policies regulations and plans, including action plans	Development of strategies for sustainable pastoralism	Forestry and Pastures	Medium
		Design of climate change projections targeting alpines and highlands and the pasture vulnerability	Forestry and Pastures	Very High
	Improved Management of Pasture sector upon risk assessment and monitoring	Strengthen capacities of Forestry and pasture units in the Local Authority level on evaluation pasture resources, as preparedness for risk assessment	Forestry and pasture	High
		Support Universities and research institutes in developing research and studies on risk assessment for pastures	Education	Medium
Livelihood Adaptation	Strengthen the coordination and management framework within and between the Forestry and pasture sectors: at national and	Support smallholder livestock communities in rural and highland areas through based local investment programs, by scaling up and integrating climate change adaptation options	Forestry and Pastures	Medium
		Monitoring of biodiversity and species composition in pasture, including the exploitation and management of Invasive Alien Species (IAS)	Forestry and Pastures	Medium

	local levels			
Risk Reduction and Management for Resilience	Early warning measures	Improvements on predicting capacity on the status of bio-resources through improving the research on pasture biodiversity and productivity	Forestry and Pastures	High
	Preparedness and Response	Protect and preserve pasture and meadows through ecosystem-based management.	Forestry and Pastures	High

Table 25 Summary of planned adaptation measures and priority level for Lagoons and Wetlands sector

Adaptation measures for Lagoons and Wetlands			Sectors	Priority level
Institutional Adaptation	Strengthen the institutional framework	Institutional and organizational strengthening of central and local governmental structures (NAPA and RAPA) and local municipalities on developing the structures at regional and local level which are capable on identifying and addressing the stressors and develop Adaptive Management Plans.	Protected Areas	Very High
	Strengthen the policy framework: development and enhancement of laws, policies regulations and plans, including action plans	Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan, including lagoons and protected areas)	Protected Areas	Very High
		Proclaiming additional Marine Protected areas along the wetland and lagoon area will support integrated efforts into developing adaptation measures.	Protected Areas	High
		Development of risk management plans especially on Flood Prevention	Protected Areas	Medium
		Rehabilitation and restoration of degraded habitats, including barriers along the coastal zone	Protected Areas	High
		Maintain water communication with the sea through the natural communication channels	Protected Areas	Medium
		Support monitoring agencies in design and perform water quality in each wetland/lagoon to track impacts of climate change on abiotic factors (temperature and dissolved oxygen) to reduce risks through environmental quality monitoring methods and techniques	Environment	High
Livelihood Adaptation	Strengthen the coordination and management framework within and between different sectors	Supporting research communities in performing biodiversity monitoring programs in each wetland/lagoon, including bird population and Invasive Alien Species (IAS)	Protected Areas	High
		Development of ecotourist activities in the wetland/lagoon area such as birdwatching, hiking, etc	Protected Areas	High
		Control of water extraction in the aquifer	Agriculture	Medium
Risk Reduction and Management for Resilience	Early warning measures	Establishing the early warning system to prevent floods and fires with impact on sensitive areas/habitats	Protected Areas	Very High
	Preparedness and Response	Protect and preserve natural resources within lagoon and wetland areas through sustainable management and planning of all economic activities.	Protected Areas	Very High
		Training and qualification for local administration and communities living within	Protected	Very High

		Protected areas on climate change impacts.	areas	

Table 26 Summary of planned adaptation measures and priority level for Aquaculture and Fisheries

Adaptation measures for Aquaculture and Fisheries			Sectors	Priority level
Institutional Adaptation	Strengthen the institutional framework (e.g. coordination)	Institutional and organizational strengthening of central and local governmental structures (following a co-management approach) in providing interconnection between planning authorities and other inter-sectoral bodies that play a role in adapting against climate changes	Fishery	High
	Strengthen the policy framework: development and enhancement of laws, policies regulations and plans, including action plans	Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan, including lagoons and fishery sectors)	Fishery	High
		Development of fishery sectoral climate change adaptation plans integrated to the supporting sectors (water, energy and agriculture) and development of risk management plans[75]	Fishery	Very high
	Improved Management of Fishery sectors based upon risk assessment and monitoring (e.g. incorporating system feedbacks)	Addressing the specific needs of small scale coastal fishing and supporting the socio-economic role of sea fisheries in coastal and insular areas	Fisheries	High
		Restructuring and modernize the fishing fleet by improving work and safety, conditions, the quality and hygiene of products, energy efficiency and selectivity.	Fisheries	Very High
		Improving the marine fisheries employment age structure and promoting the diversification of activity and/or parallel employment, as alternative solution to impacted fishery related activities by the CC.	Fisheries	Very High
		Supporting populations dependent on the fisheries sector in coastal and isolated areas by providing them financial conditions for more sources of incomes.	Fisheries	High
Livelihood Adaptation	Strengthen the coordination and management framework within and between the fishery sectors: at national and local levels (e.g. municipalities)	Strengthening the sector by investing in development of new markets and expanding the range of offered products (as a collaboration with the processing industry and partners from other countries).	Fisheries	Very High
		Improving scientific capacities to predict/assess the future state of the fisheries sectors in the face of climate changes.	Fisheries	High
		Strengthening the resilience of natural resources by following an adaptive fisheries management approach (application of the Ecosystem Based Approach)	Fisheries	High
		Increasing the involvement of fishers in the tourism sector (like *pesca*-tourism)	Fisheries	Medium
		Exploitation and Management of Invasive Alien Species (IAS)	Fisheries	Medium
		Strengthening aquaculture capacities by following *ad-hoc* recommendation and measures regarding environmental parameters and diseases[76]	Aquaculture	Very High

[75] Development of fishery…and development of risk management plans were aggregated

[76] Strengthening aquaculture capacities by following the *ad–hoc* measures regarding the diseases and "Strengthening aquaculture capacities by following *ad-hoc* recommendation and measures regarding environmental parameters" were aggregated

		Improving aquaculture capacities by species diversifying, while oriented toward local and international markets	Aquaculture	High
		Strengthening aquaculture capacities by using adequate fingerlings (dimensions, age and density) in the on-growing facilities and improving aquaculture capacities by adapting qualitative and proper feed quantity to changed climate conditions[77]	Aquaculture	High
Risk Reduction and Management for Resilience	Early warning measures	Improvements on predicting capacity about the future status of bio-resources	Fisheries	High
		Study and record of the impact of climate change on current used techniques in aquaculture to develop new more efficient methods and techniques	Aquaculture	High
		Intensifying cooperation towards the direction of detection and prevention of new diseases, study of the physiology of marine species, conduct research into new and better able species to adapt and better nutritional systems that are both effective and environmentally friendly.	Aquaculture	Very High
	Risk pooling and transfer	Insurance aquaculture to avoid the risk of bankruptcy for fish farmers from damage to their facilities due to extreme weather events; incentives to insure and avoid long-term reductions in production and social problems of the abandonment of their profession	Aquaculture	Very High
	Risk Reduction	Reducing exposure to risks at sea, such as storms and winds, can include training and provision of safety gear or GPS devices (it mainly includes lakes and marine fisheries).	Fisheries	Medium
		Increased resilience of aquaculture to reduced flow of water, changes in water physicochemical parameters, and occurrence/spread of fish and mussel's diseases	Aquaculture	High
	Preparedness and Response	Protect and preserve fisheries resources via a gradual transition from a fisheries management policy based on the control of fishing effort to an Ecosystem-Based management.	Fisheries	Very High
		Strengthening research capacities in the field of selective breeding, aqua-feed and breeding in closed systems.	Aquaculture	High
		Apply aquaculture closed production systems and integrated aquaculture technologies	Aquaculture	Medium

[77] Improving aquaculture capacities by adapting qualitative and proper feed quantity to changed climate conditions and "Strengthening aquaculture capacities by using adequate fingerlings (dimensions, age and density) in the on-growing facilities" were aggregated

4. FAIRNESS, AMBITION AND CONTRIBUTION TOWARDS ACHIEVING THE OBJECTIVE OF THE CONVENTION

The revised NDC of Albania presents an ambition that contributes to achieving the objectives of the UNFCCC and the Paris Agreement, and to achieve regional and national strategies and plans.

At the **national level**, the NDC is aligned with Albania's long term national and sectoral development strategies, plans and goals. On mitigation, sectoral projections used for the NDC scenario are based on national strategies, including the National Strategy on Development Integration 2015-2020, the National Strategy on Climate Change, the National Action Plan on Mitigation, the National Energy Strategy, and other sectoral plans. On adaptation, the planned adaptation measures for settlements, populations and tourism are aligned with the National Strategy for Development and Integration 2015-2020, especially the pillar 4^{th} on Growth through the sustainable use of resources and territorial development. They are also in tune with the objectives of the National Adaptation Plan, as well as the ones of the Integrated Cross-Sectoral Plan for the Coast and the National Strategy for Sustainable Tourism Development 2019-2023, among others.

The revised NDC is also in harmony with Albania's post-earthquake/disaster and COVID-19 green recovery strategies and plans. The proposed adaptation measures, and especially the ones on the built environment and on disaster risk management, are aligned with and contribute to the guiding principles of the Albania post-disaster needs assessments, which specifically aims to achieve reconstruction and recovery in a manner that increases the resilience of infrastructures, ecosystems, the environment, and vulnerable communities to future disasters, including anthropogenic and climate shocks, and to promote adaptation to climate change by introducing specific measures into sectoral recovery and reconstruction programs. The revised NDC is also aligned and contributes to the UN Albania COVID-19 Socio-Economic Recovery and Response Plan, which complements the Government of Albania's National Response Plan and the National Strategic Preparedness and Response Plan (SPRP). The revised NDC supports the need to invest in a low-carbon and resilient economy, by promoting clean, green, sustainable and resilient investments, ensuring post COVID-19 green recovery.

The revised NDC is closely aligned with the Fourth National Communication being developed in parallel, as well as the Third National Communication of Albania to the UNFCCC.

At the **regional level**, the NDC is also aligned with EU's Green Deal, which aims to enhance the EU climate 2030 objective, taking into account all sectors (including FOLU), to decarbonise the energy sector, supporting innovation in transport and industry; through an action plan in order to boost the efficient use of resources by moving to a clean, circular economy. According to the EU Green Deal, a Just Transition Mechanism and Fund has been set up to help regions and sectors the most affected by the cost of transition, due to their reliance on fossil fuels such as coal.

The Green Agenda for the Western Balkans, included in the Communication on an Economic and Investment Plan for the Western Balkans adopted by the European Commission in 2020, has five pillars: (1) climate action, including decarbonisation, energy and mobility, (2) circular economy, addressing in particular waste, recycling, sustainable production and efficient use of resources, (3) biodiversity, aiming to protect and restore the natural wealth of the region, (4) fighting pollution of air, water and soil and (5) sustainable food systems and rural areas. The implementation of this Green Agenda requires substantial public and private funding, at national, regional and international level, and the EU considers supporting innovative financial instruments such as the Instrument for Pre-Accession (IPA). This revised NDC is aligned and directly contributes to the first pilar on climate action (both on mitigation and adaptation), as well as the 3rd one biodiversity (adaptation measures on adapting the supporting natural environment).

At the **global level**, as presented in point 6 of section 3, implementation of this revised NDC contributes to achievement of the Paris Agreement, reflecting Albania's own national circumstances. In this sense, Albania's contribution is both fair and ambitious. Albania's historical and current levels of GHG emissions are low, at the global level and in comparison to other European countries. Albania's national GHG emissions represented only 0.02% of global emissions in 2016. While the average level of emissions per inhabitant was 8.7 t CO_2e/hab in the EU-27 in 2018, the level of emission per capita in Albania was 3.5 t CO_2e/hab in 2016. Albania is a country with an economy in transition and expects human and economic developments in the next decades, which would increase the level of emissions, which, as noted, are historically low. The NDC considers a lower level of emissions increase in comparison to the expected business-as-usual scenario (-16.3% in 2030), considering more sectors and gases than in its first NDC. This constitutes a high ambition given the capacities of the country. The emissions reduction objective is not defined as a general target but is based on a bottom-up approach taking into account possible mitigation actions sector by sector, ensuring that the final target remains a realistic and reachable figure, considering the current of implementation of existing mitigation actions, which is sometimes limited. Albania will take into account the ultimate objective of the UNFCCC in its future development and commits to decouple GHG emissions from its economic growth and embark on a low emission development pathway beyond 2030.This NDC also includes adaptation measures, which is an enhancement of the first NDC, and will absorb significant resources.

In addition, the implementation of this NDC will directly contribute to achievement of the Sustainable Development Goal (SDG) 13: Climate action, and indirectly to SDG7: Affordable and Clean Energy (mitigation target), SDG3: Good health and well-being (adaptation health measures), and SDG 5: Gender equality (cross-cutting focus on the revised NDC, which is addressing gender differentiated vulnerabilities to climate change and gender gaps and structural barriers).

The implementation of the mitigation and adaptation measures included in this revised NDC will contribute to human rights in a broader sense, in line with Albania's national policies and regional and global commitments, including the 2030 Agenda and the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters, through participatory processes, including a strong engagement of youth.

By promoting the climate proofing of residential and productive infrastructure, touristic accommodation and assets and health (and other social) facilities, and the strengthening of disaster risk management, the revised NDC is aligned and directly contributes to the Sendai Framework for Disaster Risk Reduction 2015-2030 which outlines four priorities for action to prevent new and reduce existing disaster risks: (i) Understanding disaster risk; (ii) Strengthening disaster risk governance to manage disaster risk; (iii) Investing in disaster reduction for resilience and; (iv) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

5.MEANS OF IMPLEMENTATION

5.1. Institutional and legal aspects

Strengths: The Inter-Ministerial Working Group on Climate Change (IMWGCC), which coordinates all institutions involved in climate change processes, will facilitate the implementation of this NDC, and will promote some of the proposed adaptation measures, especially on strengthening the enabling environment. Furthermore, Albania's institutional arrangements already enable the preparation of national inventory and projections and comply with international reporting requirements. The existing coordination between the Ministry of Tourism and Environment, other ministries, UNDP, FAO-Albania, and other institutional actors, is a strength to improve the MRV framework in the country as well as the implementation of mitigation and adaptation actions. General and sectoral mitigation and adaptation strategies are well documented in specific legal and policy documents, such as the National Energy and Climate Plan. The National Climate Change Strategy included national mitigation and adaptation plans (NAP). The Government of Albania is currently developing an action plan for this NDC to provide direction and a timeline for implementing adaptation and mitigation actions.

Gaps: Precise objectives or means of implementation are sometimes lacking, and some of the policy and legal documents have not been fully approved. There is a lack of consistency among different areas of policy, which relies on a high number of external consultancy projects. There is a need to move from a project-based approach to a more mainstreamed process. There is a lack of public awareness to acknowledge relevance of climate change. Adopted policies and measures are not always applied.

The adaptation section of this NDC incorporates adaptation actions for the Albanian Coast encompassing all current policies and strategies targeting settlements, population and tourism. This structure provides an opportunity to adopt a systematic approach to implementing adaptation actions. The NAP focuses on mainstreaming adaptation into sectoral approaches. Doing this will contribute to strengthen the enabling environment when implemented.

5.2. Knowledge and capacity

Strengths: Some knowledge and capacities are available within the administration, universities and other Albanian institutions both on mitigation and adaptation. For example, technical capacities are available to develop the MRV for mitigation in all sectors.

Gaps: However, scientific, technical and societal capacities could be further developed, to generate scientific evidence to support decision making on the most strategic measures and their implementation. For instance, on mitigation, the country is lacking harmonized, complete and consistent datasets for various sectors, such as for Waste and FOLU. Existing datasets could be improved for a more precise monitoring. Furthermore, there is no mitigation action tracking system that would enable the monitoring of implementation of policies and measures and of their impact in terms of GHG emissions reduction. In terms of adaptation, technical capacity to plan for adaptation, both on policy and on technical aspects, needs to be further strengthened at all levels.

5.3. Technology transfer

Strengths: Albania already benefits from the creation of the *Units of Information, Technology and Communication* and the *Agency of Research, Technology and Innovation* (AKTI). In some sectors, there is no need for important technology transfer (Agriculture, FOLU). In the Waste sector, a technology transfer is already undergoing with the building of new incinerators.

Gaps: Albania would benefit from updating its Technology needs Assessment (TNA), assessing the technology needs for both mitigation and adaptation in the different economic sectors. Its latest version was published in 2005 and is a bit outdated. For the energy sector, there is a need to enhance technology transfer, for example for the oil and gas sector and on renewable energy. According to the EU Low Carbon Economy Roadmap, significant investments and technological transfers will be needed, in particular in new low-carbon technologies, renewable energy, energy efficiency, and grid infrastructure. Adapting the supporting built environment and climate proofing residential and productive infrastructure, touristic accommodation and assets and health (and other social) facilities will also require accessing new technologies.

5.4. Finance

Strengths: Albania has a robust financial strategy on mitigation and adaptation, including financial needs and potential sources of funding. Adaptation measures were prioritized in this revised NDC according to the relative magnitude of their costs, among others. Several measures that are very important for adaptation also have a low cost including several measures related to generating scientific evidence in support of decision-making and to capacity-building. These could be more easily incorporated in budgets and short-term plans. In the agriculture sector, most mitigation actions have a low cost and even can deliver additional revenues.

Gaps: Albania does not currently integrate climate change considerations and criteria, as well as relevant policies, in the guidance, procedures and methodologies used for selection and appraisal of public investment programs and projects. Such criteria need to include: (i) impacts of the project on climate change mitigation efforts, to determine if the project will lead to an increase or decrease of GHG emissions. Projects that have significant impact on GHG emissions should conduct GHG accounting and use the shadow price of carbon in their economic analysis and (ii) assessment of climate change risks and vulnerabilities relevant for the project, as well as if the project outcomes contribute to adaptation efforts and strengthening climate resilience. Public and private investments shall be secured and tracked so that they ensure effective implementation of the NDC in all sectors. In addition, Albania has limited experience in carbon pricing instruments to promote decarbonisation, including the EU Emissions Trading Scheme. With regards to adaptation, some essential measures involving among other climate-proofing infrastructure, or disaster risk management are not highlighted as having a “very high priority” mainly due to their high technical complexity and costs.

6. CLARITY, TRANSPARENCY AND UNDERSTANING

Element of transparency	Albania updated NDC
1.Quantifiable information on the reference point (including, as appropriate, a base year):	
Reference year(s), base year(s), reference period(s) or other starting point(s)	Albania is committed to reduce its GHG emissions from its projected BAU baseline by the year 2030. Therefore, the target is expressed as a mitigation effort of -20.9% total GHG emissions reduction in 2030 compared to business-as-usual scenario for this year. Starting point of projections calculation is 2016: emissions are calculated from 2016 to 2030. NDC's implementation timeframe spans from 2021 to 2030.
Quantifiable information on the reference indicators, their values in the reference year(s), base year(s), reference period(s) or other starting point(s), and, as applicable, in the target year	Business-as-usual emissions in 2030 are calculated through a projection of emission based on the continuation on recent trends, current implemented policies, and take into account macroeconomics indicators evolution such as GDP and population. Total emissions (including FOLU) for the BAU scenario increase by +49.4% between 2016 and 2030. Details of emissions for the reference year and the starting point are given in the NDC main text.
For strategies, plans and actions referred to in Article 4, paragraph 6, of the Paris Agreement, or polices and measures as components of nationally determined contributions where paragraph 1(b) above is not applicable, Parties to provide other relevant information	Not applicable.
Target relative to the reference indicator, expressed numerically, for example in percentage or amount of reduction	The difference, in 2030, with the BAU scenario, is -3,170 kt CO_2e below BAU in 2030, which represents a **mitigation impact of -20.9%.**
Information on sources of data used in quantifying the reference point(s)	National inventory GHG emissions from the 1st BUR draft and the 4th National Communication were used to estimate the starting point (2016) and to projected emissions up to 2030.
Information on the circumstances under which the Party may update the values of the reference indicators	National inventory emissions may be updated in two years, for the compilation of the 2nd BUR to reflect more accurate data.
2. Time frames and/or periods for implementation	
Time frame and/or period for implementation, including start and end date, consistent with any further relevant decision adopted by the CMA	NDC's implementation timeframe spans from 2021 to 2030. Additional mitigation actions (actions that are not already in place even if sometimes they were already planned, but not effectively enforced) are considered in the calculation for this period. However, mitigation actions from existing policy and strategy have already begun and some are taken into account between the starting date (2016) and the current year (2021), considering their level of enforcement, explaining some differences between the BAU and NDC scenarios for this period.
Whether it is a single-year or multi-year target, as applicable.	A single year target, 2030, is considered.
Scope and coverage	
General description of the target	Albania aims to reduce emissions relative to business-as-usual by 2030, with the implementation of mitigation actions in the main emitting

	sectors of the economy: Energy, IPPU, Agriculture, Waste and Forest and Other Land Use (FOLU). The inclusion of IPPU, Agriculture, Waste and FOLU are an enhancement since the INDC only covered Energy.	
Sectors, gases, categories and pools covered by the nationally determined contribution, including, as applicable, consistent with IPCC guidelines	Sectors and categories	The NDC covers all IPCC sectors Sectors covered by NDC are: - Energy (excluding international transport) - Industrial processes and product use (excluding F-gases) - Agriculture - Forest and Other Land Use (FOLU) - Waste Mitigation actions are considered for all sectors (for the IPPU sector, impacts of the Kigali Amendment are considered in the BAU).
	Gases	Carbone dioxide (CO_2) Methane (CH_4) Nitrous oxide (N_2O) HFCs PFCs, SF_6 and NF_3 are not covered as they are considered negligible. The inclusion of perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) will be added to the NDC coverage once included in Albania's GHG inventory.
	Geographical	Entire national territory
How the Party has taken into consideration paragraphs 31(c) and (d) of decision 1/CP.21	Albania revised NDC takes into consideration all main emitting sectors as well as removals. For IPPU, the ratification of the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, is considered in the BAU and NDC scenarios.	
Mitigation co-benefits resulting from Parties' adaptation actions and/or economic diversification plans, including description of specific projects, measures and initiatives of Parties' adaptation actions and/or economic diversification plans.	Mitigation co-benefits are expected to result from the implementation of adaptation actions: - Strengthen the policy framework: development and enactment of laws, policies, regulations and plans, including action plans, and mainstreaming as well as Enhancing technical capacity are crucial for the implementation of mitigation actions. - Adaptations actions targeting the protection of environment to preserve the water resources, such as the protection of forest in the upper areas of watersheds, are consistent with the implementation of actions to enhance forest management and reduce the fuelwood exploitation increasing the sinks in the FOLU sector. - Adaptations actions targeting the diversification of energy sources and the promotion of energy efficiency are consistent with the mitigation actions defined for the Energy sector. - Climate proofing transport infrastructure could also increase the reduction of emissions from the fossil fuel combustion within the Energy sector. - Adaptation actions targeting the adoption of integrated, ecosystem-based approaches (EbA) and/or nature based solutions (NbS), such as the protection and restoration of existing forest/vegetation or green approaches to the built environment are consistent with the implementation of FOLU mitigation actions and can help reach additional carbon uptakes in soil and biomass. - Adaptation actions targeting the promotion of climate-smart and sustainable agriculture, forestry and fisheries can result in mitigation co-benefits, in line with the objectives defined for croplands and grassland within the FOLU sector.	

