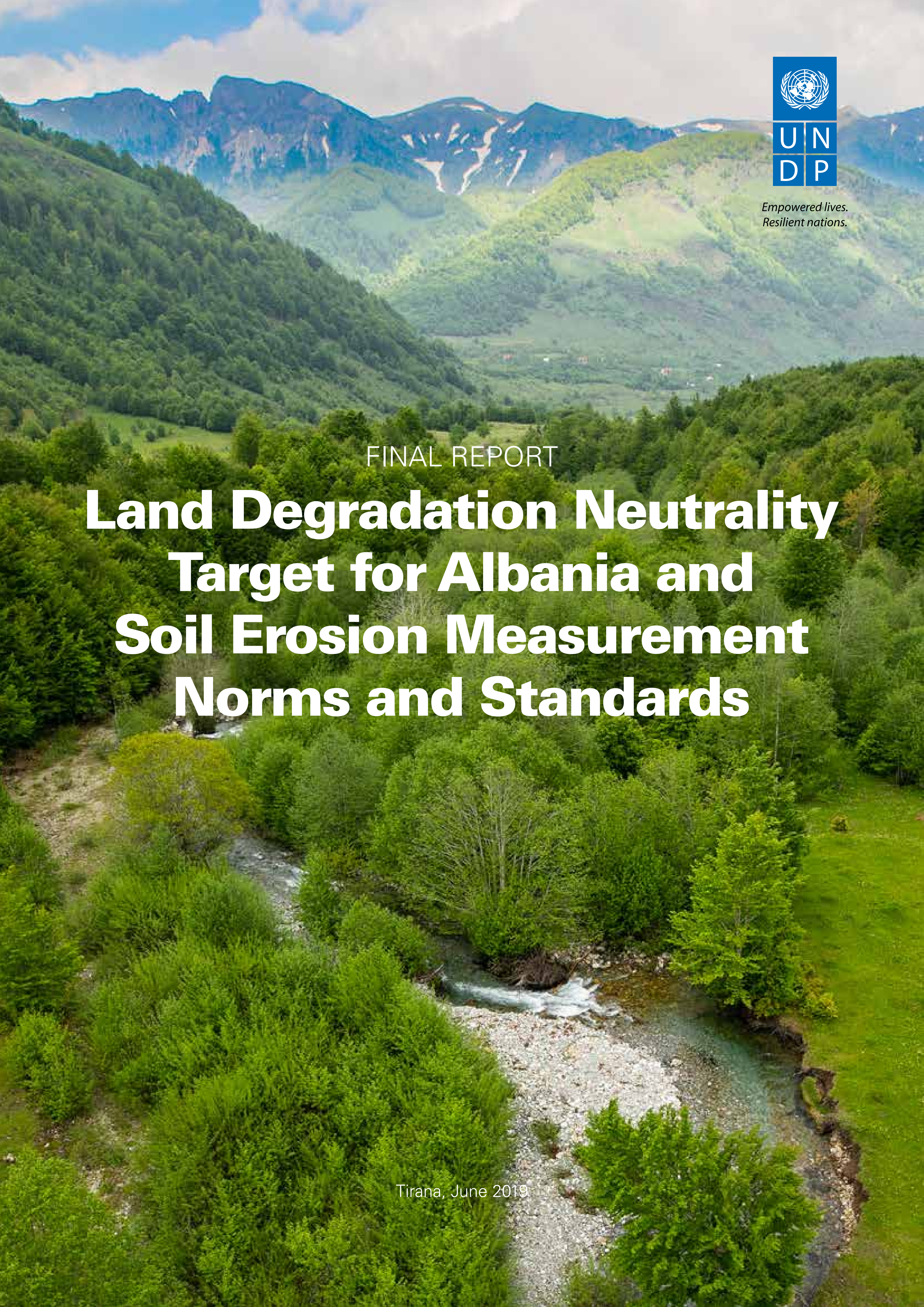

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FINAL REPORT

Land Degradation Neutrality Target for Albania and Soil Erosion Measurement Norms and Standards

Tirana, June 2019

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Photo on the Cover
Përroi i Skrapatushës, Velipoja, Vermosh/ Alket Islami

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Abbreviations

AUT	Agricultural University of Tirana
CBD	UN Convention on Biological Diversity
CEMSA	Consolidation of the Environmental Monitoring System in Albania
CLC	CORINE Land Cover
CSO	Civil Society Organisations
DCM	Decisions of the Council of Ministers
EAP	Environmental Action Program
EIMMS	Environmental Information Management and Monitoring System
EIMS	Environmental Information and Monitoring System
EEA	European Environment Agency
EU	European Union
ECS	Environmental Crosscutting Strategy
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	The statistical department of the FAO
GAEC	Good Agricultural and Environmental Conditions
GEF	Global Environment Facility
GEO	Group on Earth Observations
GSP	Global Soil Partnership
HLPF	High-Level Political Forum
IAEG-SDGs	Inter-Agency and Expert Group on Sustainable Development Goal Indicators
INSII	International Network of Soil Information Institutions
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
ITPS	Intergovernmental Technical Panel on Soils
IUCN	International Union for Conservation of Nature and Natural Resources
IWG	Intergovernmental Working Group
LCCS	Land Cover Classification System
LDN	Land Degradation Neutrality
LUCAS	Land Use/Cover Area frame Statistical Survey
LULUCF	Land Use, Land Use Change and Forestry
MAES	Mapping and Assessment of Ecosystem Services

MDGs	Millennium Development Goals
MARD	Ministry of Agriculture and Rural Development
MIE	Ministry of Infrastructure and Energy
MTE	Ministry of Tourism and Environment
NEPA	National Environment Protection Agency
NCCS	National Climate Change Strategy
NGO	Non-Governmental Organisation
PFD	Policy Forum on Development
RED	Regional Environmental Departments
CLP	Regional Commission on Land Protection
RC	Regional Councils
SDGs	Sustainable Development Goals
SDO	Sustainable Development Observatory
SLM	Sustainable Land Management
SOC	Soil Organic Carbon
SEMS	Soil Erosion Monitoring System
SPI	Science Policy Interface
SCLP	State Committee on Land Protection
SILP	State Inspectorate of Land Protection
TEEB	The Economics of Ecosystems and Biodiversity
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNFCCC	United Nations Framework Convention on Climate Change
USLE	Universal Soil Loss Equation
UNCCD	United Nations Convention to Combat Desertification
UNCCD SPI	United Nations Convention to Combat Desertification Science-Policy Interface
VGGT	FAO Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests
WOCAT	World Overview of Conservation Approaches and Technologies

Glossary of selected terms

"arid, semi-arid and dry sub-humid areas" means areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65;

"affected areas" means arid, semi-arid and/or dry sub-humid areas affected or threatened by desertification;

"affected countries" means countries whose lands include, in whole or in part, affected areas;

"biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.

"biological resources' includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

"desertification" means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities;

carbon stock. The quantity of carbon in a 'pool, meaning a reservoir or system which has the capacity to accumulate or release carbon. It includes carbon in above-ground biomass (carbon in all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage) and soil carbon (organic carbon in mineral and organic soils (including peat) to a specified depth) (FAO, 2005).

"combating desertification" includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at:

- prevention and/or reduction of land degradation;
- rehabilitation of partly degraded land; and
- reclamation of desertified land;

"drought" means the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems;

"ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

ecosystem services. According to the Millenium Ecosystem Assessment (2005), ecosystem services are "the benefits people obtain from ecosystems", and four categories are distinguished: supporting, provisioning, regulating and cultural services.

FAO. Food and Agriculture Organization of the United Nations

farmland. Includes cropland as well as intensive pasture.

forest. based on the FAO categories of land use, forests are determined both by the presence of trees (tree canopy cover of more than 10%) and the absence of other predominant land uses.

grassland. Grassland refers to grassy, partly dry biomes and also includes extensive open land used for pasture and grazing. International Food Policy Research Institute.

'habitat" means the place or type of site where an organism or population naturally occurs.

"land" means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system;

"land degradation" means reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

- soil erosion caused by wind and/or water;
- deterioration of the physical, chemical and biological or economic properties of soil
- long-term loss of natural vegetation;

"land degradation neutrality" means a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.

"mitigating the effects of drought" means activities related to the prediction of drought and intended to reduce the vulnerability of society and natural systems to drought as it relates to combating desertification;

"protected area" means a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.

"soil erosion" is the washing or blowing away (by water or wind) of the top layer of soil.

"soil pollution" is defined as the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and/ or the ecosystem.

"sustainable development" is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".[1]

Sustainable Development Goals (SDG). The Sustainable Development Goals are a UN Initiative, officially known as "Transforming our world: the 2030 Agenda for Sustainable Development". They are a set of 17 Goals associated with 169 targets for 2030, adopted in September 2015 by the 193 countries of the UN General Assembly.

"sustainable use" means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

1. Our Common Future, also known as the Brundtland Report

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01 Introduction

1.1 National overview

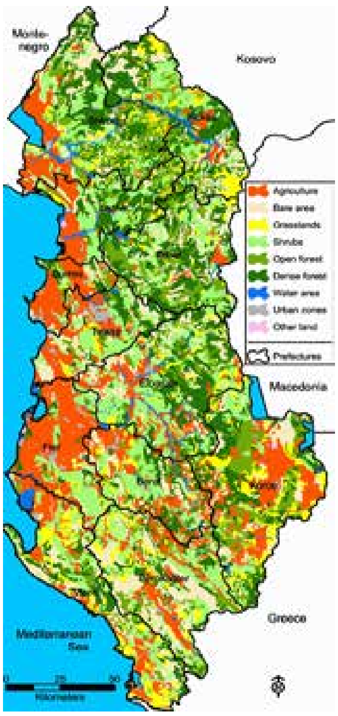
Albania is located in South-Eastern part of Europe. The country has a total territory of 28,748 km^2, of which 24% is agricultural land, 36% forest and 16% pastures and meadows (figure 1). The remaining 24% is classified as other, which includes urban areas, lakes and waterways and unused rocky. The population is 2,787,600 inhabitants (2013)[2]. Albania is part of the Mediterranean Alps, and is characterized by a diversity of rock formations. The relief is mostly hilly and mountainous (more than 75% total area[3]). The highest point is 2751 m above sea level (Korabi Mountain) and the lowest one is 8 meters below sea level (Terbufi). The averege altitude of the country is 708 m above the sea level and only 16.2 percent are below 100 m above sea level. The altitude declines moving from the east to the west of the country, and this determines the conditions of the climate, land, and vegetation. The Adriatic and Ionian Seas have a great impact on the climate, flora and fauna. Albania is rich of rivers, lakes, wetlands, groundwater, and seas. The main rivers are the Drini, Buna, Mati, Shkumbini, Semani, Vjosa, Erzeni, Ishmi and Bistrica and their courses have an important effect on the country's coastal biodiversity. Albania's is divided into six river basins: Drin basin , Mat basin, Ishmi and Erzen basin, Shkumbin basin, Seman basin and Vjosë basin. About 247 natural lakes, and a considerable number of artificial lakes, are located inside the country.