	- Adaptation actions targeting the climate proofing coastal buildings and facilities are beneficial to the mitigation actions set up for the residential and commercial buildings subsector within the Energy sector. - Adaptation actions in the hydropower infrastructure allow to further exploit renewable energy and decrease emissions from the energy industries.	
4. Planning process		
Information on the planning processes that the Party undertook to prepare its NDC and, if available, on the Party's implementation plans, including, as appropriate:		
i. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a gender-responsive manner;	To enhance its 1st NDC, Albania has set up an institutional arrangement that implies experts from different institutions, such as the Ministry of Environment and Tourism and UNDP Albania. The development of the revised NDC has been highly participatory.	
ii. Contextual matters, including, inter alia, as appropriate:	National circumstances, such as geography, climate, economy, sustainable development, and poverty eradication	The Republic of Albania is a Balkan country in Southeast Europe, mostly mountainous. Albania has a subtropical Mediterranean climate, with some continental influence. In 2019, Albania had an estimated population of 2.88 million. Recent demographic developments show that Albania's population is shrinking and heading towards aging. Albania is fairly densely populated. In 2018, the average population density was 99.7 inhabitants per km^2. Albania has experienced a strong urbanization process. After 50 years of communist rule, Albania has transformed from one of the poorest countries in Europe in the early 1990s to an upper-middle-income country in 2020. Economic growth has been associated with structural economic changes. In 2019, the service sector constituted about 50% of the GDP of the country. Industry and construction made up about 20% of the GDP and the agriculture sector contributed about 19% of the GDP. The socio-economic progress of Albania has been recently hampered by two shocks: the country was hit by a devastating earthquake in November 2019; and the COVID-19 crisis. The earthquake and the pandemic are expected to significantly increase poverty. A detailed presentation of the national circumstances is provided in the main text of the NDC.
	Best practices and experience related to the preparation of the NDC	To prepare the update of the NDC, the objective was to maintain consistency between existing inventory and reporting processes. The preparation of the NDC was a

		work implying national experts for the mitigation and adaptation sections.
	Other contextual aspirations and priorities acknowledged when joining the Paris Agreement	Not applicable
Specific information applicable to Parties, including regional economic integration organizations and their member States, that have reached an agreement to act jointly under Article 4, paragraph 2, of the Paris Agreement, including the Parties that agreed to act jointly and the terms of the agreement, in accordance with Article 4, paragraphs 16–18, of the Paris Agreement;	The updated NDC target for 2030 will be fulfilled by Albania and is not part of regional joint agreement.	
How the Party's preparation of its NDC has been informed by the outcomes of the global stocktake, in accordance with Article 4, paragraph 9, of the Paris Agreement	Albania will consider the results of the Global Stocktake to be issued by the UNFCCC in 2023[78].	
Each Party with an NDC under Article 4 of the Paris Agreement that consists of adaptation action and/or economic diversification plans resulting in mitigation co-benefits consistent with Article 4, paragraph 7, of the Paris Agreement to submit information on:	How the economic and social consequences of response measures have been considered in developing the NDC;	This revised NDC is an enhancement of the first NDC in that it includes adaptation measures, focusing on the Albanian coast and AFOLU. Section 4 presents climate variability and change in the country, analyses climate risks, impacts and vulnerability for three priority sectors, discusses gender distribution, gaps and structural barriers regarding climate risks, impacts and vulnerability, and categorizes and prioritizes adaptive measures. Development and mitigation co-benefits and ease of implementation was considered to prioritize adaptation measures.
	Specific projects, measures and activities to be implemented to contribute to mitigation co-benefits, including information on adaptation plans that also yield mitigation co-benefits, which may cover, but are not limited to, key sectors, such as energy, resources, water resources, coastal resources, human settlements and urban planning, agriculture and forestry; and economic diversification actions, which may cover, but are not	See the list of expected mitigation outcomes resulting from adaptation actions in section 3 of this table.

[78] According to Article 14.2 of the Paris Agreement, the Conference serving as the Meeting of the Parties to the Agreement (CMA) shall undertake its first global stocktake in 2023 and every 5 years thereafter unless otherwise decided by the CMA. It is expected that the reduction commitments of the updated NDC of Albania will be considered in the Global Stocktake Report to be published in 2023 by the UNFCCC and its outcomes will be considered for the 2025 NDC.

	limited to, sectors such as manufacturing and industry, energy and mining, transport and communication, construction, tourism, real estate, agriculture and fisheries	
5. Assumptions and methodological approaches, including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals		
Assumptions and methodological approaches used for accounting for anthropogenic greenhouse gas emissions and removals corresponding to the Party's nationally determined contribution, consistent with decision 1/CP.21, paragraph 31, and accounting guidance adopted by the CMA	Methods applied are presented in the main text of the NDC.	
Assumptions and methodological approaches used for accounting for the implementation of policies and measures or strategies in the nationally determined contribution	The NDC takes into account current and draft policies and measures that have been used to define the list of mitigation actions for each sector. Assumptions about the level of implementation of these policies and measures were prepared in discussion with national experts, considering the national circumstances and the current level of implementation of existing objectives.	
If applicable, information on how the Party will take into account existing methods and guidance under the Convention to account for anthropogenic emissions and removals, in accordance with Article 4, paragraph 14, of the Paris Agreement, as appropriate;	The NDC takes into account the existing methods and guidance under the Convention, and considers its key principles of transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting.	
IPCC methodologies and metrics used for estimating anthropogenic greenhouse gas emissions and removal.	Methodologies from IPCC 2006 Guidelines are applied to estimate historical and projected emissions. The NDC is consistent with the latest national GHG inventory compiled. Global Warming Potential Values from IPCC Second Assessment Report are applied.	
Sector-, category- or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance, as appropriate, including, as applicable	i. Approach to addressing emissions and subsequent removals from natural disturbances on managed lands;	Natural disturbances are accounted for in the inventory and in the calculation of projections for the NDC. Forest wildfires are the only disturbances considered and are not excluded from the total of emissions in the FOLU. A background level (excluding exceptional episodes) of emissions is used for the projections, as exceptional episodes cannot be predicted.
	ii. Approach used to account for emissions and removals from harvested wood products;	HWP are not yet accounted in the national inventory, immediate oxidation assumption is applied. The same is done in the NDC to be consistent. Next inventories will consider whether HWP calculation could be improved.
	iii. Approach used to address the effects of age-class structure in forests;	No specific modelling of forest biomass has been applied. Projection is based on the parameters (increment rate, losses) used in the inventory.
Other assumptions and methodological approaches used for	i. How the reference indicators, baseline(s) and/or reference	The BAU scenario is based on the most likely evolution of the

understanding the nationally determined contribution and, if applicable, estimating corresponding emissions and removals, including	level(s), including, where applicable, sector-, category- or activity specific reference levels, are constructed, including, for example, key parameters, assumptions, definitions, methodologies, data sources and models used;	Albanian energy sector according to the baseline scenario of the National Energy Strategy approved by the Albanian Government on August 8, 2021 and with no further policy interventions. It was developed accordingly to the National Energy Strategy considering new set of macro-economic drivers such as GDP and population. LEAP was the energy model used for energy demand forecast until 2030.
	ii. For Parties with nationally determined contributions that contain non-greenhouse-gas components, information on assumptions and methodological approaches used in relation to those components, as applicable;	Not applicable
	iii. For climate forcers included in nationally determined contributions not covered by IPCC guidelines, information on how the climate forcers are estimated;	Not applicable
	iv. Further technical information, as necessary;	Not applicable
The intention to use voluntary cooperation under Article 6 of the Paris Agreement, if applicable	The accounting rules for international carbon markets under Article 6 of the Paris Agreement have not been set up yet. Albania intends to sell carbon credits during the period until 2030 to contribute to cost-effective implementation of the low emission development pathway and its sustainable development. Albania foresees that the utilization of international market mechanism is conditional on having effective accounting rules developed under the UNFCCC to ensure the environmental integrity of the mechanisms.	
6. How the Party considers that its NDC is fair and ambitious in light of its national circumstances		
How the Party considers that its NDC is fair and ambitious, in the light of its national circumstances,	Albania will take into account the ultimate objective of the UNFCCC in its future development and commits to decouple GHG emissions from its economic growth and embark on a low emission development pathway beyond 2030. Albania considers its update of the INDC ambitious because it covers more sectors and gases, and it increases the reduction target compared to BAU to be achieved in 2030. To ensure the implementation of this higher mitigation ambition, substantial investments will be required. The updated NDC target thus represent progression beyond the current NDC. Adaptation has also been considered in the updated NDC. The country's emissions per capita will remain substantially lower than the European average (3.5 Mg CO_2 eq. per capita in Albania, compared to 8.4 Mg CO_2 eq. per capita in the EU-27).	
Fairness considerations, including reflecting on equity;		
How the Party has addressed Article 4, paragraph 3, of the Paris Agreement;	Albania's updated NDC represents an enhancement of the first NDC, as the scope includes more sectors and gases, and the mitigation target in 2030 is more ambitious (from 11.5% to 20.9%).	
How the Party has addressed Article 4, paragraph 4, of the Paris Agreement;	The updated NDC includes all sectors except PFCs, SF_6 and NF_3 from IPPU, while the first NDC included only Energy sector, showing the intent to have a mitigation target covering all sectors.	
How the Party has addressed Article 4, paragraph 6, of the Paris	Not applicable	

Agreement.	
7. How the NDC contributes towards achieving the objectives of the Convention as set out in its Article 2	
How the NDC contributes towards achieving the objective stated in UNFCCC Article 2, which has been later clarified as the objective of limiting global warming at +2°C and if possible +1.5°C through the climate neutrality during the 21st century	The revised NDC of Albania contributes to the global mitigation effort considering its national circumstances. The mitigation actions are defined for all sectors and therefore tackle all sectors of the economy. The inclusion of the FOLU sector allows an increase in the absorptions by the sinks of this sector, which could contribute to the global climate neutrality during the second half of the 21st century.
How the NDC contributes towards Article 2, paragraph 1(a), and Article 4, paragraph 1, of the Paris Agreement	Albania is a developing country, highly vulnerable to the effects of the climate change. National GHG emissions represent only 0.02% of global emissions in 2016. Considering the national circumstances for the economic development of the country, the NDC mitigation actions reduce the increase of emission from 2016 to 2030. A peak of emissions is not projected during the timeframe of the current NDC.

7.ANNEXES

Annex 1. Mitigation calculations (details for sectors)

7.1. Energy

The BAU scenario is based on the most likely evolution of the Albanian energy sector with no further policy interventions. It was developed according to the National Energy Strategy considering new set of macro-economic drivers such as GDP and population. The base year was calibrated to the official 2016 national GHG inventory. The current structure of energy supply and demand in all economic sectors remains similar to the base year. A continued prevalent use of electrical energy for heating and warm water in residential and the service sector. A significant portion of future demand for electricity is met through new power hydropower plants but also new thermal general based on imported natural gas. It is expected that Albania will become a net exporter of electricity from 2025 onwards. National energy intensity decreases only slightly in the BAU scenario from 2016 to 2030.

The NDC scenario is based on the National Energy Strategy and also takes into account the Gas Master Plan of Albania, considering the introduction of natural gas in almost all sectors (including energy industry, manufacturing industry, transport, commercial, residential and agriculture). This scenario considers the implementation of the different National Energy Efficiencies Actions Plans (NEEAP) to increase energy efficiencies in both supply and demand reaching a 15% gain in 2030. The 15% in final demand is split among sectors as presented in the table below.

Table 27. Distribution of energy efficiency gains between Energy subsectors

Sector	%
Residential	22
Services	19
Industry	25
Transport	31
Agriculture	3
Total Saving Potential	100

It also takes into account the National Renewable Energy Action Plan (NREAP) with objectives of a share of 38% of renewables in the final energy consumption in 2020 and 42% in 2030.

7.1.1. Electricity Production

The BAU scenario is based on the following production mix evolution. It is expected that natural gas will enter the market in 2023 and then increase in 2026 with the entry into force of new CCGT (combined cycle gas turbine) installations.

Table 28. Production mix evolution – BAU scenario

Units: MW Branches	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Other CCGT													150	150	150	300	300
Vlora										93	93	93	93	93	93	93	93
Bistrica2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
MSW								5	5	5	5	10	10	10	15	15	15
Wind											50	50	75	100	120	140	150
Bistrica1	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Shkopet	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Ulez	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Fierza	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Komani	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Vaudejes	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
Ashta	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Kalivaci												80	80	80	80	80	80
Devolli Cascade				75	75	75	75	75	75	235	235	235	235	235	235	235	235
Skavica Cascade												230	230	230	230	230	230
Vjosa Cascade																	
New SHP	196	206	217	228	240	253	266	279	293	308	323	339	356	374	393	413	433
Solar PV	1	1	1	7	11	11	15	15	50	150	160	300	320	350	360	380	400
Imports/Export Net Transfer Capcity	660	660	660	660	660	660	660	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100
Biomass {unspecified}										5	6	6	8	8	10	10	10
Total	**2 340**	**2 350**	**2 361**	**2 453**	**2 469**	**2 482**	**2 499**	**2 957**	**3 006**	**3 379**	**3 455**	**3 926**	**4 140**	**4 213**	**4 269**	**4 479**	**4 529**

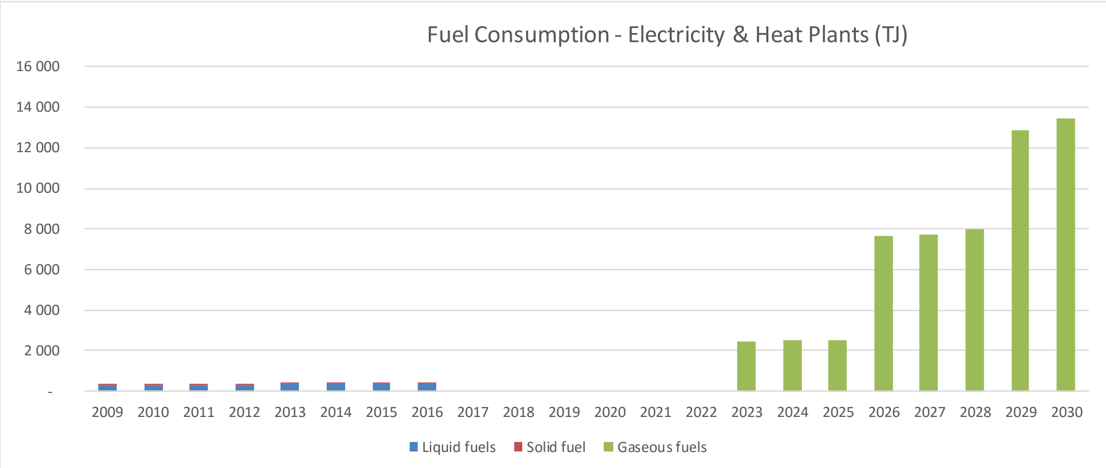
In the NDC scenario, new CCGT (300 MW) are replaced by additional renewable energy sources (+50 MW of solar PV and +50 MW of wind):

Table 29. Production mix evolution – NDC scenario

Units: MW Branches	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Other CCGT																	
Vlora										93	93	93	93	93	93	93	93
Bistrica2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
MSW								5	5	5	5	10	10	10	15	15	15
Wind											50	50	75	100	120	140	200
Bistrica1	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Shkopet	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Ulez	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Fierza	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Komani	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Vaudejes	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
Ashta	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Kalivaci												80	80	80	80	80	80
Devolli Cascade				75	75	75	75	75	75	235	235	235	235	235	235	235	235
Skavica Cascade												230	230	230	230	230	230
Vjosa Cascade																	
New SHP	196	206	217	228	240	253	266	279	293	308	323	339	356	374	393	413	433
Solar PV	1	1	1	7	11	11	15	15	50	150	160	300	320	350	360	380	450
Imports/Export Net Trai	660	660	660	660	660	660	660	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100
Biomass {unspecified}										5	6	6	8	8	10	10	10
Total	**2 340**	**2 350**	**2 361**	**2 453**	**2 469**	**2 482**	**2 499**	**2 957**	**3 006**	**3 379**	**3 455**	**3 926**	**3 990**	**4 063**	**4 119**	**4 179**	**4 329**

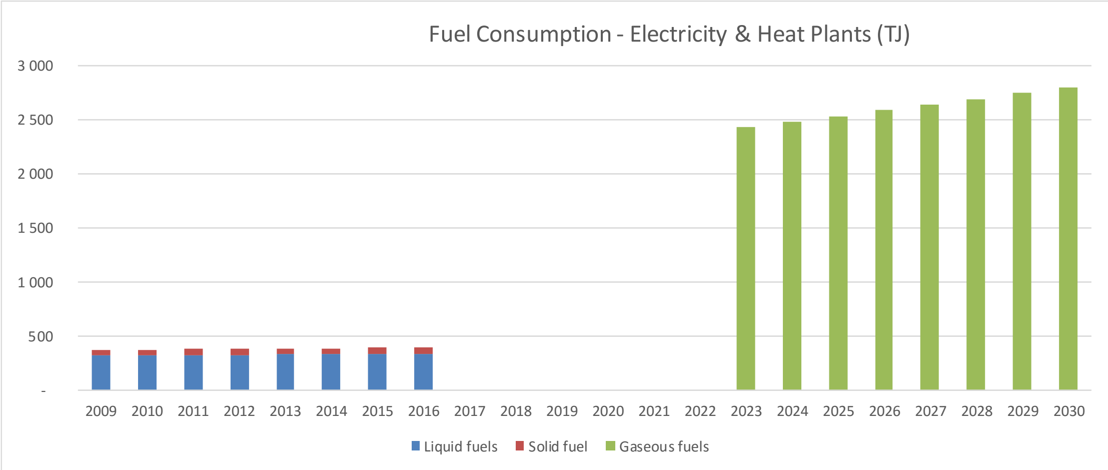
The impact in terms of Natural gas consumptions according to both scenarios is presented on the figures below.

Figure 27. Fuel consumption – electricity and heat plants (BAU)



Natural gas consumption is reduced by 79% between the BAU and the NDC scenarios because of the reduction of electricity production from thermal power generation due to the increase in renewable electricity production and the reduction of distribution losses and final consumption thanks to energy efficiency actions.

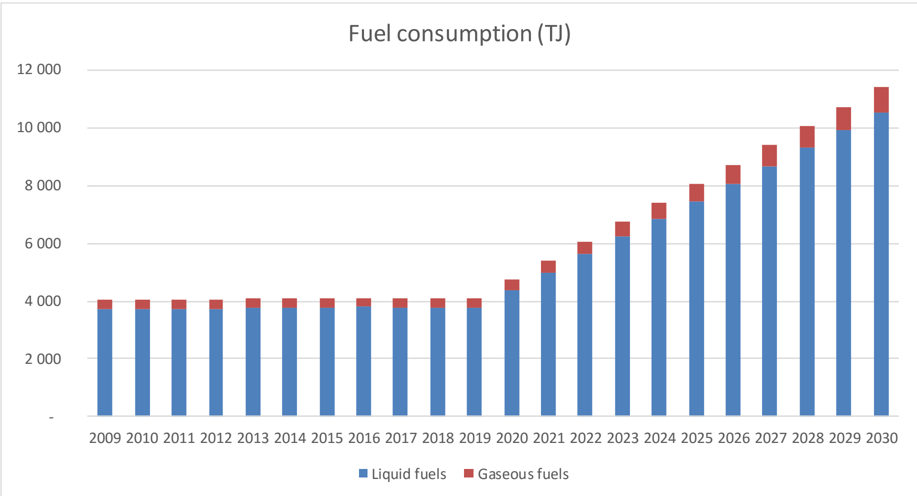
Figure 28. Fuel consumption – electricity and heat plants (NDC)



7.1.2. Refining

It is expected that the crude oil amount refined will increase from 300 kt in 2016 to 900 kt in 2030 according to national full capacities. Emissions increase proportionally. BAU and NDC have similar trends.

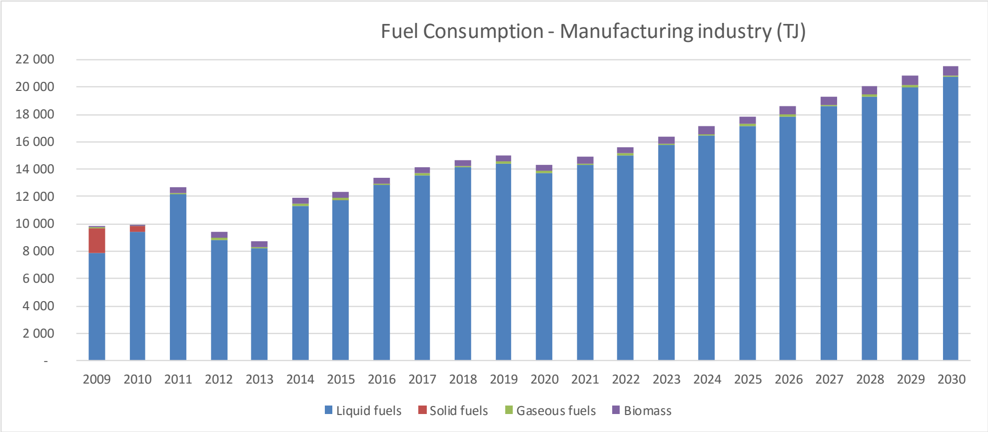
Figure 29. Fuel consumption – petroleum refining (BAU; NDC)



7.1.3. Manufacturing industry

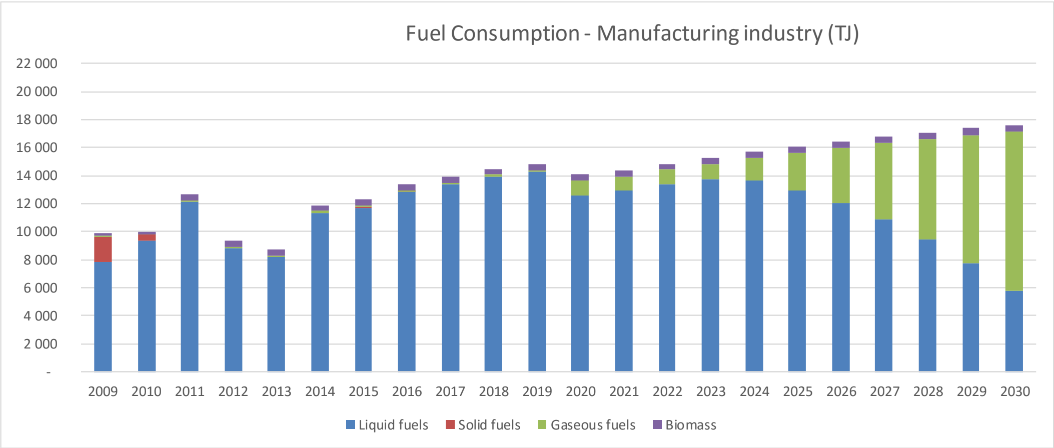
In the BAU, activity trend evolves proportionally to the GDP forecast. The energy mix remains the same on the entire time series, mainly relying on petroleum products.

Figure 30. Fuel consumption – manufacturing industry (BAU)



The NDC scenario takes into account the EE target in 2030. Total energy consumption (excluding electricity) is reduced by 18% in 2030 between the BAU and the NDC scenarios. Liquid fuels are reduced by 75% between the two scenarios as natural gas consumption is increasing.

Figure 31. Fuel consumption – manufacturing industry (NDC)



7.1.4. Aviation

Modelisation is based on LEAP assumptions: differences between the two scenarios are marginal.

According to the report “Feasibility Study for an airport in the South of Albania” Republic of Albania - Civil Aviation Authority (2019), a correlation factor of 2 can be applied to the GDP growth.

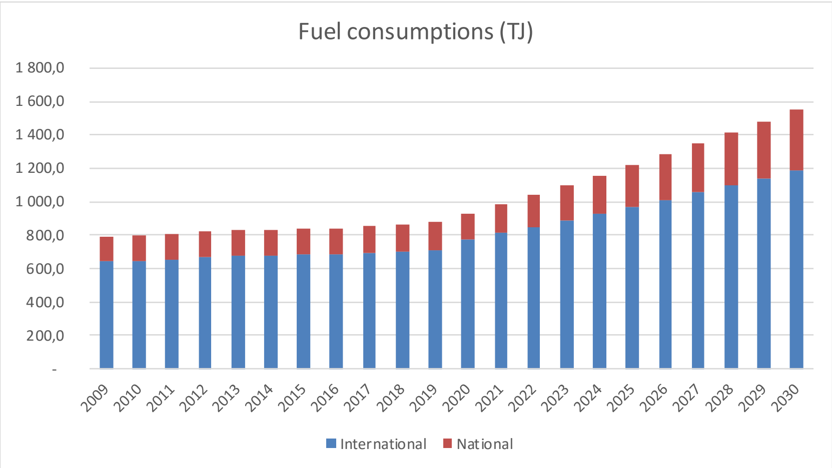
Table 30. Forecast of Correlation coefficients and GDP growth for aviation

Table 10 : Forecast of Correlation Coefficients and GDP Growth

Indicators	Years		
	2019-2028	2028-2038	2038-2048
GDP growth	4%	3.5%	3.0%
Correlation coefficient	2	2	1.8
Passenger growth	7.9%	7.0%	5.4%

This leads to a doubling of national consumption between 2016 and 2030 which is consistent with the coming opening of airports in the country.