Among the more important ones are the transboundary lakes of Shkodra, Ohrid, and Prespa, the largest ones in the Balkans. In the coastal area of

2. INSTAT, 2012
3. FAO country report, http://www.fao.org/ag/agp/agpc/doc/counprof/albania/albania.htm

Albania there are such wetlands as Karavasta, Narta, Patoku, Kune-Vaini, Orikumi, and others, with a total area of 150 km^2.[4] The soils of Albania are varied and create special zones according to the climate, flora, relief etc.

Figure 1. Albania land cover



The coastal zone is mostly occupied by fertile alluvial soils; the sub mountainous zone in the center is covered by hills with mainly flysch (sandstones and schists) and marls, while most of the eastern part of the country is covered by high mountain massifs mainly consisting of limestone. There are four soil zones according to their altitudes: grey - brown soils occur at altitudes up to 600 m make up about 15% of the country along the coastal area of which 70% are under crops; brown mountainous soils occur in the interior of the country, at altitudes from 600 to 1000 m an make up 38% of the total area (40% arable land); grey forest soils occur at altitudes from 1 000 to 1 800 m and make 15% of the total land area (of which 10% is cultivated); mountain meadow soils occur at altitudes of 1 600 – 2 600 m and make 10% of the country area[5].

Soil erosion is identified as a big problem in Albania. Estimates for soil erosion show values from 32 tons per hectare up to 185 tons per hectare[6]. The main factors causing erosion are the climate (altitude, mountainous terrain, rainfall and bare slopes) and human activities such as deforestation, irrigation, overgrazing, topography modifications, field and forest fires and lack of proper measures against erosion. Another form of land degradation is the landslides, found in many areas throughout country, greatly reducing not only to the sustainability of agriculture but also the long term security of rural housing[7]. Eroded areas are spread all over, but most typically they occur in the eastern part of Albania, where the degradation of land resources is more intense.

Due to the widely applied practice of burning stubble fields, the soil organic matter in arable land is being depleted. Inadequate farming techniques, non-application of crop rotation, decreased soil cultivation, low and unbalanced use of organic and mineral fertilizer and the use of ineffective measures for plant

4. Report on National situation of biodiversity in Albania
5. FAO country report for Albania
6. The World Bank, 1993
7. Zdruli 1998

protection also contribute to the continuous degradation of agricultural land.
The primary reason for habitat loss and degradation is deforestation in high mountain areas and desertification of arable land. The conversion of agricultural arable land for housing construction also and the destruction of the pastures and meadows causes to habitat changes and land degradation. Also, negative impacts on biodiversity have been identified in the coastal area. The excessive flooding of large areas and discharge of untreated waste waters in rivers still remain major environmental problems in Albania[8].

1.2 Objective and scope of this study

This project has been designed to strengthen capacity for environmental monitoring and information management in Albania by establishing an operational environmental information management and monitoring system (EIMMS).
The project will address the need for an environmental monitoring system that is integrated throughout relevant government institutions and that uses international monitoring standards for indicator development, data collection, analysis, and policy-making. It will also build on existing technical and institutional capacity in Albania to align its management and monitoring efforts with global monitoring and reporting priorities. Increased capacity in this area will improve reporting to the Rio Conventions and lay the groundwork for sustainable development through better-informed environmental policy.
The project will aim at:

- Development of the EIMS to enable integration of global environment commitments into planning and monitoring processes.
- Development and application of uniform indicators encompassing UNFCCC, CBD and CCD concerns and global environmental threats.
- Stakeholder's capacity for information management (collection processing) of key global environment data and utilization (interpretation and reporting) is enhanced at national and local level.

The Land Degradation Neutrality (LDN) concept works to better communicate multiple cross-sectorial benefits of LDN related measures, to ensure that key decision makers understand the ground-breaking opportunities presented by setting an LDN target.
LDN is a "lens" that helps focus on the multiple services that land provides, creating coherence among sustainable development policies. Setting a LDN target provides clear direction for action.

8. Draft report "Soil quality monitoring", AUT, 2018

While the LDN target-setting process is consistent with international guidelines (e.g. SDGs and the Rio Conventions), to be successful it must be aligned with national development priorities and build on national sustainable development processes.

While LDN falls under the thematic scope of the UNCCD, developing cross-cutting actions that encompass the interests of the other Rio Conventions is vital for its success. Actions to achieve LDN can also help reach the Aichi Biodiversity Targets and the National Biodiversity Strategies and Action Plans established under the Convention on Biological Diversity (CBD) and become a core element of the Nationally Determined Contributions in the context of the United Nations Framework Convention on Climate Change (UNFCCC).