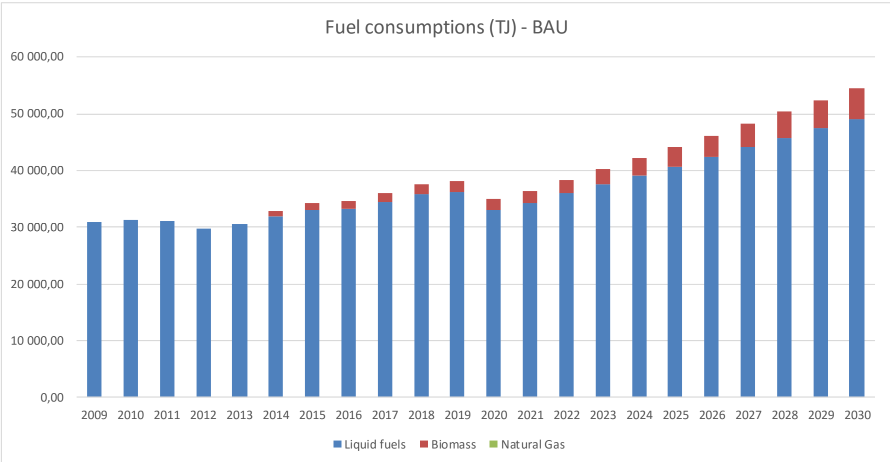
Figure 32. Fuel consumption – domestic and international aviation (BAU; NDC)



7.1.5. Road transport

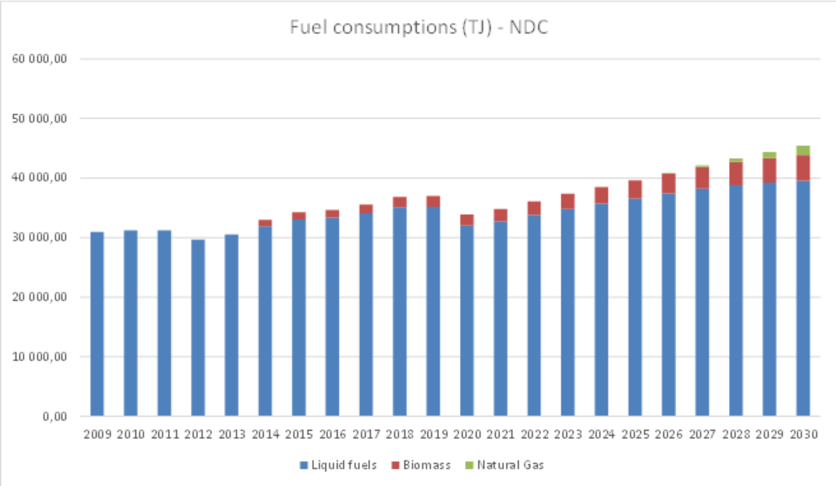
Modelisation is based on LEAP assumptions distinguishing passenger and freight transport. The biofuel share is between 3 to 4% of the blend in the recent years and increases up to 10% in 2030 as officially endorsed.

Figure 33. Fuel consumption – road transport (BAU)



NDC modelisation based on LEAP assumptions takes int account EE improvement. Natural gas is expected to enter the market from 2026 onwards. These assumptions were complemented by increasing penetration of electrical vehicles and bicycle ride lengths reducing overall passenger vehicles fuel consumptions by 14.5%. Total fuel consumption (excluding electricity) decreases by 16.6% between the BAU and NDC scenarios in 2030.

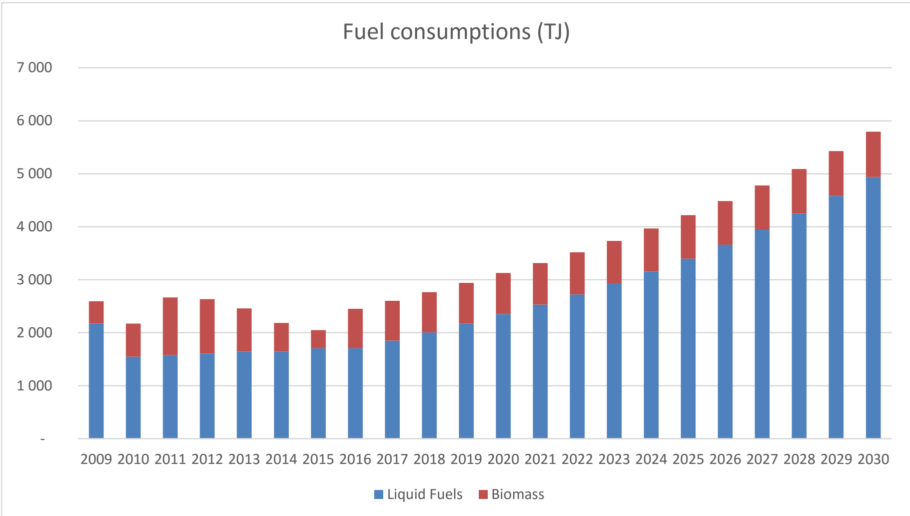
Figure 34. Fuel consumption – road transport (NDC)



7.1.6. Activity data – Commercial

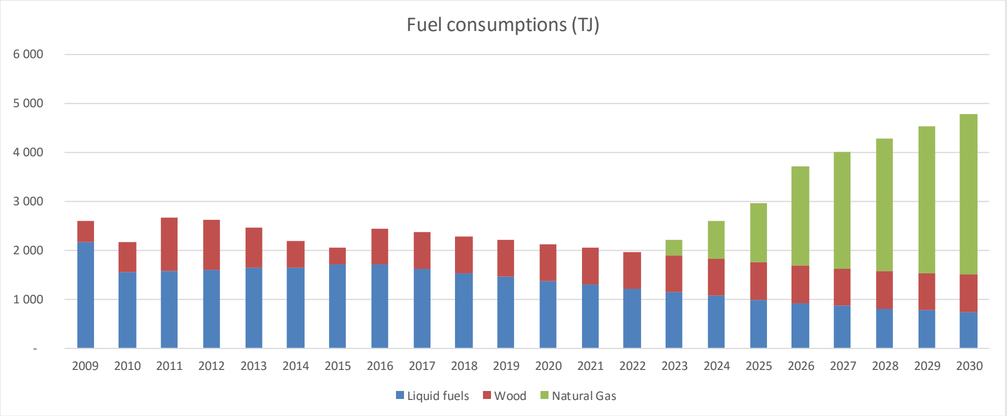
Modelisation is based on LEAP assumptions. The consumption is expected to increase by 136% between 2016 and 2030 due to the increase of heated surfaces (m²). This increase is driven by LPG (Liquefied petroleum gas) consumption as the wood consumption increase is expected to be limited to 15% maximum on the same period.

Figure 35. Fuel consumption – commercial (BAU)



In the NDC scenario, the consumption is expected to decrease by 17.3% in 2030 compared to the BAU scenario. Natural gas will enter the market from 2023 onwards to reach almost 70% of the total fuel consumption (excluding electricity) in 2030.

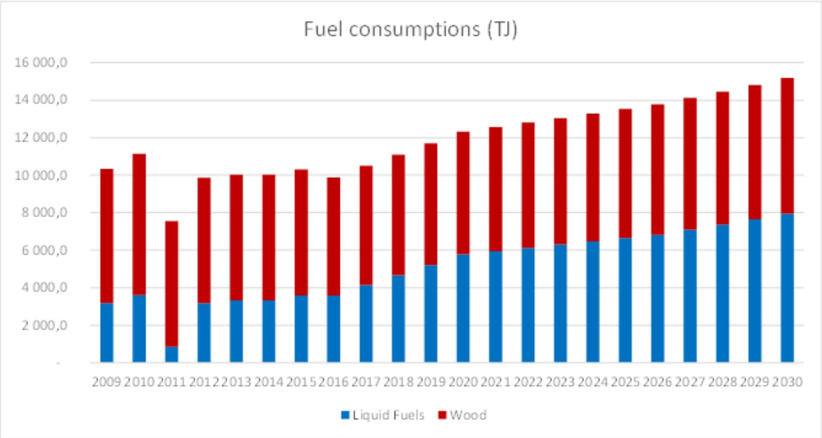
Figure 36. Fuel consumption – commercial (NDC)



7.1.7. Activity data – Residential

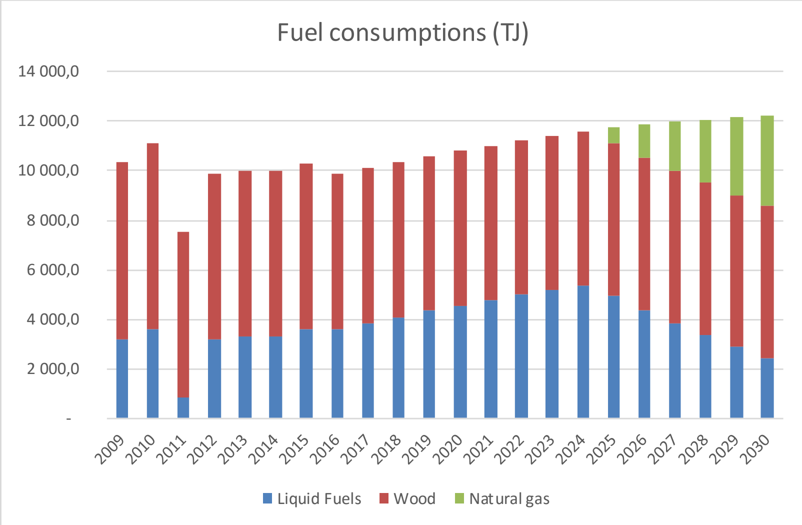
Modelisation is based on LEAP assumptions considering hot water, cooking, lighting, appliances, & air conditioning cooling. Energy consumption growth is based on the number of household growth (considering population and household size). The consumption is expected to increase by 54% between 2016 and 2030 due to the increase of heated surfaces (m²). This increase is driven by LPG consumption as the wood consumption increase is expected to be limited to 15% maximum on the same period (the share of wood drops from 64%in 2016 to 48% in 2030).

Figure 37. Fuel consumption – residential (BAU)



The total fuel consumption (excluding electricity) in 2030 is expected to be reduced by 19.3% between the BAU and NDC scenarios. The mix will evolve as biomass and liquid fuels consumptions will be reduced and compensated by natural gas from 2023 onwards which will reach 30% of total fuel consumption in 2030.

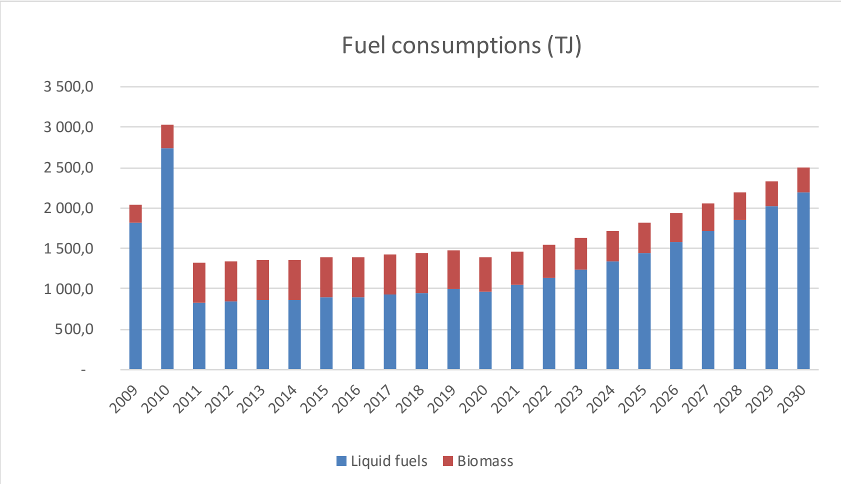
Figure 38. Fuel consumption – residential (NDC)



7.1.8. Activity data – Agriculture

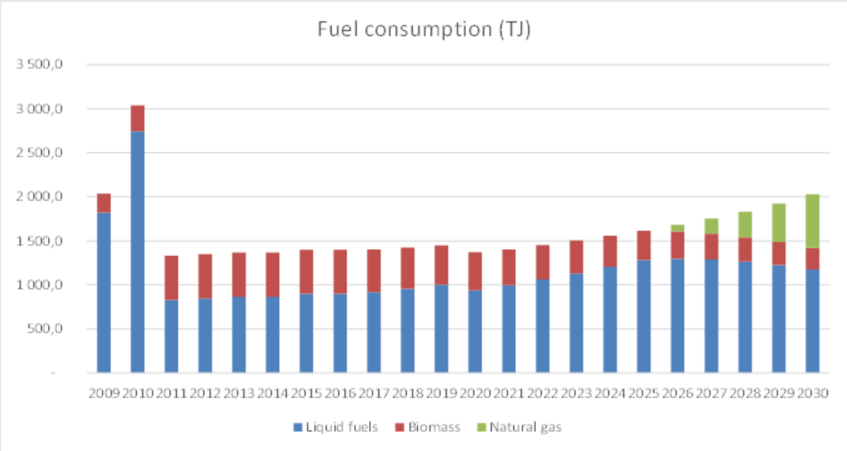
Modelisation is based on LEAP. Energy consumption growth is based on GDP forecast, final energy intensity and energy mix variations. The consumption is expected to increase by 78% between 2016 and 2030, liquid fuels increasing from 64% to 88% in the mix.

Figure 39. Fuel consumption – agriculture (BAU)



Energy consumption is expected to decrease by 19% in 2030 between the NDC and BAUs scenarios, Natural gas being introduced in 2026 to reach 30% of total fuel consumption in 2030.

Figure 40. Fuel consumption – agriculture (NDC)



7.2. IPPU

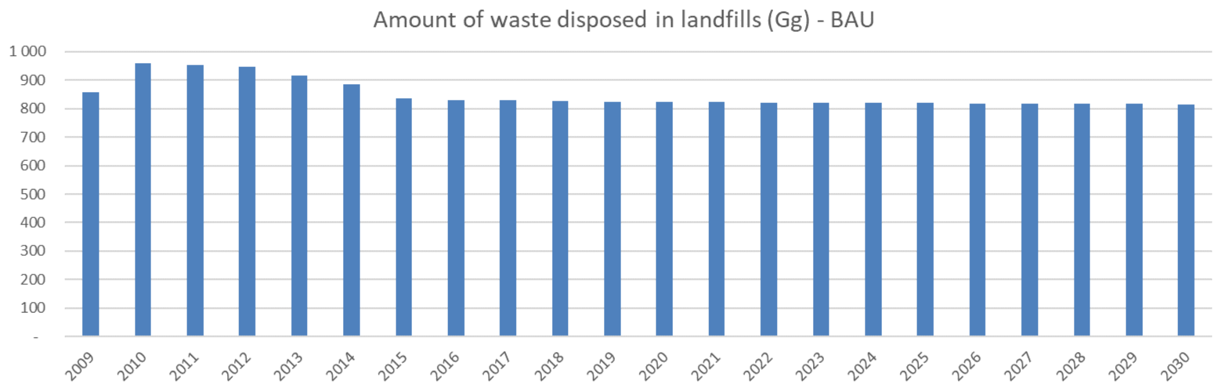
The BAU scenario is based on the GDP trend for all sub-sectors of the manufacturing industry. For F-gases, emissions are based on a model considering imports, bank, equipment market, refrigerant market share, equipment production, average characteristics of equipment, etc. The impact of the Kigali amendment ratification is considered in the BAU.

In the NDC scenario, no improvements are expected concerning emissions from industrial processes - the scenario is the same as the BAU (this does not include energy consumption which is covered under the energy sector).

7.3. Waste

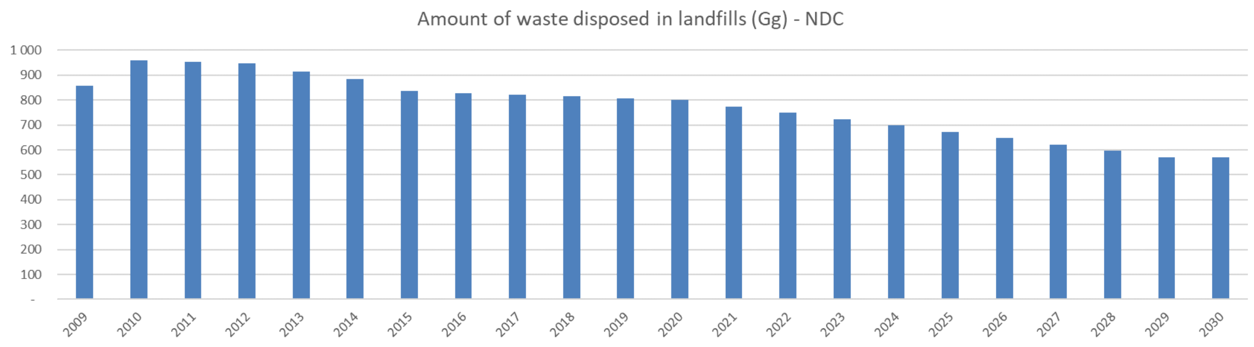
For the **landfilling** subsector, in the BAU scenario, it is assumed that no methane capture system is installed until 2030 and that the amount of waste produced per year and per capita remains stable.

Figure 41. amount of waste disposed in landfills - BAU



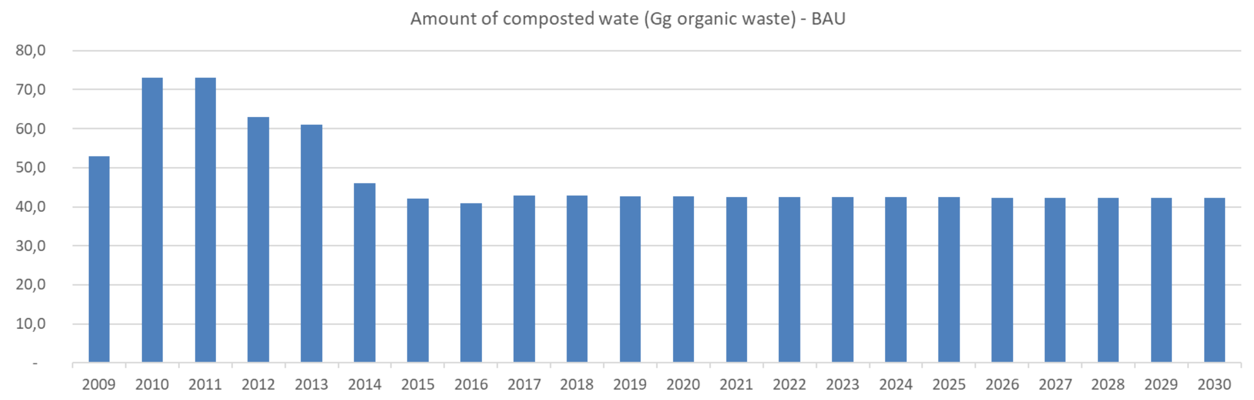
In the NDC scenario, it is assumed that methane capture systems are installed between 2020 et 2030 and it is considered a decrease of the amount of biodegradable waste going on landfills.

Figure 42. amount of waste disposed in landfills - NDC



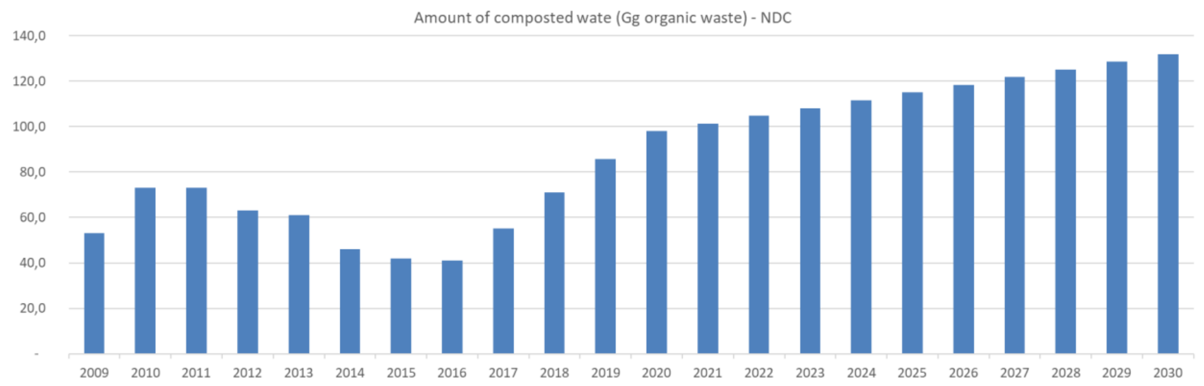
For the **composting** subsector, in the BAU scenario, the amount of composted waste per inhabitant per year between 2017 and 2030 is considered equal to the average of the last three (03) years from the inventory. This average is applied to the evolution of the national population from 2017 to 2030.

Figure 43. amount of composted waste - BAU



In the NDC scenario, according to the waste national management plan, it is assumed that the amount of composted waste will increase.

Figure 44. amount of composted waste - NDC



For the incineration subsector, in the BAU scenario, the amount of incinerated waste per inhabitant per year between 2017 and 2030 is considered equal to the average of the last three

(03) years from the inventory. This average is applied to the evolution of the national population from 2017 to 2030.

Figure 45. amount of waste incinerated - BAU

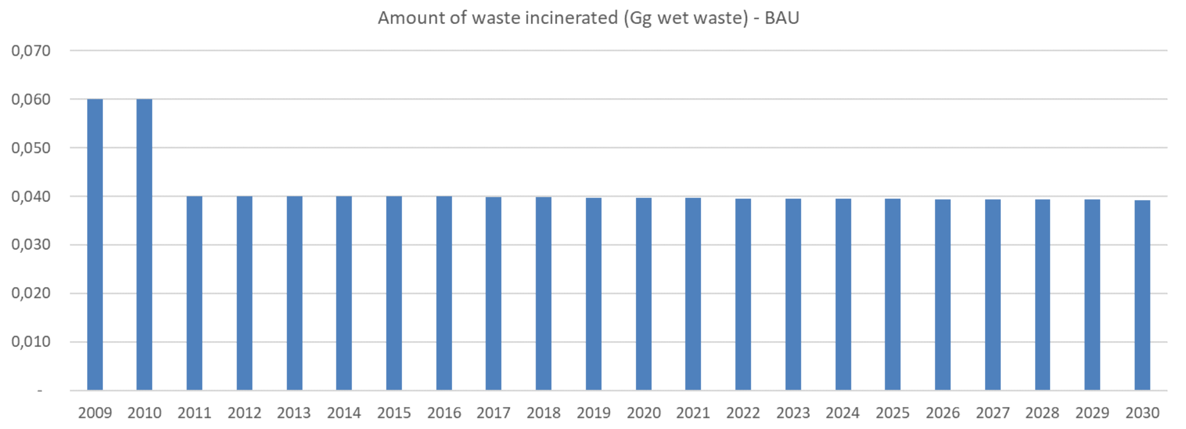
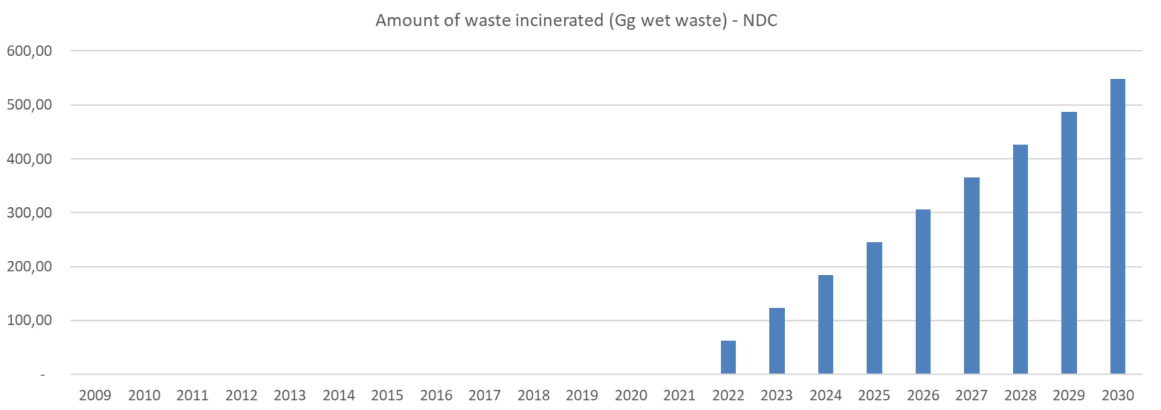


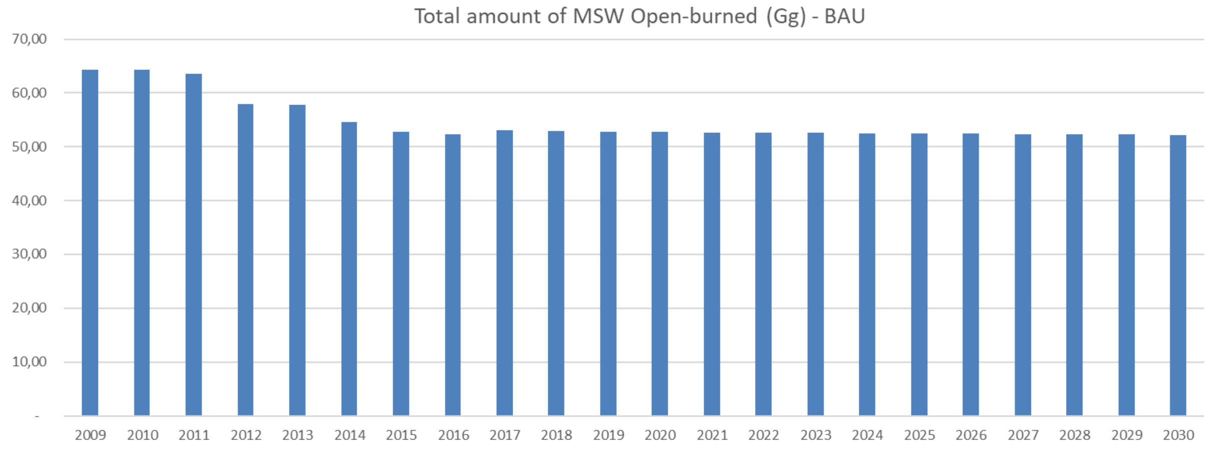
Figure 46. amount of waste incinerated - NDC

In the NDC scenario, the total amount of clinical waste incinerated is considered constant until 2030. It is considered that the incineration of MSW started in 2017. Between 2017 and 2021, the amount of incinerated MSW increased slowly du to testing phases. Then, between 2021 and 2030, it is assumed an important rise of the total amount of incinerated MSW associated among other things with the diversion of waste from landfills.



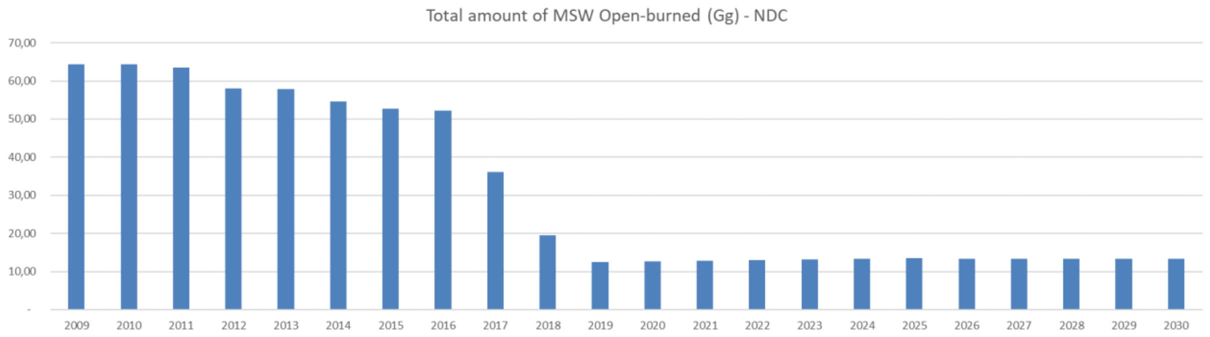
For the **open burning** subsector, in the BAU scenario, the amount of burned waste per inhabitant per year between 2017 and 2030 is considered equal to the average of the last three (03) years from the inventory. This average is applied to the evolution of the national population from 2017 to 2030.

Figure 47. amount of municipal solid waste (MSW) open-burned - BAU



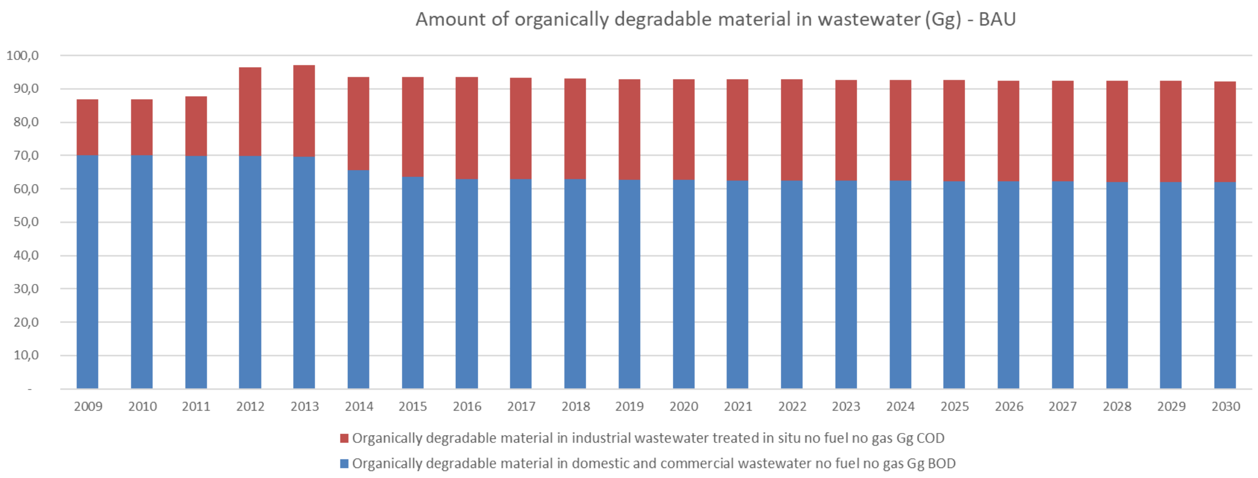
In the NDC scenario, it is considered a decrease of the open burned waste until 2020 then a little rise between 2020 and 2030 in accordance with the uncollected amount of waste to the waste national management plan.

Figure 48. amount of municipal solid waste (MSW) open-burned - NDC



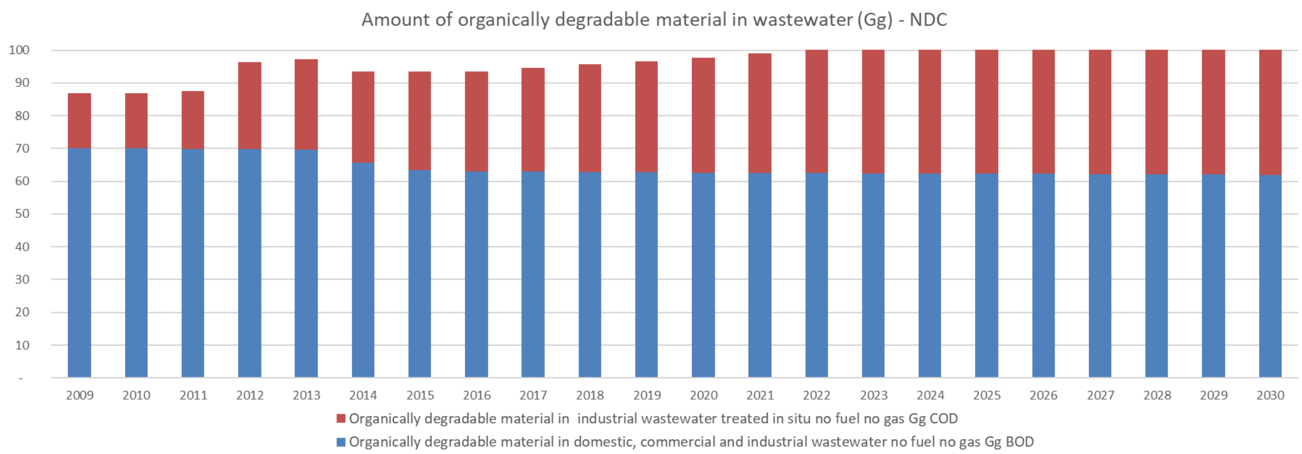
For the **wastewater treatment** subsector, in the NDC scenario, the analysis considers a stagnation of the total industry product evolution until 2030, and a stagnation of the connection rate to the anaerobic shallow lagoons.

Figure 49. amount of organically degradable material in wastewater - BAU



For the wastewater treatment subsector, in the NDC scenario, the analysis considers an increase of the total industry product evolution until 2030 estimated from national data and the GDP growth rate. Concerning the connection rate to the anaerobic shallow lagoons for the urban population, it is considered a little increase until 2030.

Figure 50. amount of organically degradable material in wastewater - NDC



The following table presents hypothesis applied for the NDC scenario in the Waste sector.

Table 31. Hypothesis used for the NDC scenario

Sub-sector	N°	Hypothesis	Targets	References
Landfilling	1	The distribution of the population between rural and national territories is estimated by 2030 according to UN data.	2020: 62.1% 2025: 66.1% 2030: 69.5%	United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition.
Landfilling	2	The total population until 2030 is estimated according to reported national data.	2020: 2,859 thousands inhabitants 2025: 2,845 thousands inhabitants 2030: 2,831 thousands inhabitants	TNC and communications with national inventory teams
Landfilling	3	The total amount of waste going on landfills is calculated by considering the directive "Governmental Decree No.418, dated 27.05.2020".	In 2030 biodegradable the amount of municipal waste going in landfill is reduced to 35% of the total amount (by weight) of biodegradable municipal waste produced in year 2010. Every year between 2016 and 2020, we consider that there is a similar decrease as the one observed between 2015 and 2016. Amounts for the period 2021 and 2029 are estimated by linear interpolation based on known 2030 value.	. Governmental Decree No.418, dated 27.05.2020 ; Communications with national inventory teams
Landfilling	4	The amount of methane recovered from SWDS is estimated by considering data from the GACMO tool.	Beginning of CH_4 capture in 2025 and linear evolution until the capture of 10% of 1.34 million tonnes of CH_4 in 2030.	TNC and communications with national inventory teams

Landfilling	5	The following trends are considered to remain similar after 2016 : - the distribution of Municipal Solid Waste by management practices, - the estimation of Industrial waste going on landfills, - the amount of sludge generated in wastewater treatment plants going on landfills, - we consider bulk waste and not waste differentiated by category,		
Composting	6	An increase in the amount of composted waste is considered in accordance with the national waste management plan.	According to the national plan, it is estimated that the amount of composted waste will grow by 34% between 2017 and 2016, by 29% between 2017 and 2018, by 20% between 2018 and 2019, by 15% between 2019 and 2020 then by 3% per year until 2030. This growth is applied to the amount of composted waste estimated in the Albanian inventory.	Albanian Waste National Strategy - Table A5.1 - Waste projection
Composting	7	The emission factors associated with CH4 and N2O are considered to be constant.		Expert judgement
Incineration	8	The total amount of clinical waste incinerated is considered constant until 2030. Likewise, the emission factors associated with clinical waste are also.		Expert judgement
Incineration	9	Start of MSW incineration in 2017 (only for testing) and gradual increase between 2021 and 2030.		. Communication with Albania . Albanian Waste National Strategy - Table A5.1 - Waste projection
Open burning	10	We assume that the amount of waste burned in open fires will decrease in the same way to the decrease in the quantity of waste not collected in Albania in accordance with the national waste management plan.	It is estimated that the amount of composted waste will decrease by 31% between 2017 and 2016, by 46% between 2017 and 2018, by 37% between 2018 and 2019. After 2019, it is considered a grow by 1.5% per year until 2030. This growth is applied to the amount of open burned waste estimated in the Albanian inventory.	Albanian Waste National Strategy - Table A5.1 - Waste projection
Open burning	11	We consider the emission factors of CH_4 and constant N_2O.		Expert judgement
Wastewater treatment	12	The distribution of the population between rural and national territories is estimated by 2030 according to UN data.	2020: 62.1% 2025: 66.1% 2030: 69.5%	United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition.
Wastewater treatment	13	The total population until 2030 is estimated according to reported national data.	2020: 2,859 thousands inhabitants 2025: 2,845 thousands inhabitants 2030: 2,831 thousands inhabitants	TNC and communications with national inventory teams
Wastewater treatment	14	Regarding the different wastewater treatment systems, no development in rural areas is considered in accordance with communications with Albanian experts. Considering the establishment of 2 new small wastewater treatment plants, an increase in the rate of connection of the urban population to shallow anaerobic lagoons is considered. This development is considered similar to that observed between 2009 and 2016.	Increase of the rate of connection of the urban population to shallow anaerobic lagoons. 2009: 1.63% 2016: 1.71% 2017: 1.73% 2020: 1.76% 2025: 1.82% 2030: 1.88%	TNC and communications with national inventory teams

Wastewater treatment	15	The total industry product evolution until 2030 is estimated from national data and the GDP growth rate.	Increase of the total industry product evolution until 2030 estimated from national data and the GDP growth rate (except for Petroleum Refineries, data provide from energy sector). The following data are respectively about 2016 and 2030. Beer & Malt (t/yrs): 862 026 - 1 366 209 Dairy Products (t/yrs): 108 988 - 172 734 Meat & Poultry (t/yrs): 159 819 - 253 295 Pulp & Paper (t/yrs): 2 327 - 3 688 Wine & Vinegar (t/yrs): 22 420 - 35 533	TNC and communications with national inventory teams
Wastewater treatment	16	The annual per capita protein consumption from 2017 and 2018 comes from FAOSTAT data. After 2018, we consider the average of 2016, 2017 and 2018.	2016: 35,04 kg/person/yr 2017: 43,11 kg/person/yr 2018: 42,22 kg/person/yr 2019-2030: 40,12 kg/person/yr	Food and Agriculture Organization of the United Nations (FAO) - Statistics Division (ESS)
Wastewater treatment	17	All other parameters are considered constant until 2030.		Expert judgement

Sub-sector	N°	Actions	Targets	References
Landfilling	W1	Reduction in the amount of waste going to landfill.	In 2030 biodegradable the amount of municipal waste going in landfill is reduced to 35% of the total amount (by weight) of biodegradable municipal waste produced in year 2010. Every year between 2016 and 2020, we consider that there is a similar decrease as the one observed between 2015 and 2016. Amounts for the period 2021 and 2029 are estimated by linear interpolation based on calculated 2030 value.	. Governmental Decree No.418, dated 27.05.2020 TNC and communications with national inventory teams
Landfilling	W2	Setting up of methane capture installation.	Beginning of CH_4 capture in 2025 and linear evolution until the capture of 10% of 1.34 million m^3 of CH_4 in 2030.	TNC and communications with national inventory teams
Composting	W3	Increase in the amount of composted waste.	From 2016 to 2017: +34% From 2017 to 2018: +29% From 2018 to 2019: +20% From 2019 to 2020: +15% Then +3% per year until 2030	Albanian Waste National Strategy - Table A5.1 - Waste projection
Incineration	W4	Stagnation of the total amount of clinical waste incinerated.		. Communications with national inventory teams. Albanian Waste National Strategy - Table A5.1 - Waste projection
Incineration	W5	Start of MSW incineration in 2017 (only for testing) and gradual increase between 2021 and 2030.	2017: start 2017 - 2018: +100% 2018 - 2019: +50% 2019 - 2020: +33% 2020 - 2021: +25% 2021 - 2030: +27079%	
Open burning	W6	Decrease in the amount of waste burned in open fires.	From 2016 to 2017: -31% From 2017 to 2018: -46% From 2018 to 2019: -37% Then +1.5% per year until 2030	Albanian Waste National Strategy - Table A5.1 - Waste projection
Wastewater treatment	W7	No evolution regarding wastewater treatment methods in rural areas. Increase of the rate of connection of the urban population to shallow anaerobic lagoons.	Increase of the rate of connection of the urban population to shallow anaerobic lagoons. 2009: 1.63% 2016: 1.71% 2017: 1.73% 2020: 1.76% 2025: 1.82% 2030: 1.88%	TNC and communications with national inventory teams

Wastewater treatment	W8	Increase of the total industry product evolution until 2030 estimated from national data and the GDP growth rate.	The following data are respectively about 2016 and 2030. Beer & Malt (t/yrs): 862 026 - 1 366 209 Dairy Products (t/yrs): 108 988 - 172 734 Meat & Poultry (t/yrs): 159 819 - 253 295 Pulp & Paper (t/yrs): 2 327 - 3 688 Wine & Vinegar (t/yrs): 22 420 - 35 533	TNC and communications with national inventory teams
Wastewater treatment	W9	Increase of the annual per capita protein consumption estimated from FAOSTAT data.	2009 - 2016: 35.04 kg/person/yr 2017: 43.11 kg/person/yr 2018: 42.22 kg/person/yr 2019 - 2030: 40.12 kg/person/yr	Food and Agriculture Organization of the United Nations (FAO) - Statistics Division (ESS)

7.4. AFOLU

7.4.1. Agriculture

7.4.1.1. Activity data – Livestock population

The evolution of livestock population for years 2017 to 2019 has been based on the evolution observed in the FAO stat data (available until 2019). For projected years (2020-2030), the assumptions presented in the 4NC on livestock numbers have been used:

Table 32. Projection in the number of livestock for the period 2010-2050

Table 5.8: Projection in the number of livestock for the period 2010-2050 (in 000 heads)

Livestock	2010	2020	2030	2040	2050
Cattle	526.3	467	435	414	398
Sheep	1790.6	1760	1742	1730	1720
Goats	814.7	749	713	689	671
Equidae	106.2	85	75	68	63
Swine	164.0	184	199	210	218
Poultry	8245.4	9659	10596	11315	11907

The same assumptions have been made for 2030, the years between have been interpolated.

Table 33. Methods used to project livestock numbers

Animal category	Method used to project activity data
Dairy cows	Total cattle = 435,000 in 2030. The share of dairy cattle in 2016 has been maintained (around 72% of dairy cattle)
Other cattle	Total cattle = 435,000 in 2030. The share of other cattle in 2016 has been maintained (around 28% of other cattle)
Buffalo	Constant
Sheep	Total sheep = 1,742,000 in 2030
Goats	Total goats = 713,000 in 2030

Horses	Total Equidae = 75,000 in 2030. The share of horses in 2016 has been maintained (around 34% of total Equidae)
Mules and asses	Total Equidae = 75,000 in 2030. The share of mules and asses in 2016 has been maintained (around 66% of total Equidae)
Swine	Total swine = 199,000 in 2030
Chickens	Total poultry = 10,596,000 in 2030

The global assumption is **an increase in livestock population to comply with the objective to promote the Albanian agricultural production**.

No change has been made for livestock numbers between the BAU and NDC scenario.

Figure 51. projected data for livestock numbers of sheep and goats

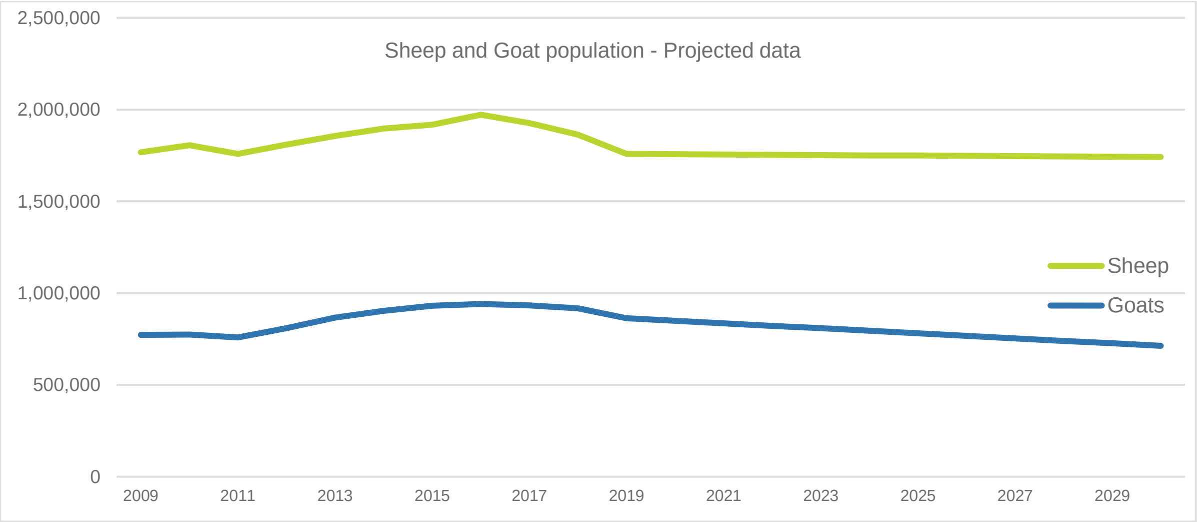


Figure 52. projected data for livestock numbers of chickens

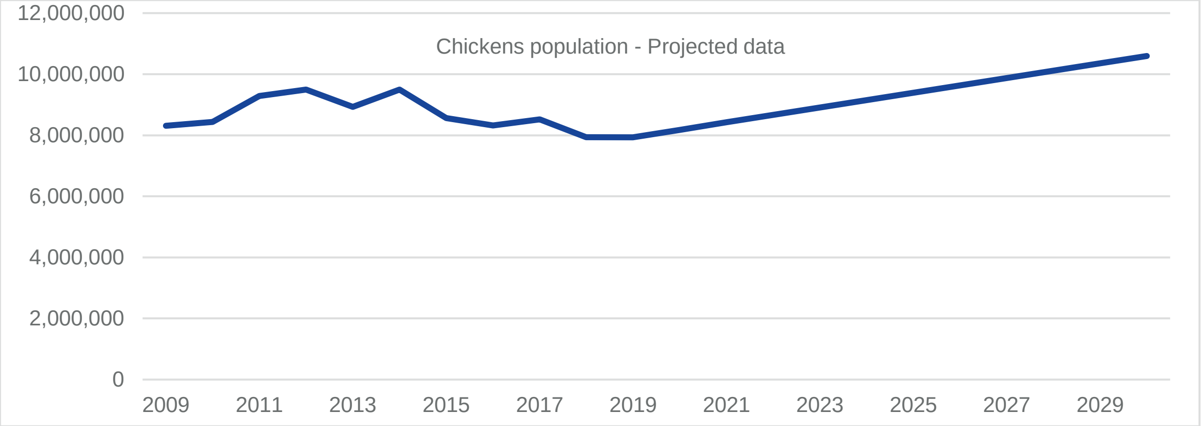
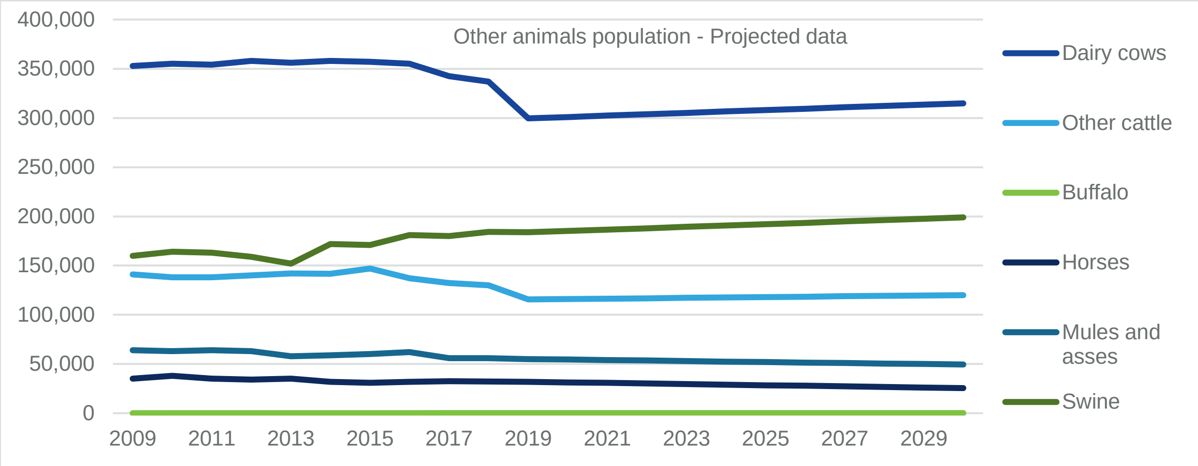


Figure 53. projected data for livestock numbers of cattle and other animals



For the BAU scenario, it is assumed that:

- The animals' feeding and associated productivity are constant, implying no change in the nitrogen excretion rate or enteric methane emission factor.
- The distribution of animals per manure management systems is maintained through time.