The project objectives are as follows:

- Provide a country context baseline
- A rationale on the importance of LDN to the country.
- Identify the main stakeholders to be involved in the process.
- Provide a report on the expected outcomes/outputs of establishing LDNs
- Assess what support can be accessed by the country through partners and donors to establish and monitor LDNs.
- Assessment of the current status, trends and drivers of land degradation to set sound LDN targets, make decisions on potential interventions, forecast changes in land-based natural capital and track progress.

The main tasks are:

- Setting LDN Baseline.
- Assesses land degradation trends, mainly in the identified hotspots of Ulza and Bovilla and evaluate whether these should be priority areas for LDN action, or propose others.
- Identify the drivers for land degradation to better understand the dynamics of land degradation at the (sub-) national level, determining the drivers that are directly linked to local land-use systems and underlying drivers that can be local, national or global and reflect demographic, economic and socio-political circumstances that impact local land-use systems indirectly.
- Review the gap assessment in land degradation focal area developed with the NAP process.
- Develop the norms and standards for soil erosion measurement as per the EU requirements.

"

Sustainable development" *is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*[10]

1.3 Sustainable Development Goals and Environmental Information and Monitoring Systems

The 2030 Agenda for Sustainable Development (ASD), adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests[9] .

The 17 goals have three dimensions; social, economic and environmental. There are a total of 232 indicators under these dimensions of which 80 indicators are connected to resource and waste management. For Albania to achieve Sustainable Development Goals by 2030, it is imperative to ensure a means to measure, monitor and report the progress on SDGs. This framework, need the functioning of the environmental, information, monitoring and management system (EIMMS).

Over the past decades, sustainable development has been promoted by a number of Albanian adopted policy documents. The Environmental Crosscutting Strategy (ECS) has identified main objectives to reach the final goal of having a healthy ecological environment through the development of sustainable use of natural resources, the prevention of environmental contamination and degradation and the promotion of environmental protection.

Since the Rio Conference, progress towards achieving sustainability has been assessed in various ways, and different rankings for the sustainability situation in Albania are available. Data published by the Global Footprint Network in 2010 placed Albania 74th in the descending list of 154 countries ranked by their ecological footprint.

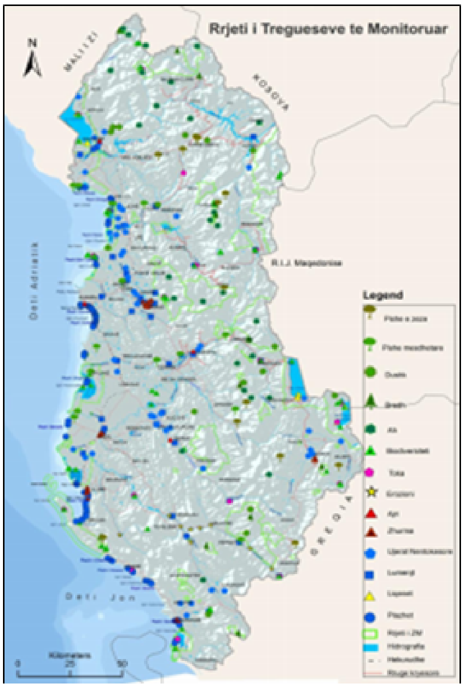
Environmental problems in Albania have been caused mainly by unsustainable forestry, agricultural and pastoral practices, abandoned industrial installations, mining enterprises and waste dumps. Soil erosion and the contamination of land pose major concerns. The waste management situation is at a very low level and has become a major source of pollution. Many of these environmental issues are not stand alone, but are mutually related and interdependent.

The National Environmental Agency (NEA) is the responsible institution for environmental monitoring the environment in Albania (figure 2).

The United Nations' adoption of the 17 sustainable development goals (SDGs), under the 2030 A genda for Sustainable Development, urged the Albanian institutions to generate the information with the aim of supporting planning and monitoring of socioeconomic development interlinking with

9. https://sustainabledevelopment.un.org
10. Our Common Future, also known as the Brundtland Report

Figure 2. Albanian map and data of Albania environmental monitoring system



Albania environmental monitoring system for 2018	Number of monitoring points
Air	121
Noise	57
The river water	151
Lake water	36
Lagoon water	33
Sea water	28/102
Underground water	59
Bio-quality water	95
Soil	26
Forest	99
Biodiversity	76

environmental sustainability dimensions.[11].

SDGs 2, 3, 6, 11, 13, 14, and 15 refer to targets which commend direct consideration of soil resources. For instance, food security (SDGs 2 and 6), food safety (SDG 3), land-based nutrient pollution of the seas (SDG 14), urban development (SDG 11), and sustainability of terrestrial ecosystem services (SDG 15) are all depending on the provision of ecosystem services where soil properties and functions play a key role to deliver these.

There are five groups of SDGs and assigned indicators where soil plays a central role, namely:

- explicitly include productivity (2.3, 2.4),
- explicitly include soil degradation (15.3),
- name soil in the SDG although no soil-based indicator has been proposed (3.9),
- have direct relevance to soil resources with explicit reference to land resources but no reference to soil (11.3),
- have direct relevance of soil to SDG without naming soil in SDG nor including soil-related SDG indicator (6.4, 6.5, 13.2, 14.1, 15.5)[12].

Land management can be considered as a marker of the Sustainable Development Goals (SDGs). Environmental information, monitoring and management systems are the main instrument for assessing the progress of each country towards the SDGs commitments.

11. UN 2015
12. Tóth et al. 2018

"

Land" *means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system*[13]

"Land Degradation Neutrality" *means a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.*[15]

In particular, SDG target 15.3 on "land degradation neutrality" by 2030 to combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world. In addition, soils play an important role in mitigating and adapting to climate change (SDG 13). Further, SDGs 7 and 12 will indirectly rely on the availability of healthy soil resources. Regarding the remaining SDGs, linkages can be found to the sustainable management of soils to some extent[14].
The achievement of many the SDGs depends on the status of land, which can only be achieved through an integrated and coherent management approach. The concept of "Land Degradation Neutrality" is new and ambitious as it not only seeks to avoid and reduce degradation of land but also to combine it with measures to reverse degradation, in order to arrive at neutrality. The terms "Land Degradation" and "Land Degradation Neutrality" is a starting point for implementing 15 SDGs, the target 15.3 .
The "Land Degradation Neutrality" is now a part of the 2030, UN Agenda for Sustainable Development (target 15.3).
However, Albania EIMMS is not complete. The Government should substantially increase financial resources for environmental monitoring in order to fully implement the annual national environmental monitoring program[16].

1.4 Land management and climate change

First, it is necessary to distinguish the difference between the terms "land" and "soil" that are used often inter changeably. In July 2015, the 12th Conference of the Parties to the UNCCD agreed on a differentiation between the terms. According to the UNCCD, there are overlaps between land and soil, but they do not denote the same thing: "**while soil constitutes one of the most essential natural resources of our planet",** "the land comprises a multifunctional ecological system, whose natural capital, soil and biodiversity, interacting with water and atmosphere, generate the flow of ecosystem services that support human wellbeing by securing the life and livelihood of individuals and communities"[17].
Soils make up the second largest carbon reservoir in the world, after oceans. The world's soils store more carbon than the planet's biomass and atmosphere combined. This includes soil organic carbon, which is essentially biodiversity: microbes, fungi and invertebrates, as well as root matter and decomposing vegetation. Soil carbon stocks can be increased through appropriate land management to provide many benefits besides off setting greenhouse gas emissions.

13. UNCD Convention
14. Keesstra et al. 2016
15. UNCD Convention
16. Albania Environmental Performance Reviews, Third review UN, New York and Geneva, 2018
17. UNCCD 2015, para. 22

Wetlands store especially high amounts of carbon in small scale areas. The drainage of wetlands and moors and also the conversion of grasslands, thawing of permafrost soils can cause soils to function as significant sources of CO_2 emissions. The contribution of the agricultural sector to GHG emissions is estimated to be 35 % (2001 data). Methane represents 78 % of this share mainly due to the enteric fermentation of livestock. 95 % of this methane from farms is emitted by cattle (73 %) and sheep (16 %) and the remainder comes from manure management[18].

Greenhouse gas emissions continue to rise and climate change can further compound and add to existing environmental problems in Albania. The country has four major climatic zones, which contribute to the country's rich biological diversity: southern part of the coastal line; central and northern part of the coastal line zone; hilly zone and mountain zone.

Albania is very vulnerable to ***climate change*** due to high exposure to extreme weather (drought, heat spell, flooding), high sensitivity (great reliance on hydropower, irrigation and large share of population living in low elevation coastal zones). This, combined with the low adaptive capacity due to the low GDP per capita and limited institutional capacity, may exacerbate effect on water resources, energy production, tourism, ecosystems, agriculture and coastal zones.[19] Changing weather in Albania have already been observed over the last 15 years with increasing temperatures, decreasing precipitation, and more frequent extreme events like floods and droughts. Projections indicate a decline in summer rainfalls of about 10 percent by 2020 and 20 percent by 2050.

The future climate scenario for Albania predicts changes, such as: increased temperatures, prolonged drought, increased risks of flood landslides and fires, decreased precipitation and reduction of water resources and increased pests and diseases on arable land with a negative impact on agriculture, forests and biodiversity.[20]

A set of sectors and areas in the country have been identified to be at high risk including water resources, hydro-energy, coastal zone, ecosystems and agriculture. Impacts of climate change on the agricultural sector are expected to be mixed with increase in production of wheat and alfalfa and reduction in grapes, olives and livestock. Albania has addressed mitigation and adaptation through the National Climate Change Strategy (NCCS), which consists of a set of priorities for action in order to integrate climate change concerns into other economic development plans[21].

However, the integration of the climate change issues in the sectorial policies remains a challenge and the following obstacles should be overcome: i) lack of legal frame to adapt to these challenges, preventing the implementation of sustainable long term measures; ii) lack of institutional capacities to evaluate

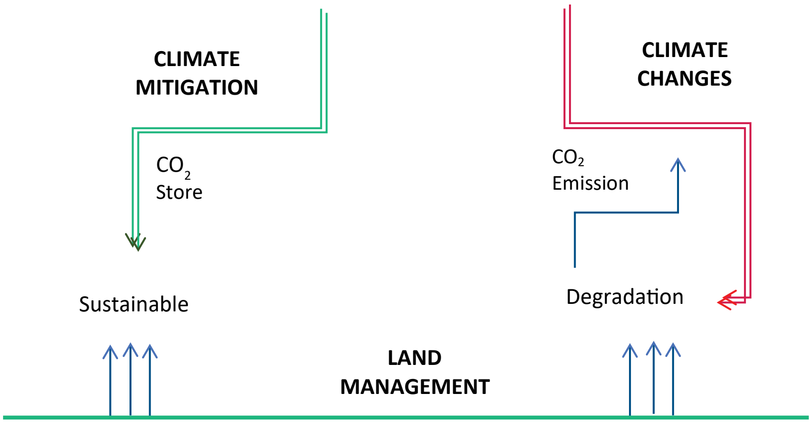
18. ISARD 2014 - 2020
19. Second National Communication of Albania to the United Nations Framework Convention on Climate Change, 2009.
20. National Report on Climate Change, 2008.
21. Albania has ratified both the United Nations Framework Convention on Climate Change and its Kyoto Protocol

the impacts of climate changes and subsequently apply this information to find feasible solutions to sustainable development.[22]