7.4.1.2. Mitigation actions – Livestock

Contrary to the BAU, for the NDC scenario, improved feeding techniques for animal in housing (where feeding can be controlled) are considered. The action corresponds to the action: **A5 - Optimizing animal feeding in order to reduce N_2O and CH_4 emissions**

- For this action, only cattle in housing is considered. The improved feeding techniques lead to:
- A decrease in nitrogen excretion rate (N inputs from feeding fitting better to animal needs). A 10% reduction for improved feeding is assumed.

A decrease in enteric CH_4 (add of fat in feeding): according to the GACMO (Greenhouse Gas Abatement Cost Model) tool, this can lead to a reduction of 4% of CH_4 emissions for 1% of fat added.

For the first sub-action (N inputs from feeding fitting better to animal needs), it is considered that it can be applied to **all the cattle in housing.** For the second sub-action, it is considered that **only 50% of the herd** is housed, as it can be costly.

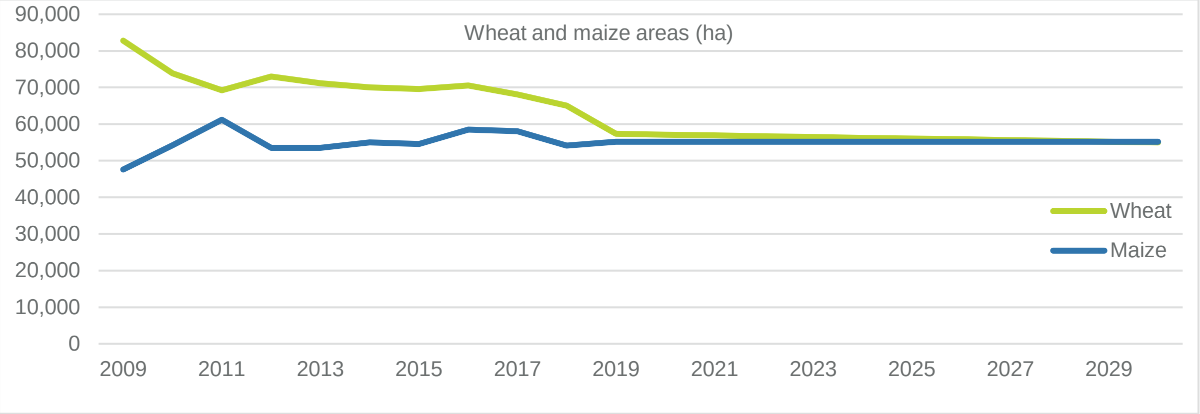
Another mitigation action is considered: **Increasing the time spent in pasture** (see action A4 in table 3). This action applies only to cattle. In 2016, dairy cows spent 18% of their time in pasture. It is considered that in 2030, they will spend 25% of their time grazing. In 2016, other cattle spent 20% of their time in pasture. It is considered that in 2030, they will spend 25% of their time grazing. This action increase carbon sequestration in pasture.

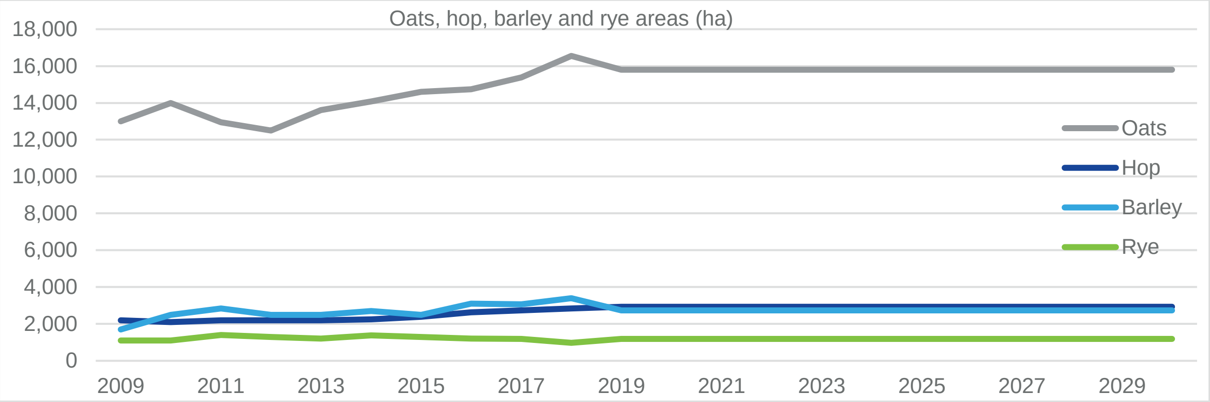
7.4.1.3. Activity data – Crop area, production and fertilization

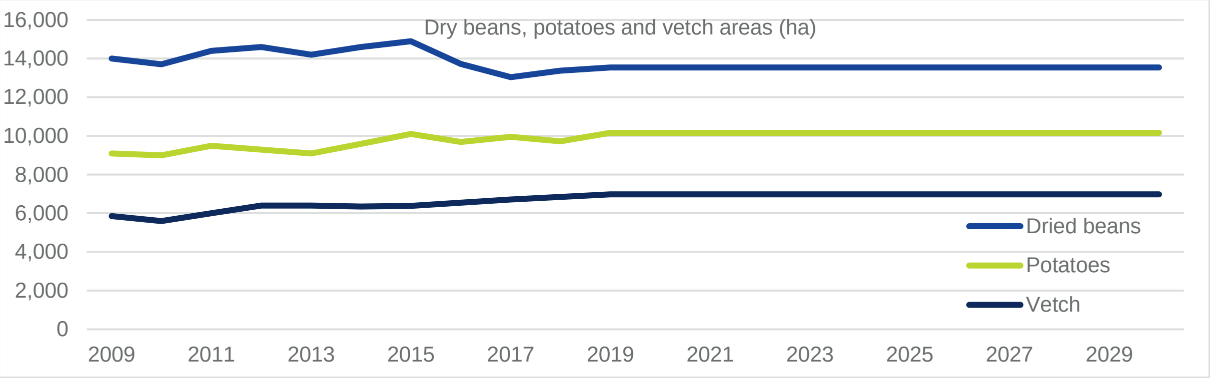
For the calculation of nitrogen from crop residues, the following crops are considered: wheat, maize, oats, hop, barley, rye, dry beans, potatoes, vetch. From 2009 to 2019, area and production data are taken from FAO stat. For all these crops, except for wheat, a constant area through time has been considered then. For wheat, the area is decreasing since 2009, and it is assumed that it would stabilize around 55,000 ha in 2030.

Areas of crops and crop production are similar in the BAU and NDC scenario

Figure 54. projected data for crop areas







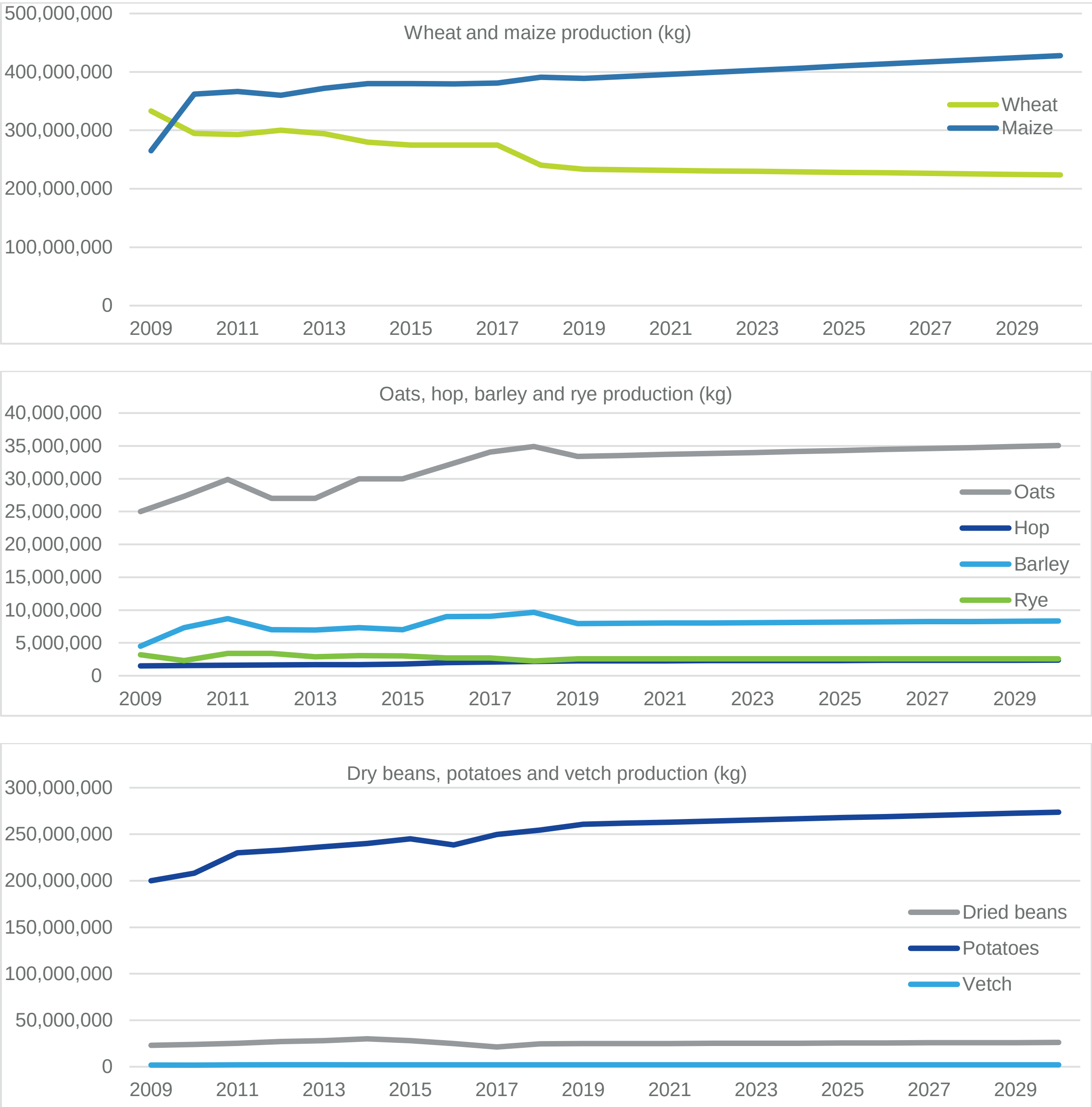
The following assumptions have been made regarding the evolution of the average yield of these crops:

Table 34. Assumptions regarding crops average yields

Crops	Method used to project activity data	Based on historical trend
Wheat	Constant yield	+1% between 2009 and 2019

Maize	Yield + 10% between 2009 and 2030	+26.6% between 2009 and 2019
Oats	Yield + 5% between 2009 and 2030	+9.9% between 2009 and 2019
Hop	Yield + 5% between 2009 and 2030	+13.4% between 2009 and 2019
Barley	Yield + 5% between 2009 and 2030	+9.4% between 2009 and 2019
Rye	Constant yield	-25% between 2009 and 2019
Dried beans	Yield + 5% between 2009 and 2030	+11.3% between 2009 and 2019
Potatoes	Yield + 5% between 2009 and 2030	+16.7% between 2009 and 2019
Vetch	Constant yield	-8% between 2009 and 2019

Figure 55. projected data for crop production



The total agricultural area is increasing through time (hypothesis presented in the FOLU sector), at 16% between 2016 and 2030. Mineral fertilization was projected based on this area evolution, assuming that the average nitrogen rate is constant for the BAU scenario.

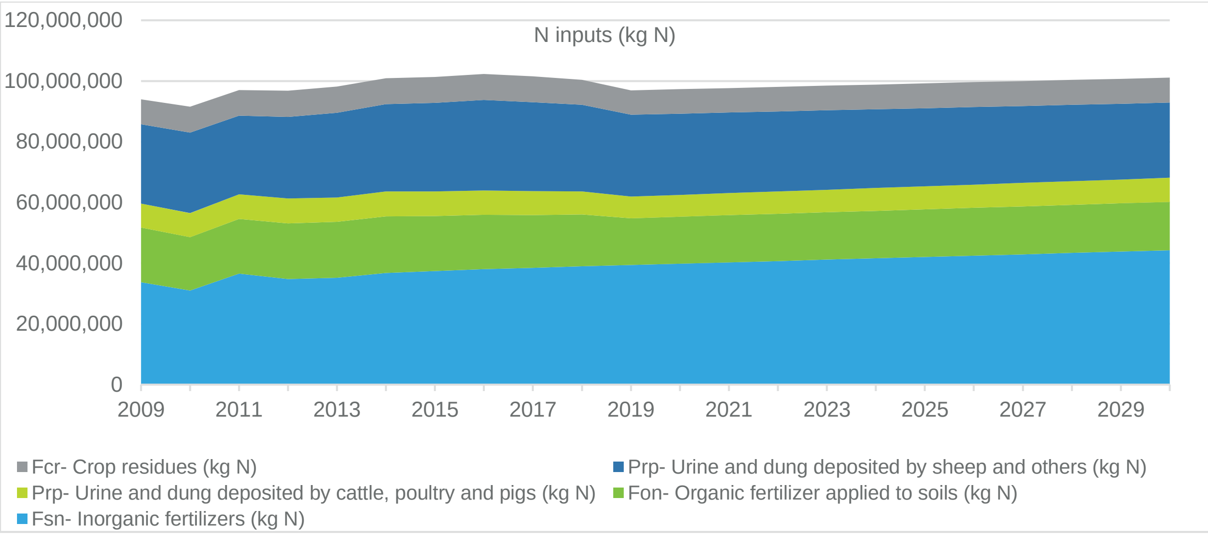
The following assumptions have been made regarding nitrogen inputs:

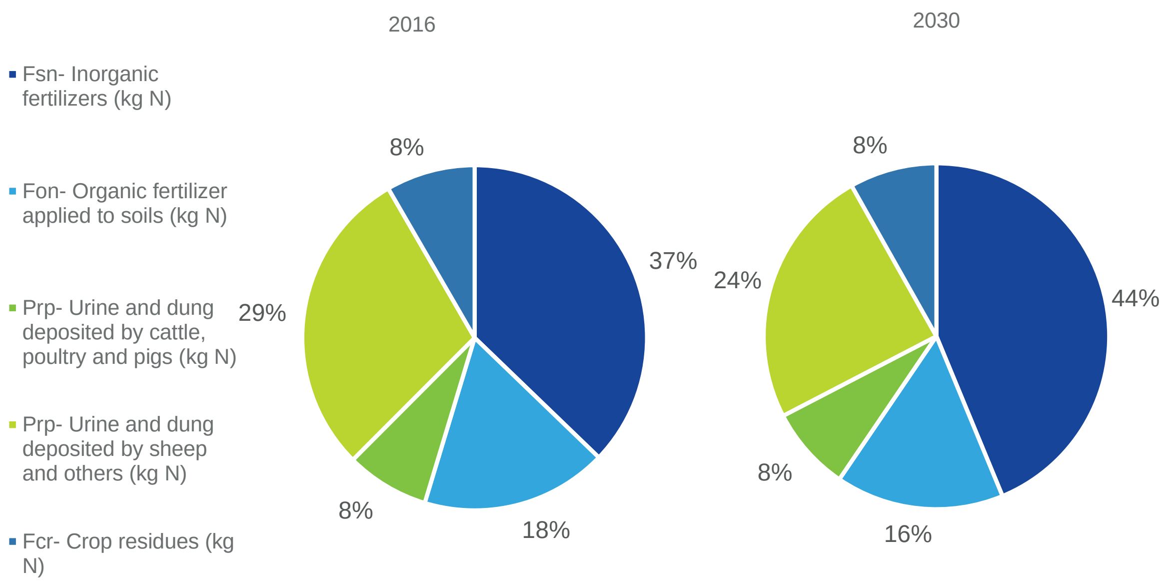
Table 35. Methods used to project nitrogen inputs

Parameter	Method used to project activity data
N from mineral fertilizers	Based on the total agricultural evolution from FOLU (+16% between 2016 and 2030)
N from compost	Constant
N from sewage	Constant
N from other organic fertilizer	Constant
Urea application (tons)	Same evolution that the one from total mineral N fertilizer applied

The nitrogen deposited by grazing animal and in manure spread is estimated according to the IPCC methodology.

Figure 56. Projected data for nitrogen inputs





The area of histosols is maintained for the whole period.

7.4.1.4. Activity data – Burning

Two types of burning are included: burning of crop residues and pasture burning. The data are taken from the EFFIS reports. For crop residues burning, the average rate of burning has been estimated for 2009-2018 for wheat: 1.3% of the area is burnt. The rate has been maintained for the whole period. For pasture burning, the average area burnt for 2009-2018 (5,154 ha) has been used for projected years. There is no difference between the BAU and NDC scenario for this smaller source of emissions.

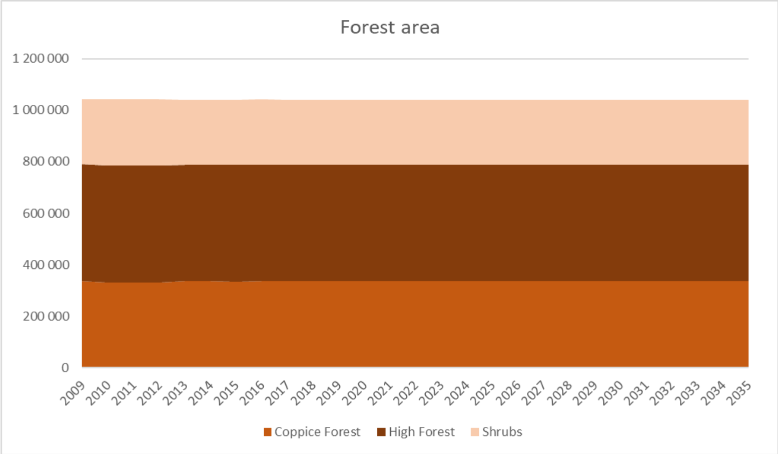
7.4.2. FOLU

The following chapters present in detail the assumptions for the BAU scenario of the FOLU sector. The BAU scenario considers the continuation of the situation and trends of the recent decade covered by the inventory:

7.4.2.1. Forest land

Forest area had been slightly decreasing (-0.1% between 2009 and 2016), mostly via the decrease of coppice forest. However, there was an increase in 2016. These are no significant long-term changes so the BAU scenario considers the forest area to remain stable with no further afforestation of deforestation in the period 2016-2035. For high forests, the mean area of the period 2013-2016 is used for all years after 2016. For coppice and shrubs, the value from the year 2016 is kept, since there is no clear trend in the period 2013-2016.

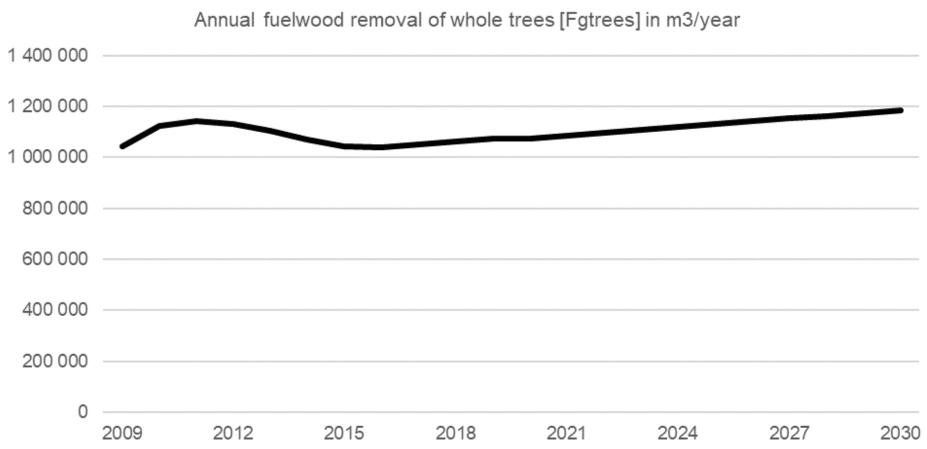
Figure 57. Projected data for forest areas



In the BAU scenario, the forest remains a net source for the whole period. CO_2 absorptions from **forest growth** is kept stable since forest area is stable and parameters are kept the same.

Fuelwood harvesting level increases in consistency with the Energy sector, which projects an increase of +14% of TJ of fuelwood consumption between 2016 and 2030. This leads to an increase in fuelwood removals in forest of also +14% between 2016 and 2030.

Figure 58. Projected data for fuelwood harvest

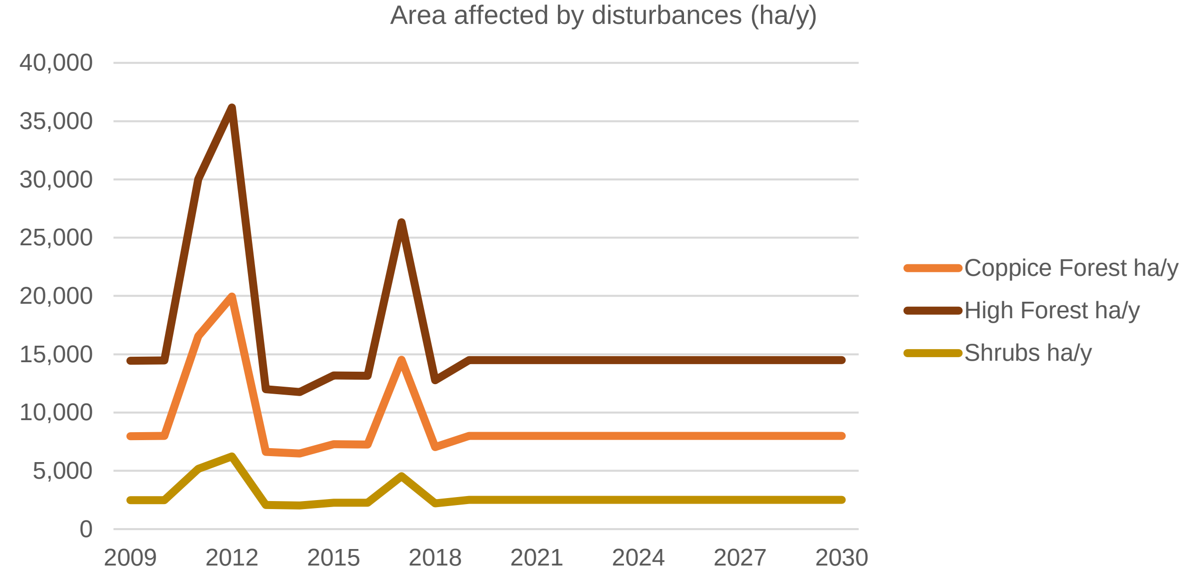


Emissions due to **wood harvesting** are also kept constant in the BAU scenario.