Loss of soil organic carbon is one of the principal signs of land degradation, and land degradation is one of the leading challenges for sustainable development, biodiversity conservation, and mitigating and adapting to climate change. It is defined as a reduction or loss of the biological or economic productivity and complexity of land (figure 3).

Sustainable management of soils is an efficient alternative of combating climate change. When land is degraded, soil carbon can be released into the atmosphere, along with nitrous oxide, making land degradation one of the biggest contributors to climate change. An estimated two-thirds of all terrestrial carbon stores from soils and vegetation have been lost since the 19th century through land degradation. Agriculture, forest and other land-use sectors generate roughly a quarter of all anthropogenic greenhouse gas emissions.

Figure 3. Links between land management and climate change



Managing land sustainably means less carbon emissions and more carbon capture. Recent studies suggest that soil carbon management presents one of the most cost-effective climate change mitigation options. Sustainable land management can be accelerated through policy and financial instruments, to increase soil organic carbon in a way that simultaneously combats desertification, prevents biodiversity loss and helps climate change mitigation and adaptation.[23]

1.5 Land degradation and UNCCD objectives

Most definitions of land degradation in the past recognised only negative effects on the soil's productive capacity for current and future use. More recently, definitions have broadened to incorporate the concept of the land's

22. Draft Environmental Inter-sectorial Strategy 2015-2020
23. https://www.iucn.org

capacity to provide ecosystem services.
The United Nations Convention to Combat Desertification (UNCCD) defines land degradation as "reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation".[24]
Land degradation remains complex to define and assess, and global level assessment is not sufficient to understand trends at the country or local levels. Similarly, taking into account various services provided by the land, FAO defines land degradation as the "reduction in the capacity of the land to provide ecosystem goods and services and assure its functions over a period of time".
To compensate for the weaknesses of global level assessments, and to guide implementation and monitoring of yearly progress, a conceptual framework for Land Degradation Neutrality (LDN) is currently developed by the UNCCD.
Proportion of land that is degraded over total land area' is emerging as the key indicator, supported by three underlying sub-indicators: 1) land cover/land cover change, 2) land productivity, and 3) carbon stock (above and below ground).
The UNCCDs strategic objectives to be achieved and the "operational objectives" that guide the actions of short and medium term are:

- To improve the living conditions of affected populations;
- To improve the condition of affected ecosystems;
- To generate global benefits through effective implementation of the UNCCD;
- To mobilize resources to support implementation of the Convention through building effective partnerships between national and international actors;
- To actively influence relevant international, national and local processes and actors in adequately addressing desertification/land degradation and drought-related issues;
- To support the creation of enabling environments for promoting solutions to combat desertification/land degradation and mitigate the effects of drought;
- To become a global authority on scientific and technical knowledge pertaining to desertification/land degradation and mitigation of the effects of drought;

LDN is a "lens" that helps focus on UNCCDs objectives and to assess the achievement at the national level.

24. UNCD Convention

02

Albania land recourse management

2.1 Legal framework on environmental and land management

In general terms, the Albanian Constitution that was adopted by Albanian Parliament in 1998 requires institutions to maintain a healthy environment, ecologically suitable for present and future generations. In the last decade and especially since 2001, a number of laws and other legal acts on the environment have been drafted and approved.

Article 5 of Albania Constitution defines the principle of sustainable development: "Public authorities, through the development, adoption and implementation of normative acts, strategies, plans, programs and projects within their competence, promote sustainable economic and social development, using natural resources in order to meet current needs and preserve the environment, without prejudice the possibility of future generations to meet their own needs".

The Albanian legal framework regarding environmental and socioeconomic issues is based on the Constitution of the Republic of Albania and consists of laws and regulatory acts, such as Decisions of the Council of Ministers (DCM), ministerial acts, regulations, guidelines and standards.

Albania achieved significant progress in the adoption of new, modern environmental legislation. This process was driven by the efforts to approximate the EU environmental ***acquis***, as the country was granted candidate status in 2014.

However, some subsidiary acts due to be adopted are still lacking and the implementation of legislation lags behind. Sometimes the legislation is too advanced vis-à-vis the administrative, institutional and financial capacities in place. Despite certain improvements, the annual national environmental monitoring program is significantly underfunded. The National Environment Agency receives only three per cent of the budget needed to implement the program and is required to prioritize activities.[25]

Environmental legislation is governed by the Law on Environmental Protection No. 10431, dated June 9, 2011[26]. This Law sets out principles, requirements, responsibilities, rules and procedures to ensure a higher level of environmental protection and includes dispositions for environmental impact assessment as a tool for environmental protection, aiming to identify and define the possible direct and indirect effects on the environment mainly to prevent these effects.

This Law establishes national and local policies on environmental protection, requirements for the preparation of environmental impact assessments and strategic environmental assessments, requirements for permitting activities that affect the environment, prevention and reduction of environmental pollution, environmental norms and standards, environmental monitoring and control, duties of the state bodies in relation to environmental issues, role of the public and sanctions imposed for violation of the Law.

The key laws related to environmental protection are listed below:

- The Law on Environmental Permits No. 10448/2011, which entered into force in 2013, further developed the system of environmental permits introduced by the Law on Environmental Protection.
- Law on Environmental Impact Assessment No. 10440/2011, which entered into force in 2013, and the Law on Strategic Environmental Assessment No. 91/2013.
- The Law on Protection of Ambient Air Quality No. 162/2014, adopted in place of the 2002 Law, enters into force in December 2017.
- DCM No. 762 dated 16.09.2015 (in the context of the United Nations Framework Convention on Climate Change, UNFCCC), designated Albania's Intended Nationally Determined Contribution (INDC), which commits the country to reduce CO2 emissions in the period 2016–2030 by 11.5 per cent compared with the baseline scenario. The draft law on monitoring and reporting of greenhouse gases (GHGs).
- The Law No. 5/2016 on the Moratorium in Forests introduced a 10-year ban on logging for industrial purposes and export. The Law is a drastic

25. Albania Environmental Performance Reviews, Third Review, 2018

26. This law is harmonized with Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage. Official Journal L 143 , 30/04/2004 P. 0056 - 0075

measure to address illegal logging, mostly logging in excess of the permitted timber quantities, which has been a common practice.
- The Law on Chemicals Management No. 27/2016 replaced the Law on Chemical Substances and Preparations No. 9108/2003. The new Law enters into force in March 2018.
- The Law on Integrated Waste Management No. 10463/2011 replaced the Law on Solid Waste Management No. 9010/2003 and the Law on Hazardous Waste Management No. 9537/2006.
- Law on Integrated Water Resources Management No. 111/2012 (in force since December 2013),
- Law on Protection of Transboundary Lakes No. 9103/2003 and Law on Protection of the Marine Environment from Pollution and Deterioration No. 8905/2002, which was amended in 2013 with regard to the institutional framework and the sanctions for administrative offences.
- The Law on the Use of Fertilizers for Plants No. 10390/2011 lays down rules on fertilizer evaluation, categorization, production monitoring, packaging, labeling, transport, storage and trading. The legal framework for organic farming is provided by the Law on Organic Production, Libeling of Organic Products and Their Control No. 106/2016, which replaced the Law on the Production, Processing, Certification and Marketing of "Bio" Products No. 9199/2004.

Law No. 7501 of 1991 – "On Land" – forms the basis for the provision of agricultural land in Albania, both in terms of ownership and use, with the intention that it should be used only for agricultural purposes. Between 1991 and 2008, Law No. 7501 was revised more than five times. Land management is linked to the land ownership and land use.
The land degradation processes in Albania include the human-induced land stresses like chemical pollution, salinization, nutrient mining of agricultural land, deforestation, over-grazing and accelerated soil erosion and natural processes or conditions, which include acidification, flooding, stony and shallows soils, and areas of low temperatures and poor accessibility[27].

2.2 Ecosystem's and biodiversity management

The Agenda 21 at the Earth Summit in 1992 at Rio de Janeiro was an opportunity to address the various domains for sustainable development: The Convention on Biological Diversity (CBD) targets "the conservation of biological diversity the sustainable use of its components and the fair and equitable sharing of the benefit arising out of the utilization of genetic resources". The ecosystem management concept is based on the relationship between sustainable resource maintenance and human demand for use of

27. Zdruli P, 2003. Soil Survey in Albania

natural resources.

Albania is distinguished for a high diversity of genetic resources, species and ecosystems. Within its territory there are maritime ecosystems, coastal zones, lakes, rivers, evergreen and broadleaf bushes, broadleaf forests, pine forests, alpine and sub-alpine pastures and meadows, and high mountain ecosystems.

Albania is also well known for its rich and complex hydrographic network composed of rivers, lakes, wetlands, groundwater and seas. Wetlands coverage is 60.215 ha or 3% of the country and around 45.000 ha are designated Ramsar sites namely: Karavasta Lagoon, Butrinti Lake and Shkodra Lake.

In Albania 3200 taxa of higher plants, 800 fungi, 1200 diatoms as well as 313 taxa of fish, 323 birds, 36 reptiles, 70 mammals and 520 molluscs are identified so far. In an overview plant species belong to 166 families and 1022 genera. Out of this plant species and 150 subspecies are endemic to Albania. There area around 400 plant species of the Balkan region.

The main elements of the Albanian flora are Mediterranean (24 %), Balkan (22 %), European (18 %) and Eurasian (14 %).

"

Ecosystem management" *is a process that aims to conserve major ecological services and restore natural resources while meeting the socioeconomic, political and cultural needs of current and future generations. The principal objective of ecosystem management is the efficient maintenance and ethical use of natural resources.*[28]

Figure 4. Albania map protected area

The Eurasian, Holartic, Mediterranean and Balkan elements dominate the fauna spectrum of the country.

Habitat loss and degradation – it comes primarily as the result of deforestation in high forest areas and desertification of arable land. The conversion of agricultural arable land to land used for housing construction leads to habitat degradation. Meanwhile in forest areas the illegal logging and destruction of meadows and pastures has a great impact on habitat loss.