Emissions from disturbances are calculated through two elements:

- The dumpings of fuelwood (that is left in forest due to lack of efficiency of the harvest), which is a loss of C from the biomass. This value is kept constant, in line with the mean value of estimated dumpings for the inventory period.
- The fires. EFFIS dataset is used for the years 2017 and 2018. Two peaks of fires are estimated: 2011-2012 and 2017. From 2019 on it is assumed a hypothesis of stability from the mean area affected by fires (excluding the peaks), for the BAU scenario. Future big fires episodes cannot be predicted and so they are excluded of the projection. For the fires, C losses lead to CO_2 emissions (reported in forest land) but also the combustion lead to CH_4 and N_2O emissions (reported in biomass burning).

Figure 59. Projected data for forest disturbances



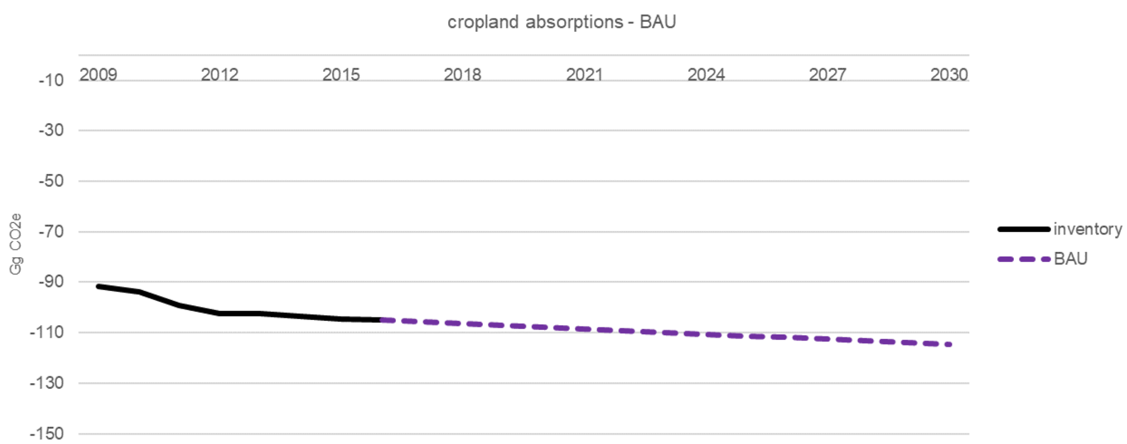
7.4.2.2. Cropland

Cropland areas decreased regularly at -1,500 ha/y between 2009 and 2016. However, the dynamics of the different subcategories were very different: cultivated cropland and fruit trees were increasing, abandoned cropland was stable, and uncultivated cropland was decreasing.

In the BAU scenario, the rate of these changes has been kept constant for all subcategories, except for uncultivated cropland, where the decrease of the areas was leading to the total loss of the category in 2025. Once a minimum threshold of 10,000 ha (10% of the initial area of 2009) is hit, the assumption is that it remains at this level after.

The CO_2 absorption from fruit trees continues its trend after 2016.

Figure 60. Projected CO_2 absorptions for cropland



7.4.2.1. Grassland

Grassland areas have been increasing during the period 2009-2016 (+12,000 ha, i.e. +2%, during the period), and a constant annual increase of 4,239 ha/y from 2011 to 2016, mostly from the conversion of Other Land. Actually, this conversion is likely to be from other conversion types (Forest to grassland, Cropland to grassland…) but with the current methodology to monitor land-use evolutions this is not known, and Other Land category is used as a remaining category.

This trend (+4,239 ha/y) is continued in the BAU scenario. It does not lead to any new emissions and removals in the BAU scenario.

7.4.2.2. Wetland

Wetland areas are stable, at 135 000 ha each year except for 2016 when it reaches 136,511 ha. This increase in 2016 is not significant enough to derive an increasing trend from it. Therefore, in the BAU scenario, the area remains constant at this 2016 level.

There is no **carbon stock change** associated with this category in the historical inventory and in the BAU scenario.

7.4.2.3. Settlements

Settlements area increases in the inventory period and this trend is continued for the projection. However, there is no **carbon stock change** associated with this category in the historical inventory and in the BAU scenario.

7.4.2.4. Other land

"Other land areas" is used as a remaining category. However, there is no **carbon stock change** associated with this category in the historical inventory and in the BAU scenario.

7.4.3. FOLU NDC scenario

The following presents in detail the assumptions for the NDC scenario of the FOLU sector. The NDC scenario considers some specific mitigation actions that aim to reduce emissions by sources and to increase absorptions by sinks. The BAU scenario is used as a baseline scenario, and the mitigation actions that make the NDC scenario differ from this baseline. The following mitigation actions are taken into account:

Table 36. Summary of the mitigation actions for the FOLU sector

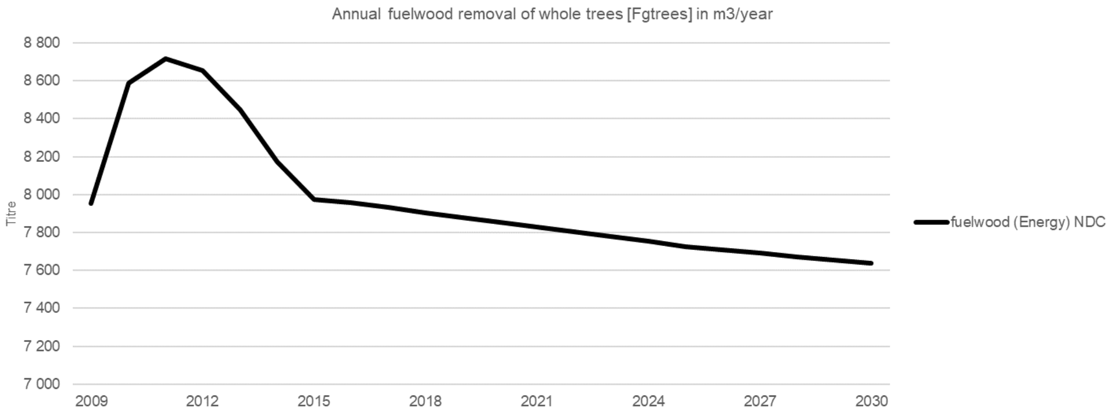
N°	Name	Reference (BAU)	Target (NDC)
L1	**Energy: changes in fuel mix, reduction of use of fuelwood. Moratorium on fuelwood**	Fuelwood consumption decreases by 14% between 2016 and 2030	Fuelwood consumption decreases by 4% between 2016 and 2030
L2	**New afforestation areas**	0 ha	+ 300 ha / y.
L3	**Improved management and monitoring to prevent wildfires**	mean risk of forest fires at 10 000 ha / year (less than bigger episodes but slightly higher than the other years to represent an increasing risk). The exclusion of big events from the projection is made for both BAU and	progressive reduction of 5% of this risk. The exclusion of big events from the projection is made for both BAU and NDC scenario so it does not lead to a discrepancy between the NDC and the

		NDC scenario so it does not lead to a discrepancy between the NDC and the BAU.	BAU.
L4	**Improving efficiency of fuelwood harvest**	No reduction of losses	reduction of the losses increases progressively from -0.25% in 2021 to -3% in 2030.
L5	**Improved sustainable forest management**	No area with improved management	progressively on 5000ha per year + higher sequestration factor
L6	**Improved sustainable grassland management to enhance carbon sequestration and protect biodiversity**	No area with improved management	an increasing area of the total grasslands, from 2% in 2021 to 20% + higher sequestration factor
L7	**Improved sustainable cropland management**	No area with improved management	Development of agroforestry is projected to be progressively increasing to 100ha in 2030. Improvement of agricultural soil practices help storing carbon in soils in areas that increase progressively to 20% of cultivated cropland in 2030.

7.4.3.1. Energy: changes in fuel mix, reduction of use of fuelwood. Moratorium on fuelwood (L1)

As fuelwood harvesting is causing the majority of carbon losses in forests, to avoid and even eliminate illegal cuttings is targeted in different policies. Plus, the action on energy mix also helps to reduce this pressure on the forest resources. The evolution of fuelwood harvest is directly consistent with projections applied in the Energy sector regarding the evolution of fuel mix. The fuelwood consumption increases by 14% between 2016 and 2030 in the BAU scenario, while it decreases by 4% in the NDC scenario.

Figure 61. Projected fuelwood harvest for the NDC scenario



7.4.3.2. New afforestation areas (L2)

Total forest area has been almost stable, slightly decreasing (-0.1% between 2009 and 2016) in the past. Moreover, there is a large area of abandoned cropland, of shrubland and other land (with sparse vegetation) that could be afforested, naturally or via plantation programs. There is a significant opportunity for afforestation and hence, for more carbon sequestration in growing trees. In the TNC (2016), two afforestation scenarios were applied: 500 ha/y and 1000 ha/y.

Based on national circumstances, and considering the current trends, potential for afforestation areas is estimated at 300 ha per year.

Therefore, it can be considered that it is not the lack of potential area that is an issue, but the costs and organizational and monitoring costs of the plantation programs and the protection of growing trees that is at stake. For the NDC scenario, these ambitious afforestation areas are considered but with an increasing progressive rate (from 100 ha in 2021, to 300 ha/y from 2025 on).

7.4.3.3. Improved management and monitoring to prevent wildfires (L3)

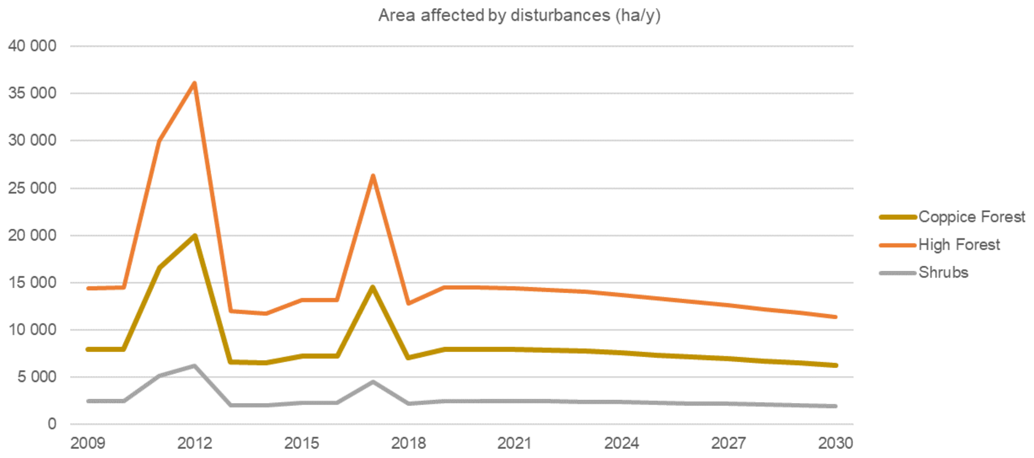
While it is not possible to predict future episodes of wildfires, the improvement of monitoring and management of forest fires, as mentioned in national policy and plans (such as ECCS) will help reduce this risk. While the BAU scenario considers a mean risk of forest fires at 10 000 ha / year (less than bigger episodes but slightly higher than the other years to represent an increasing risk), the NDC considers a progressive reduction of 5% of this risk.

Exceptional events that cannot be predicted are excluded from the calculation. A background level is calculated, in line with the way Natural disturbances are treated in the Kyoto Protocol or the EU FOLU regulation. Albania pledge to continue efforts to reduce the scope and intensity of wildfires.

This exclusion of big events from the projection is made for both BAU and NDC scenario so it does not lead to a discrepancy between the NDC and the BAU.

Moreover, in the NDC scenario, the prevention of wildfires for the background level is progressive and only reaches 5% in 2030 (compared to the BAU scenario).

Figure 62. projected forest disturbances for the NDC scenario



7.4.3.1. Improving efficiency of fuelwood harvest (L4)

While the total annual harvested volume of fuelwood is estimated at a mean of 2.66 millions of m^3 per year (FAO estimation), to be consistent with the Energy figures, it is estimated in the inventory, only a mean value of 1,09 millions of m^3 of fuelwood harvested and actually used. It means there is a loss of efficiency in the harvesting process and that approximately 60% of the wood harvested is dumped. Improving the efficiency on use of fuelwood results in a decrease in wood dumpings. The reduction of these losses increases progressively from -0.25% in 2021 to -3% in 2030, based on expert judgment with a conservative approach.

7.4.3.2. Improved sustainable forest management (L5)

This action aims to enhance carbon sequestration and protect biodiversity, including reforestation and restoration of degraded areas; development of official and certified wood harvesting, wood products and non-timber forest products Increase the protection areas (including the creation of natural corridors along rivers and ecotourism). This is mentioned in several national policy documents (ECCS; NSDI-II; NTP; IPARD; LANFPF; SPDBP; PDFS). Improved forestry management, applied progressively on 5000ha per year, allows a higher growth rate for the tree biomass in these areas. While the average annual above-ground biomass growth [Gw] is of 0.854 tdm/ha/y for coppice and high forest, and 1,0 tdm/ha/y for shrubs; a higher growth factor of 2,3 tdm/ha/y, from IPCC default values relevant for the country, is used.

7.4.3.3. Improved sustainable grassland management (L6)

This action is done to enhance carbon sequestration and protect biodiversity. Grassland mineral soil is improved by additional inputs from agricultural management (livestock management, more inputs, as seen in Agriculture sector). An input factor (Fi) of 1.11 is applied, using IPCC default values of table 5.5, to an increasing area of the total grasslands, from 2% in 2021 to 20% in 2030, based on expert judgment with national experts about available areas.

7.4.3.4. Improved sustainable cropland management (L7)

Development of agroforestry, as a widely recognized mitigation and adaptation opportunity, mentioned in national policy documents (ECCS; NSDI-II: NCCS), is projected to be progressively increasing to 100ha in 2030. Improvement of agricultural soil practices help storing carbon in soils in areas that increase progressively to 20% of cultivated cropland in 2030, based on expert judgment with national experts about available areas. A land use factor (F_{LU}) of 0.8 and a management factor (F_{MG}) of 1.02 is applied on these areas, using IPCC default values of table IPCC 2006 guidelines vol. 4 chapter 5 table 5.5.

Annex 2. Adaptation

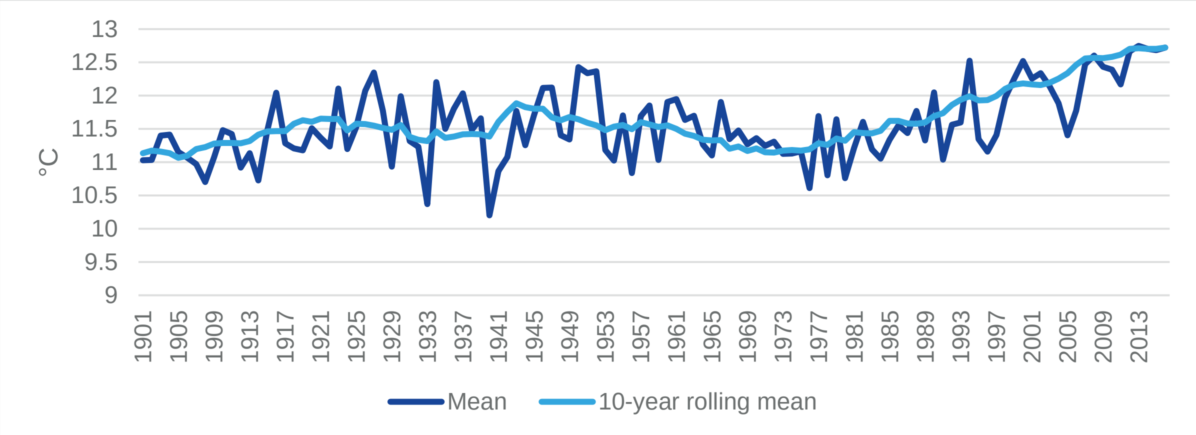
7.5. Map related to the presentation of the Albanian coast

Map 3. Coastal tourism destinations

Source: Integrated Cross-sectorial Plan for the Coast, NATP, 2015

7.6. Graphs, figures and maps related to climate variability and change

Figure 63. Mean yearly and 10-year rolling average temperature for Albania (1901-2016)



Source: World Bank CCKP, 2020.

Table 37. Projected change in monthly temperature (°C) for Albania for 2080-2099 (median and range)

Month	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
January	0.9 (0-1.9)	1.8 (0.5-2.9)	2.0 (1.1-3.2)	3.5 (2.1-4.7)
February	0.9 (-0.1-2.4)	1.9 (0.2-2.9)	2.2 (0.4-3)	3.4 (2.1-5.2)
March	1.1 (-0.1-2.1)	1.9 (0.5-2.5)	2.0 (0.8-3.2)	3.2 (2.3-5.2)
April	1.1 (-0.2-2.6)	2.0 (0.8-3.2)	2.4 (0.8-3.8)	3.7 (2.3-5.9)
May	1.0 (0.2-2.7)	2.1 (1-3.8)	2.7 (1.3-4.6)	4.4 (2.4-7.4)
June	1.5 (-0.1-3.3)	2.6 (0.9-4.4)	3.3 (1.3-5.2)	5.4 (2.9-8.9)
July	1.5 (0-3.8)	2.8 (1.5-5.2)	3.6 (1.9-6.2)	6.0 (3.6-10.2)
August	1.7 (0.1-3.9)	3.1 (1.3-5.7)	3.8 (2-6.3)	6.1 (3.5-9.9)
September	1.4 (0.3-3.1)	2.7 (1-4.4)	3.5 (1.9-5.4)	5.3 (3.5-8.6)
October	1.2 (0.2-2.3)	2.3 (1.3-3.4)	2.7 (1.4-4.5)	4.3 (2.7-6.9)
November	1.3 (-0.2-1.9)	2.1 (0.5-2.8)	2.5 (1-3.5)	3.5 (2.5-5.1)
December	1.0 (-0.2-2.2)	2.0 (-0.1-2.9)	2.3 (1-3.4)	3.4 (2-4.5)
Mean annual change	**1.21**	**2.28**	**2.75**	**4.36**

Source: World Bank Climate Change Knowledge Portal, 2020

Figure 64. Annual temperature anomalies

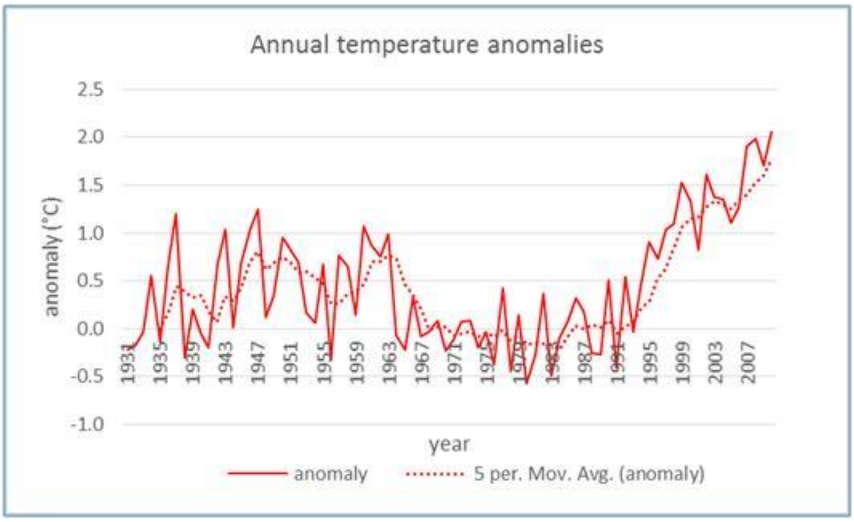
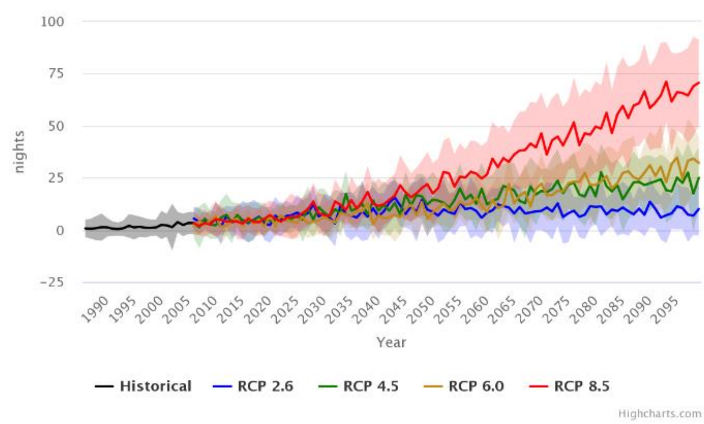
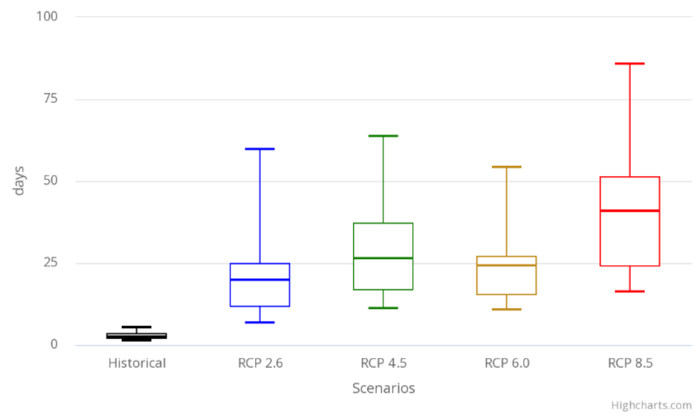


Figure 65. Tropical nights (>20°C) in Albania (1986-2099)



Source: World Bank CCKP, 2020.

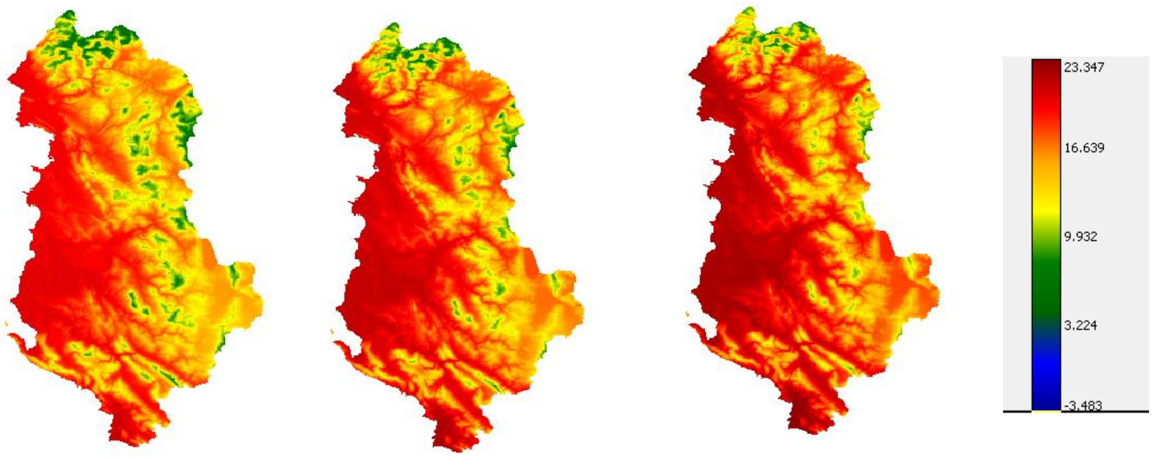
Figure 66. Warm Spell Duration Index in Albania (2040-2059)



Source: World Bank CCKP, 2020.

Map 4. Average maximum temperatures (by 2050)

baseline	RCP2.6	RCP 8.5	Temp (°C)



Map 5. Average minimum temperatures (by 2050)

baseline	RCP2.6	RCP 8.5	Temp (°C)

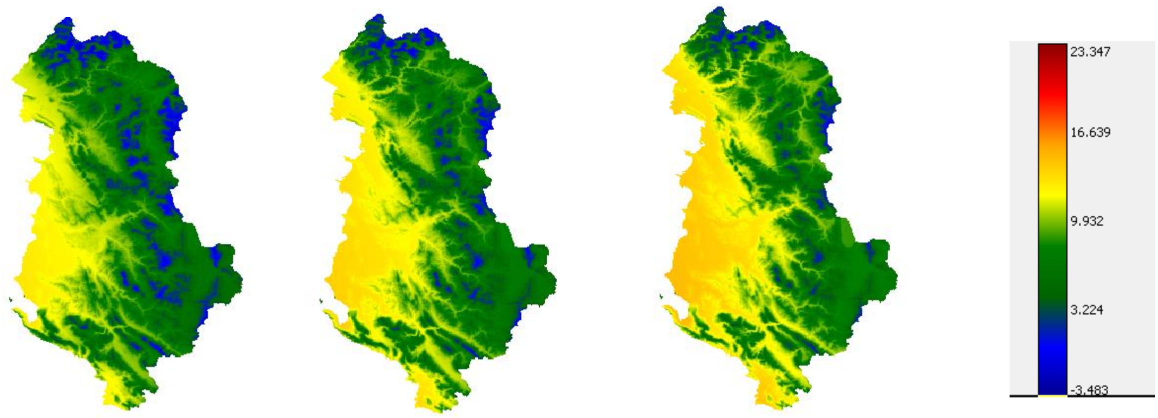
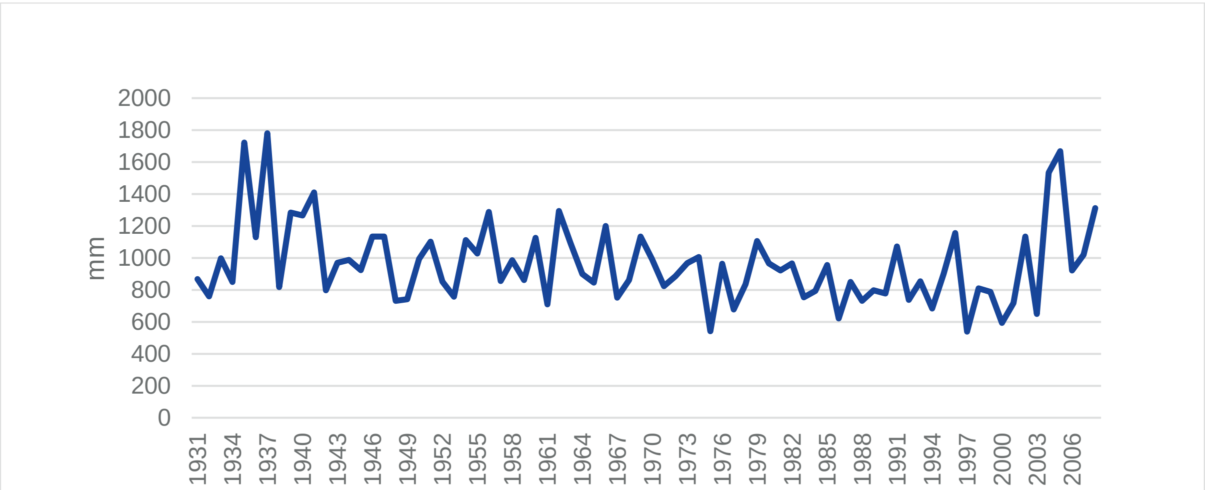


Figure 67. Average precipitation for Vlorë (1931-2007)



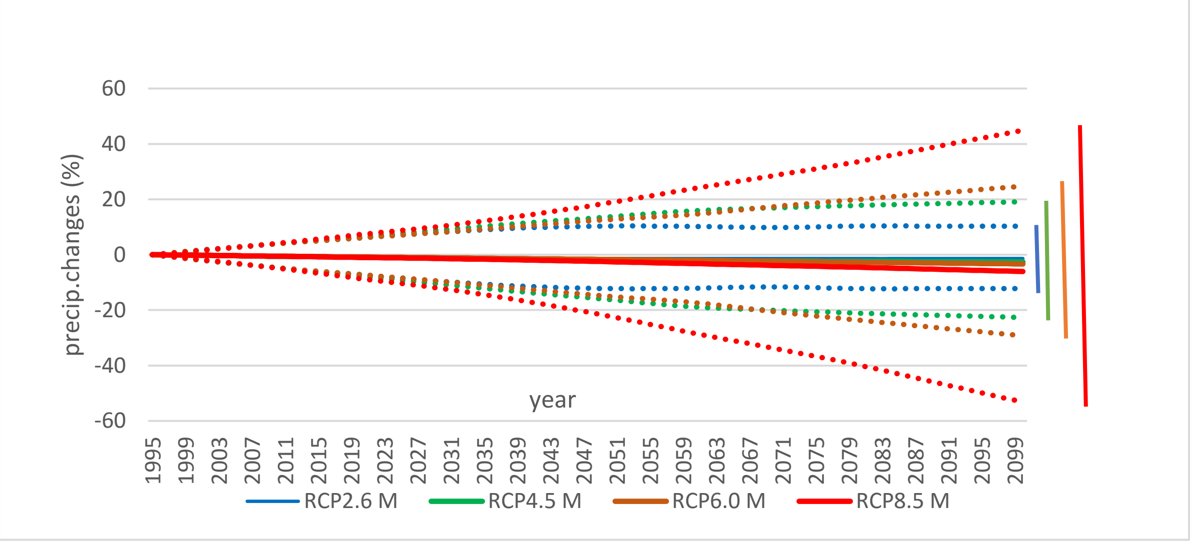
Source: E. Bruci. Draft report on Climate vulnerability and expected climate changes for the Vjosa River Basin, 4NC

Figure 68. Expected changes in precipitation (%), annual and seasonal for the Coast of Albania

		2050	2100
YEAR	RCP2.6	-1.6 (-17 to +14)	-1.6 (-17 to +14)
	RCP4.5	-2.2 (-21 to +19)	-3.0 (-30 to +26)
	RCP8.5	-2.9 (-28 to +25)	-7.1 (-65 to +60)
Winter	RCP2.6	1.8 (-12 to +16)	1.8 (-12 to +16)
	RCP4.5	2.4 (-17 to +21)	3.3 (-23 to +29)
	RCP8.5	3.2 (-22 to +29)	7.8 (-44 to +58)
Spring	RCP2.6	-3.1 (-18 to +15)	-3.1 (-18 to +15)
	RCP4.5	-4.1 (-24 to +20)	-5.7 (-33 to +27)
	RCP8.5	-5.6 (-33 to +25)	-13.5 (-80 to +68)
Summer	RCP2.6	-8.7 (-31 to +18)	-8.7 (-31 to +18)
	RCP4.5	-11.5 (-41 to +23)	-16.2 (-58 to +33)
	RCP8.5	-15.8 (-56 to +32)	-38.1 (-99 to +78)
Autumn	RCP2.6	-2.2 (-18 to +13)	-2.2 (-18 to +13)
	RCP4.5	-2.8 (-23 to +17)	-4.0 (-30 to +22)
	RCP8.5	-3.9 (-32 to +24)	-9.4 (-78 to +58)

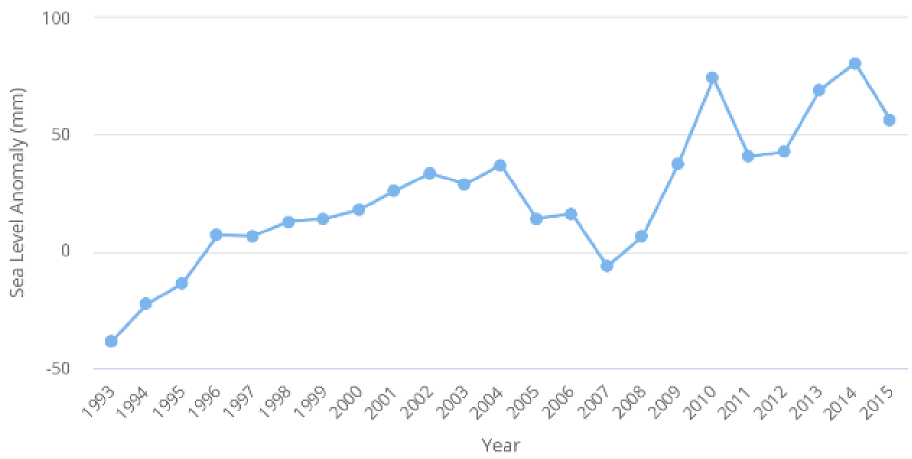
Source: TNC

Figure 69. Changes and variability of annual precipitation anomalies (%) for Lezhë (median, as well as upper and lower bounds in dotted lines)



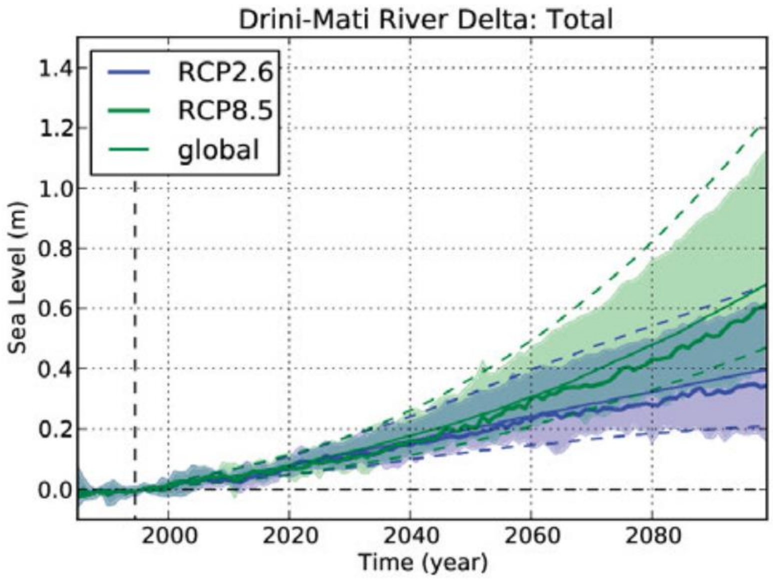
Source: TNC

Figure 70. Sea level anomalies for Albania (1993-2015)



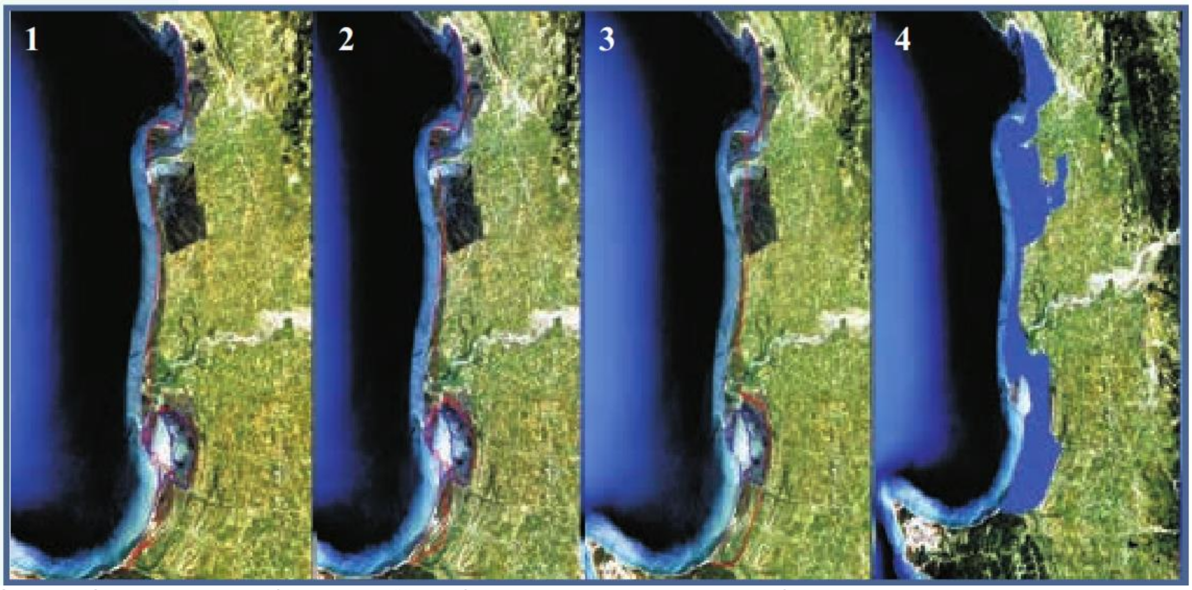
Source: World Bank CCKP, 2020.

Figure 71. Projection of sea level rise for the Drini-Mati River Delta (thick lines as median and shadowed areas as lower and upper bounds) and the World (thin lines)



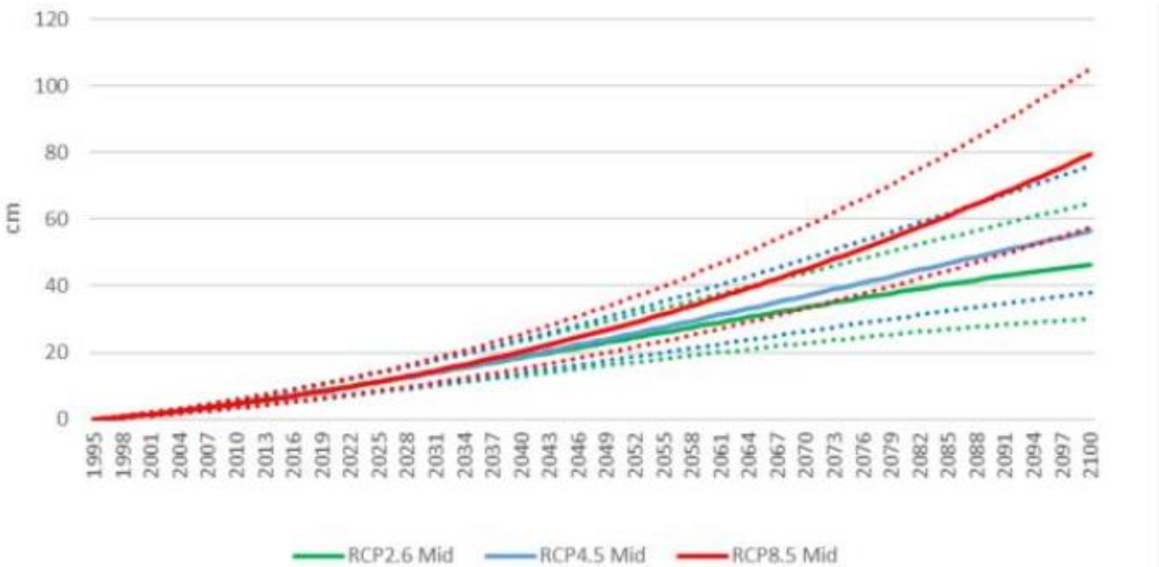
Source: World Bank, *Turn Down the Heat: Confronting the New Climate Normal, 2014.*

Figure 72. The coastline prediction (Lezhe District) for the time horizon:1-2030. (SLR=8cm); 2-2050 (SLR= 16cm); 3-2080 (SLR=35 cm); 4-2100 (SLR=0.49)



Source: Synthesis report for Project "Identification and implementation of adaptation response measures in the Drini- Mati River deltas" (Based on AR4 projections)

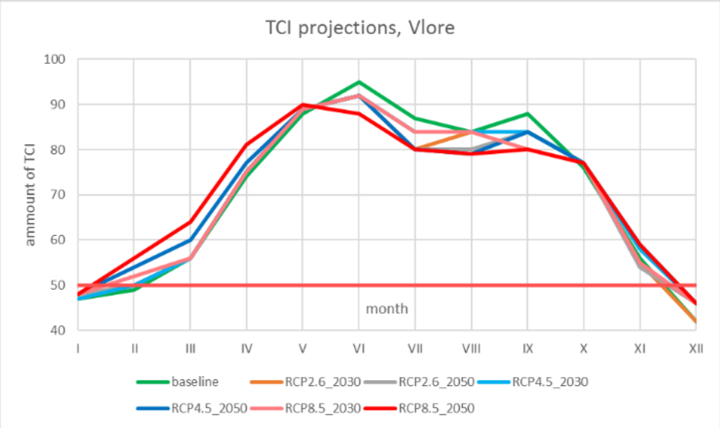
Figure 73. Projections of sea level rise for the Vjosa River basin (median, as well as upper and lower bounds in dotted lines)



Source: 4NC&1BUR, Draft Report III: Climate vulnerability and expected climate changes for the Vjosa River Basin, 2020.

7.7. Figure related to sectoral vulnerability

Figure 74. TCI projections for Vlore



4NC&1BUR, Draft Report III: Climate vulnerability and expected climate changes for the Vjosa River Basin, 2020.

7.8. Detailed prioritization table

7.8.1. Coastal zone

Adaptation measures				Co-benefit potential		Ease of implementation			Priority level
				Develop-ment	Mitigation	Institutional	Technical	Financial	
			Weights	0.8	0.2	0.3	0.3	0.4	
Strengthening the enabling environment	Policy and governance	Strengthen the institutional framework (e.g. coordination)	Institutional and organisational strengthening of governmental structures in providing interconnection between planning authorities and other inter-sectoral bodies that play a role in adapting against climate changes.	High	Low	Low	Medium	Medium	High
		Strengthen the policy framework: development and enactment of laws, policies, regulations and plans, including action plans, and mainstreaming.	Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan), specific regions (the 4 that were prioritized) or cities	High	Low	Low	Medium	Medium	High
			Development of sectoral climate change adaptation plans for the 3 main sectors prioritized and the supporting sectors (water, energy and agriculture/forestry/fisheries)	High	Medium	Medium	Medium	Medium	Very high
			Development of risk management plans	High	Low	Medium	Medium	Medium	Very high
			Mainstreaming climate change adaptation into national cross-sectoral development planning legislation, budget, regulations, procedures and tools	High	Low	Low	Medium	High	Very high
			Mainstreaming climate change adaptation into spatial/territorial development planning legislation, regulations, procedures and tools, including building	High	Low	Medium	Medium	Medium	Very high

Adaptation measures			Co-benefit potential: Develop-ment	Co-benefit potential: Mitigation	Ease of implementation: Institutional	Ease of implementation: Technical	Ease of implementation: Financial	Priority level
		codes (orientation of constructions in areas protected by floods and marine erosion)						
		Mainstreaming climate change adaptation into sectoral development planning legislation, regulations, procedures and tools (including building codes and standards for housing and other infrastructure)	High	Medium	High	Medium	Medium	Very high
		Enforcement of (revised) national, territorial and sector level legislation and regulations (building codes, water resources…)	High	Low	Medium	High	Low	High
	Increase funding for climate change adaptation: financing and fiscal planning	Mobilization of financial resources for climate change adaptation (DR preparedness, including for relocation)	Medium	Medium	High	Medium	Medium	Very High
		Fiscal preparation, including an emergency fund for disaster risk response, recovery and reconstruction	High	Low	Medium	Medium	Low	High
		Establishment of incentives and subsidies for climate smart practices (e.g., climate proofing buildings, energy efficient technologies)	High	High	High	Medium	Low	Very high
		Developing insurance schemes and social protection systems for climate change-related disasters	High	Low	Low	Low	Low	Medium
Scientific, technical and societal capacity	Generating scientific evidence to support decision-making on CCA	Support research on and monitoring of physical, biological and social aspects, including climate-related variables (including sea level and extreme weather events), the erosion of the coast, coastal and marine ecosystems, vector-borne diseases, natural resources (e.g. water and food quantity and quality, air quality),	High	Medium	Medium	Medium	Medium	Very High

Adaptation measures			Co-benefit potential		Ease of implementation			Priority level
			Develop-ment	Mitigation	Institutional	Technical	Financial	
		the built environment (e.g. location, density) and socio-economic and demographic aspects, including the modernization of monitoring equipment and systems						
		Monitor vulnerability (conduct vulnerability assessments and develop risk maps, at the territorial and sectoral levels (including infrastructure))	High	Low	High	Low	Medium	Very high
		Ensure effective communication of monitoring information to relevant sectoral and territorial actors, including through the development of end-to-end, people-centred and multi-hazard early warning (MHEW), including on floods	High	Low	Low	High	High	Very high
		Monitor and assess the implementation and results of adaptation programmes, projects and actions, ensuring the engagement of women in this process	Medium	Low	High	High	High	Very high
	Enhancing technical capacity	Capacity building (e.g. training, best practice exchange, development of guidelines) on climate change, its impacts (e.g. ecosystems, buildings, water and energy infrastructure, health) and the design, implementation, monitoring and evaluation of adaptation actions of key stakeholders (e.g. policy and decision makers, planning authorities, implementers)	High	Medium	High	Medium	High	Very high
	Awareness raising	Public information and awareness raising (e.g. awareness raising campaigns) on climate change, its impacts and the design, implementation, monitoring and evaluation of adaptation actions (e.g. heat related, resources efficiency, reclying)	High	Medium	High	Medium	Medium	Very high

Adaptation measures				Co-benefit potential		Ease of implementation			Priority level
				Develop-ment	Mitigation	Institutional	Technical	Financial	
Climate proofing residential and productive infrastructure, touristic accommodation and assets and health (and other social) facilities	Climate change delivery	Climate proofing coastal buildings and facilities to prevent further damage and degradation	Determining (green and blue) buffer zones in risk-prone areas (in the coast and in-land)	High	Medium	High	High	Medium	Very high
			Construction and maintenance of protective infrastructure (e.g. sea defences/concrete gates, increasing the level of river beds (desilting, widening channels)	Medium	Medium	High	Low	Low	Medium
			Climate proofing buildings (covering of buildings' walls and roofs with thermoisolating materials, the using of double glass windows and doors, green roofs, natural ventilation, fire evacuation routes and fire protection systems)	Medium	High	High	Medium	Low	High
Adapting the supporting built environment		Water	Integrated water basin and watershed management (e.g. protection of forest in the upper areas of watersheds)	High	Medium	Medium	Medium	Medium	Very high
			Protection of ground water (e.g. strengthening and modernization of evacuating system of salty waters, in order to impede their penetration deep in the land and their mixing with fresh waters)	High	Low	High	Low	Low	High
			Construction and maintenance of rainwater harvesting infrastructure, including water reserves	High	Low	High	High	High	Very high
			Construction and maintenance of desalination plants	High	Low	High	Medium	Low	High
			Climate proofing existing water infrastructure (e.g. pipes)	High	Low	High	Medium	Low	High
			Increase the efficiency of water use, with a focus on infrastructure	High	High	High	Medium	Medium	Very high
		Energy	Promote additional renewable energy infrastructure to diversify source of power generation	High	High	High	Low	Low	Very high

Adaptation measures				Co-benefit potential		Ease of implementation			Priority level
				Develop-ment	Mitigation	Institutional	Technical	Financial	
			Developing capacity to access energy from neighbouring countries (incl. integration in ENTSO network)	High	Medium	Low	Low	Low	Medium
			Promote energy efficiency, including the reduction of power losses in the distribution network	High	High	High	Medium	Low	Very high
			Climate proofing energy infrastructure	High	Low	High	Low	Low	High
		Transport	Climate proofing transport infrastructure	High	Low	High	Medium	Low	High
		Telecommunications	Climate proofing telecommunications infrastructure	High	Low	High	Medium	Low	High
Adapting the supporting natural environment		Adopt integrated, ecosystem-based approaches (EbA) and/or nature based solutions (NbS)	Protection and restoration of existing forest/vegetation, reforestation	High	High	High	Medium	Medium	Very high
			Managing/restoring river beds (embankments) and reforesting river sides to increase water retention	High	High	High	High	Low	Very high
			Protection and restoration of coastal wetlands	High	High	High	Medium	Low	Very high
			Green approaches to the built environment (green roofs, streets, corridors and open spaces/ water open spaces)	High	High	Medium	High	High	Very high
		Protected areas	Strengthen the system of protected areas, including coastal and marine ecosystems, for effective conservation and sustainable use	High	High	High	Medium	Medium	Very high
		Promote climate-smart and sustainable agriculture, forestry and fisheries		High	High	High	Medium	Medium	Very high
Strengthening disaster risk management			Strengthening capacity of civil defence/emergency units to respond to extreme weather events (e.g. medical assistance during summertime)	High	Low	Medium	Medium	Medium	Very high
			Displacement and relocation of high-risk infrastructure (particularly residential and	High	Low	Low	Low	Low	Medium

Adaptation measures		Co-benefit potential		Ease of implementation			Priority level
		Develop-ment	Mitigation	Institutional	Technical	Financial	
	social infrastructure) in safer territories						
Promote gender equality in terms of climate change adaptation	Promote gender equality in decision making on climate change policies on central levels of policymaking and strengthen capacities of institutions to integrate gender considerations in climate change policies	High	Low	Medium	High	High	Very high
	Update the relevant national and local strategic documents in order to integrate best practices and information with gender and climate change issues taken into consideration	High	Low	Medium	Medium	High	Very high
	Develop and pilot gender-related climate change adaptation projects with demonstration and awareness focus on AFOLU as well as energy at local level	High	Low	High	Medium	High	Very high

7.8.2. AFOLU

Crops

Adaptation Measures in Crops Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	0.8	0.2	0.3	0.3	0.4	
Construction of new modern irrigation system and rehabilitation and modernization of existing irrigation systems to restore irrigation	High	Medium	Medium	Medium	High	Very High

Adaptation Measures in Crops Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	0.8	0.2	0.3	0.3	0.4	
on360.000 ha arable land, which could potentially be irrigated						
Gradual transition from classic forms of gravity irrigation to modern forms of irrigation (sprinkler and drop irrigation	Medium	Medium	Medium	Medium	Medium	High
Strengthening water use associations for the management of the of the irrigation water and raising the awareness of farmers for the payment of the irrigation fee	Medium	Low	Low	Low	Medium	Medium
Construction of a new drainage system and rehabilitation of existing drainage infrastructure	High	Medium	Medium	Medium	High	Very High
Increase by at least 50% of the current number of excavators and machinery needed for maintenance of drainage infrastructure	High	Medium	Medium	Medium	High	Very High
Increase the financial support for municipalities, to undertake the necessary interventions in the secondary and tertiary drainage canals.	Medium	Medium	Medium	Medium	Medium	High
Increase of the flood protection capacities. From a total of 850 km of river and sea embankments, about 300 km of them, need urgent repairs.	High	Medium	Medium	Medium	High	Very High
The update of the river management plans (river Buna, Drin, Mat, Shkumbinand Vjosa), and assessment of the additional interventions, needed for flood cases in the areas with medium and high risk.	Medium	Low	Medium	Medium	Medium	Medium
Application of subsidy schemes for farmers, for the introduction of new technologies in agricultural production.	High	Medium	Medium	Medium	Medium	Very High
Financial support for the application of agricultural crop insurance schemes, for the harmful effects of climate change	High	Medium	Medium	Medium	Medium	Very High
Increase institutional capacity, to monitor climate indicators, as well as indicators related to the effects of climate change in agriculture	Medium	Low	Medium	Medium	Medium	Medium
Raising the awareness of farmers and agricultural specialists, on the risk posed by climate change in agriculture, as well as necessary measures to adapt to these climate changes.	Medium	Low	Medium	Medium	Medium	Medium
Introduction of new cultivation techniques, such as direct planting, (no-tillage systems), as well as soil mulching	Low	Low	Medium	Medium	Medium	Medium

Adaptation Measures in Crops Sector Weights	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
	0.8	0.2	0.3	0.3	0.4	
Application of agroforestry practices, combining the growth of agricultural crops accompanied by forest trees, and construction of hedgerows and windbreaks on the fields planted with crops	Low	Low	Medium	High	Medium	Medium
Reduction as much as possible of chemical inputs in agriculture and introduction of new cultivation technologies	Medium	Medium	Medium	High	Medium	High
Promotion of organic farming and application of precision farming systems	Low	Low	Medium	Medium	Medium	Medium
Introduction of pest and disease resistant cultivars, as well as improvement of pest monitoring and information system	Medium	Medium	High	Medium	Medium	High
Application of crop cultivation in protected environments, increasing the area of greenhouses, tunnels and hail protection systems	Medium	Medium	Medium	High	Medium	High
Promoting plant breeding programs, which are focused on development of new cultivars adapted to climate change (drought and cold resistant)	Medium	Low	Medium	Medium	Medium	Medium
Application of crop rotation practices, in the plain areas of the country, as well as the planting of perennial crops, in hilly and mountainous areas,	Low	Low	Medium	Medium	Medium	Medium
Diversification of crops cultivated on farm, and diversification of farm activities, altering of agricultural production with agroprocessing, agro-tourism etc.	Medium	Low	Medium	Medium	Medium	Medium

Livestock

Adaptation measures	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	*0.8*	*0.2*	*0.3*	*0.3*	*0.4*	
Increase institutional capacity, to monitor climate indicators, livestock data, regarding the number, level of production in different seasons for respective AEZ.	Very High	Medium	High	High	High	Very High
Development of livestock sectoral climate change adaptation plans	Very High	High	High	High	High	Very High
Development of National Strategies and Action Plans for Agricultural Genetic Resources	High	Medium	High	High	High	Medium
Establishment of a weather alert system to enable livestock farmers to protect animals. Improve the capacities of livestock farmers and herders to understand and cope with risk posed by climate change in livestock.	Very High	Medium	High	High	High	Very High
Application of subsidy schemes to farmers, for the introduction of new technologies in livestock husbandry, diversification and processing activities.	Very High	High	High	High	High	Very High
Financial support for the application of livestock insurance schemes, for the harmful effects of climate change	Very High	High	High	High	High	Very High
Strengthening capacities of national veterinary service to protect animal health and wellbeing.	Very High	High	Very High	High	High	Very High
Improving the livestock sector's environmental sustainability. Increasing efficiency of natyral resources use.	High	Medium	Very High	High	High	High
Capacity building of institutions and farmers associations to plan and implement appropriate breeding programs to improve animal production and their resistant to climate change.	Very High	High	Very High	Very High	Very High	Very High
Capacity building of farmers for conservation and sustainable use of native animal genetic resources, as more resistant and adapted to climate changes and environment.	High	High	High	High	High	High
National cryo-bank establishment or enhancing collaboration with international gene banks for cryo conservation of most vulnerable native animal genetic resource.	Very High	Medium	Very High	High	High	Very High
Improving the livestock sector's environmental sustainability. Increasing efficiency of natural resources use.	High	High	High	Medium	High	Medium
Diversification, intensification and/or integration of pasture management, crop production and agro forestry practices for extensive system of livestock husbandry.	High	High	Medium	Medium	High	Medium

Adaptation measures	Co-benefit potential		Ease of implementation			Priority level
Increasing the efficiency of pasture management through sustainable grazing practices like as rotational grazing, adjusting the frequency and timing of grazing to match the livestock's needs with the availability of pasture resources. Establish and maintain water points for livestock in grazing areas and shelters to protect animals during hot seasons.	High	High	Medium	Medium	Medium	Medium
Implementation mixed livestock farming systems, such as stable -fed systems during winter and pasture grazing, in the spring-autumn period. Better use of alpine pastures, during summer especially for fattening animals to avoid overgrazing near villages.	High	Medium	Medium	Medium	Medium	Medium
Increasing livestock mobility, traditional strategy of transhumant herders; in winter period from mountainous regions to low land regions and vice versa during summer time	High	Medium	Medium	High	High	Medium
Applying agroforestry as an intergrated approuch for extensive grazinfg system of livestock	High	High	High	High	High	High
Diversification of farm animal species because they exploit different feed resources. They can be affected differently from the outbreak of diseases. They have different reproductive rates and can contribute differently to rebuild livestock holding after drought, disease or natural disasters.	High	High	Medium	High	High	Medium
Improve the environment inside housings/application of efficient cooling equipments like as fans, water sprinklers to minimize heat stress. Planting trees round stables.	Medium	Medium	Medium	High	High	Medium
Improve management of water resources through the introduction of simple techniques for localized irrigation (e.g. drip and sprinkler irrigation), accompanied by infrastructure to harvest and store rainwater, such as tanks connected to the roofs of houses and small surface and underground dams.	High	High	High	High	High	High
Improving farmers knowledge to appropriate animal husbandry, feed conservation methods, feeding practices and reproductive strategies.	Very High	Medium	High	High	Medium	High
Reduction of livestock number, keeping most productive animals especially for stable fed system.	High	Very High	High	Medium	High	Medium

Forestry

Adaptation Measures in Forestry Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	***0.8***	***0.2***	***0.3***	***0.3***	***0.4***	
Improve capacities in forest fire management	High	Medium	High	High	High	Very high
Improve logistics in fire fighting	High	High	Medium	High	High	Very high
Improve information on fire detection	High	Medium	High	High	High	Very high
Improve public awareness	Medium	High	High	High	Medium	Very high
Improve communication	High	High	High	High	Medium	Very high
Change from pure to mixed forests	High	Low	Low	High	High	Very high
Establish a national and local network of experts and volunteers	High	Low	High	High	High	Very high
Manage forests to ensure that a high diversity of species	High	Medium	Medium	High	High	Very high
Manage forests to ensure that a high diversity of age classes	High	Medium	Medium	High	High	Very high
Introduce silvicultural measures in sensitive areas	High	Medium	Medium	High	High	Very high
Afforestation in bare lands inside forest	High	High	High	High	High	Very high
Improve of monitoring in forest health	High	High	High	High	High	Very high
Promote multifunctional forest systems	High	High	High	Medium	High	Very high
Implement intensive thinning to reduce density and favor vitality of the remaining trees.	High	High	Medium	High	High	Very high
Support drought-resistant genetic to replace species at the limit of their site suitability	High	High	Medium	High	High	Very high
Variation (extended or reduced) crop rotation periods	Medium	High	High	High	High	Very high
Prioritize silviculture to protect valuable biodiversity stands	High	High	High	High	Medium	Very high
Adoption of nursery techniques to obtain a hardening in the plant characteristics	High	High	High	High	High	Very high
Promotion of mixed forests, uneven-aged forests and forest conversion	High	High	Medium	High	High	Very high
Avoid soil erosion and compaction to preserve water storage	High	Medium	High	High	Medium	Very high
Protect and manage understory	Medium	Low	Low	Low	Medium	Medium
Improve of monitoring in forest health	High	High	High	High	High	Very high
Improve information on pest and diseases management	High	Medium	High	High	High	Very high
Implement the ‘quarantine’ for new pests/diseases	Medium	High	High	High	Medium	Very high

Adaptation Measures in Forestry Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	***0.8***	***0.2***	***0.3***	***0.3***	***0.4***	
Introduce cost effective practices in pest/diseases management and environmentally friendly	Medium	Medium	Medium	Medium	Medium	High
Maintain mixed forests, uneven-aged forests, and forest conversion	High	Medium	Medium	High	High	Very high
Prioritize silviculture to protect valuable biodiversity stands	High	Medium	Medium	High	High	Very high
Improve information at international and local level	High	High	Medium	High	High	Very high
Improve capacity building	High	High	High	High	Medium	Very high
Protect and manage understory	Low	Medium	Medium	Medium	Low	Medium
Promote species resistant	High	High	Medium	Medium	Medium	Very high
Avoid water stress to species	Medium	Medium	Medium	Medium	Medium	High
Develop an action plan to deal with most present pest and pathogens in Albanian forests	High	High	High	High	High	Very high
Improve utilization of timber and non-timber products	High	High	High	Medium	Medium	Very high
Improve capacities in all forest management aspects	High	High	High	Medium	High	Very high
Improve of capacities on pests and diseases management	High	High	High	High	High	Very high
Introduce new technologies in afforestation and forest management	High	High	High	High	High	Very high
Establish forest extension service at local level	High	High	High	Medium	High	Very high
Draft an action plan for research and innovation in forestry sector	High	High	High	Medium	High	Very high
Implement of monitoring in forest health	High	Medium	High	High	High	Very high
Promote multifunctional forest systems	High	Medium	High	High	High	Very high
Implement intensive silviculture measures	High	Medium	Medium	High	High	Very high
Support forest biodiversity species	High	Medium	Medium	Medium	High	Very high
Adaptation in (extended or reduced) crop rotation periods	High	Medium	Medium	Medium	Medium	Very high
Prioritize silviculture to protect valuable biodiversity stands	Medium	Low	Low	Medium	Medium	Medium
Landscape regeneration at large scale	High	High	High	High	High	Very high
Promotion of mixed forests, uneven-aged forests and forest conversion	Medium	Medium	Low	Low	Low	Medium
Introduce fast growing species	High	Medium	Medium	Medium	Medium	Very high
Protect the forests from overgrazing	High	Medium	Medium	Medium	Low	High
Improve pests and diseases management	High	High	High	High	High	Very high
Change from pure to mixed forests in artificial plantations	Medium	Medium	Low	Low	Low	Medium
Improve flood protection for coastal forests	Medium	Medium	Medium	Medium	Medium	High
Diversify energy sources to reduce pressure on forests	High	Medium	Medium	High	High	Very high

Adaptation Measures in Forestry Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	***0.8***	***0.2***	***0.3***	***0.3***	***0.4***	
Improve energy efficiency to reduce pressure on forests	High	Medium	Medium	High	High	Very high
Guide species composition in forests	Medium	Medium	Low	Low	Low	Medium
Afforestation in burned areas	High	High	High	High	High	Very high
Introduce new technologies in afforestation and forest management	High	High	High	High	High	Very high
Implement an action plan for research and innovation in forestry sector	High	High	Medium	High	High	Very high
Support natural regeneration in places where it is possible	High	High	High	High	High	Very high
Support conversion from shrubs and coppice to high forest	Medium	Medium	Low	Low	Low	Medium
Create and condition for the fir (Abies sp.), silver birch (B.pendula) and the scot pine (P.sylvestris) to shift/migrate since their habitat is currently isolated	High	Medium	Medium	High	High	Very high
Draft management plans for forest and pastures management unit (FPMU)	High	High	High	Medium	High	Very high
Introduce ES for every big hydropower plants in Albania	High	Medium	Medium	Medium	Medium	Very high
Introduce ES for protection of infrastructure (road network)	High	Medium	Medium	Medium	Medium	Very high
Introduce ES for protection of tap water (Bovilla)	High	High	Medium	High	High	Very high
Introduce ES for coastal protection	High	High	Medium	High	High	Very high
Landscape regeneration at large scale	High	High	High	High	High	Very high
Introduce ESs in all related fields in the country	Medium	Medium	Medium	Medium	Medium	High
Approximate and implement EU regulations relevant to forestry	High	High	Medium	High	High	Very high
Improve law implementation	High	High	High	High	High	Very high
Support for introducing new technologies in forest sector	High	High	Medium	High	High	Very high
Support for adaptation for some important species (fir, Scot pine, silver birch etc.)	High	Medium	Medium	High	High	Very high
Implement national strategy and action plan for climate changes	High	High	Medium	High	High	Very high
Support for increasing forestry area	High	High	High	High	High	Very high
Improve of politics and financial instruments to make the forestry sector efficient	High	High	High	High	High	Very high
Draft a national plan for afforestation based on ecologic settings	High	High	Medium	High	High	Very high

Pastures and Meadows

Adaptation Measures in Pastures and Meadows Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	*0.8*	*0.2*	*0.3*	*0.3*	*0.4*	
Strengthen the capacities of the newly established Forestry Agency and the Forestry Unit at Municipality level on developing including pastures and meadows in the regional development plans, including designating specific role and responsibilities in adapting against climate changes	Low	High	High	High	Medium	High
Development of strategies for sustainable pastoralism	Medium	Medium	Medium	Medium	Low	Medium
Design of climate change projections targeting alpines and highlands and the pasture vulnerability	Medium	High	High	Medium	Medium	Very High
Strengthen capacities of Forestry and pasture units in the Local Authority level on evaluation pasture resources, as preparedness for risk assessment	High	Medium	Low	Medium	Low	High
Support Universities and research institutes on developing research and studies on risk assessment for pastures	Low	Medium	Medium	Medium	Low	Medium
Support smallholder livestock communities in rural and highland areas through based local investment programs, by scaling up and integrating climate change adaptation options	Medium	High	Medium	Medium	Low	Medium
Monitoring of biodiversity and species composition in pasture, including the exploitation and management of Invasive Alien Species (IAS)	Low	Medium	Medium	Low	Low	Medium
Improvements on predicting capacity on the status of bio-resources through improving the research on pasture biodiversity and productivity	High	High	Medium	Low	Low	High
Protect and preserve pasture and meadows through ecosystem-based management.	Medium	High	High	Medium	Low	High

Wetlands and Lagoons

Adaptation Measures in Lagoons and Wetlands Sector	Co-benefit potential		Ease of implementation			Priority level
	Development	Mitigation	Institutional	Technical	Financial	
Weights	*0.8*	*0.2*	*0.3*	*0.3*	*0.4*	
Institutional and organizational strengthening of central and local governmental structures (NAPA and RAPA) and local municipalities on developing the structures at regional and local level which are capable on identifying and addressing the stressors and develop Adaptive Management Plans.	Medium	High	High	High	Medium	**Very High**
Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan, including lagoons and protected areas)	Medium	High	Medium	High	Medium	**Very High**
Proclaiming additional Marine Protected areas along the wetland and lagoon area which will supported integrated efforts into developing adaptation measures	Medium	High	High	Medium	Low	**High**
Development of risk management plans especially on Flood Prevention	Medium	High	Low	Medium	Low	**Medium**
Rehabilitation and restoration of degraded habitats, including barriers in lagoon/wetland, along the coastal zone	Medium	High	High	Medium	Low	**High**
Maintain water communication of lagoon areas with the sea through the natural communication channels	Medium	High	Medium	Medium	Low	**Medium**
Support monitoring agencies in design and perform water quality in each wetland/lagoon to track impacts of climate change on abiotic factors (temperature and dissolved oxygen) to reduce risks through environmental quality monitoring methods and techniques	Medium	High	Medium	High	Low	**High**
Supporting research communities in perform biodiversity monitoring programs in each wetland/lagoon, including bird population and Invasive species	Medium	High	High	High	Low	**High**
Development of ecotourist activities in the wetland/lagoon area such as birdwatching, hiking, etc	Medium	Medium	Medium	Medium	Medium	**High**
Control of water extraction in the aquifer	Low	Medium	Medium	Low	Medium	**Medium**
Establishing the early warning system to prevent floods and fires with impact on sensitive areas/habitats	High	High	Medium	Medium	Low	**Very High**
Protect and preserve natural resources within lagoon and wetland areas through sustainable management and planning of all economic activities	Medium	High	High	High	Medium	**Very High**
Training and qualification for local administration and communities living within Protected areas on climate change impacts	Medium	Medium	High	High	Medium	**Very High**

Fishery

Fishery Adaptation Measures		Weights	Co-benefit potential: Development 0.8	Co-benefit potential: Mitigation 0.2	Ease of implementation: Institutional 0.3	Ease of implementation: Technical 0.3	Ease of implementation: Financial 0.4	Priority level
Institutional Adaptation	Strengthen the institutional framework (e.g. coordination)	Institutional and organizational strengthening of central and local governmental structures (following a co-management approach) in providing interconnection between planning authorities and other inter-sectoral bodies that play a role in adapting against climate changes	High	Low	Low	Medium	Medium	High
	Strengthen the policy framework: development and enhancement of laws, policies regulations and plans, including action plans	Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan, including lagoons and fishery sectors)	High	Low	Low	Medium	Medium	High
		Development of fishery sectoral climate change adaptation plans and the supporting sectors (water, energy and agriculture)	High	Medium	Medium	Medium	Medium	Very high
		Development of risk management plans	High	Medium	Medium	Medium	Medium	Very high
	Improved Management of Fishery sectors based upon risk assessment and monitoring (e.g. incorporating system feedbacks)	Addressing the specific needs of small scale coastal fishing and supporting the socio-economic role of sea fisheries in coastal and insular areas	Medium	Medium	Medium	Medium	High	High
		Restructuring and modernize the fishing fleet by improving work and safety, conditions, the quality and hygiene of products, energy efficiency and selectivity	High	High	Medium	Medium	Low	Very high
		Improving the age structure of employment in the sea fisheries sector and promoting the diversification of activity and parallel employment, as alternative solution to impacted fishery related activities by the CC	High	High	Medium	Medium	Low	Very high
		Supporting populations dependent on the fisheries sector in coastal and isolated areas	Medium	Medium	Medium	Medium	High	High
Livelihood Adaptation	Strengthen the coordination and management framework within and between the	Strengthening the sector by investing in development of new markets and expanding the range of offered products	High	High	Medium	Medium	Low	Very high
		Strengthening capacities to assess the future state of the sector due to climate change impacts	High	High	Low	Medium	Medium	High

Fishery Adaptation Measures			Co-benefit potential		Ease of implementation			Priority
			Development	Mitigation	Institutional	Technical	Financial	
	fishery sectors: at national and local levels (e.g. municipalities)	Strengthening the resilience of natural resources through adaptive fisheries management	High	High	Low	Medium	Medium	High
		Increasing the involvement of fishers in the tourism sector (like pesca-tourism)	Low	Medium	Medium	Medium	High	Medium
		Exploitation and Management of Invasive Alien Species (IAS)	Low	Medium	Medium	Low	High	Medium
		Strengthening aquaculture capacities by following ad-hoc recommendation and measures regarding environmental parameters and diseases	High	High	Medium	Low	High	Very high
		Improving aquaculture capacities by species diversifying, while oriented toward local and international markets	Medium	High	Medium	Low	High	High
		Strengthening aquaculture capacities by using properly fingerlings in the on growing-facilities	Medium	Medium	Medium	Medium	High	High
		Improving aquaculture capacities by adapting qualitative and proper feed quantity to changed climate conditions	Medium	Medium	Medium	Medium	High	High
Risk Reduction and Management for Resilience	Early warning measures	Improvements on predicting capacity about the future status of bio-resources	Medium	High	Medium	Low	High	High
		Study and record of the impact of climate change on current used techniques in aquaculture to develop new more efficient methods and techniques	Medium	High	Medium	Low	High	High
		Intensifying cooperation towards the direction of detection and prevention of new diseases, study of the physiology of marine species, conduct research into new and better able species to adapt and better nutritional systems that are both effective and environmentally friendly.	High	High	Medium	Low	High	Very high
	Risk pooling and transfer	Insurance aquaculture to avoid the risk of bankruptcy for fish farmers from damage to their facilities due to extreme weather events; incentives to insure and avoid long-term reductions in production and social problems of the abandonment of their profession	High	High	Medium	Low	High	Very high
	Risk Reduction	Reducing exposure to risks at sea, such as storms and winds, can include training and provision of safety gear or GPS devices (it mainly includes lakes and marine fisheries).	Medium	Medium	Low	Low	High	Medium
		Increased resilience of aquaculture to reduced flow of	Medium	High	Medium	Low	High	High

Fishery Adaptation Measures			Co-benefit potential		Ease of implementation			Priority
			Development	Mitigation	Institutional	Technical	Financial	
		water, changes in water physicochemical parameters, and occurrence/spread of fish and mussel's diseases						
	Preparedness and Response	Protect and preserve fisheries resources via a gradual transition from a fisheries management policy based on the control of fishing effort to an ecosystem-based management.	High	High	Medium	Medium	Medium	Very high
		Strengthening research capacities in the field of selective breeding, aqua-feed and breeding in closed systems.	Medium	High	Medium	Low	High	High
		Apply aquaculture closed production systems and integrated aquaculture technologies	Medium	Medium	Medium	Low	Medium	Medium