Impacts on biodiversity have been identified especially in the coastal area of Albania. Major events include excessive flooding of large areas and erosion along the coastline of the country. The achievement of favourable status of conservation for species is aimed through biodiversity law and protected areas law, which contain provisions for the protection of biodiversity inside protected areas as well as outside them.

National Agency of Protected Areas, that is founded by the Council of

28. wiki/Ecosystem_management

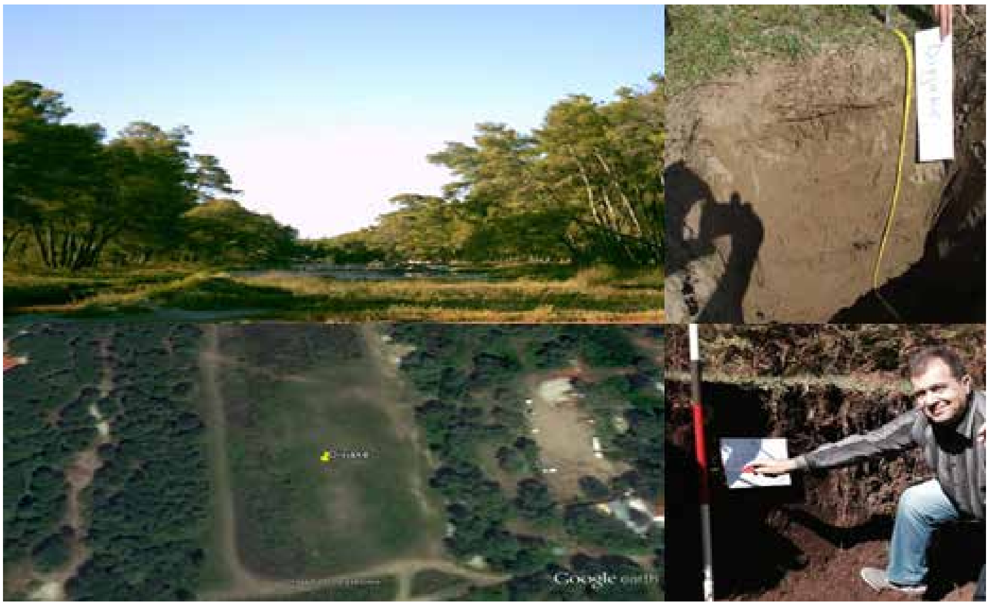
Ministers, Decision No. 102, date 04.02.2015, aimed management, protection, development, expansion and operation of the protected areas in our country, which today account for about 16% of the territory of Albania. NAPA manages the network of protected areas and other natural networks as Natura2000 under management plans (figure 4).
NAPA monitors flora and fauna in these areas. The Government of Albania has established a representative system of Protected Areas (PAs), which covers almost 16% of the Albanian territory. The system of protected areas consists primarily in 15 national parks, several managed natural reserves and protected landscapes that shelter the greatest natural and biodiversity values of the country.
This large network is recently being complemented with Regional Protected Areas, established and managed by local authorities[29]. However, as of early 2017, NAPA has not produced any monitoring reports on biodiversity.

2.3 EIMS-Soil quality monitoring and soil erosion assessment

The monitoring of soil quality is the responsibility of the NEA, and is then subcontracted to the Faculty of Agro-environment at the University of Agriculture, Tirana. Several indicators of soil quality (pH, N, P, K, Ca, Mg, organic matter, and heavy metals (Cd, Cr, Co, Ni, Pb, Zn) are monitored at 30 fixed sites as described by the Consolidation of the Environmental Monitoring System in Albania (CEMSA) monitoring network.
The monitoring programme is running on a three-year cycle collecting data on 10 sites per year (Lepani (Berat), Tull (Durrës), Topojan (Dibër), Klosi (Dibër), Gjegjan (Kukës), Theth (M. Madhe), Koplik (M. Madhe), Ishull Lezhë (Lezhë), Dritaj (Elbasan), Karavasta Lushnje etc (figure 5)
Soil erosion is monitored at certain sampling stations in the field and calculations are made by the Faculty of Forestry; however, the methodology used is not compatible with EU norms and standards.

29. www.akzm.gov.al/us/napa

Figure 5. Monitoring of the soil quality at the "Laguna Karavasta" station



In addition, Corine land cover data exists as published by the European Environment Agency (EEA) in 2016. A forest inventory is is underway and this will further contribute to the monitoring of land use in the country.
Several indicators for land use are monitored by the Ministry of Agriculture and Rural Development (MARD) as stipulated in DCM No. 1189 dated 18.11.2009 "On rules and procedures for drafting and implementation of the national environmental monitoring programme".

03

Land Degradation Neutrality setting in Albania

3.1 Importance of LDN implementation and monitoring to the country

Land degradation and restoration causes substantial costs. Soil is considered a non-renewable re-source because it can take centuries to develop under natural conditions and it is impossible to completely restore once degraded. The restoration process leads to considerably higher costs than the costs incurred to avoid of degradation in the first place.[30]

Land degradation due to natural and human factors is an active phenomenon in Albania since many years now. Geographic location, climatic conditions, relief, high levels of land exposure against threats hold an essential role in setting Albania's targets and strategies towards National Land Degradation Neutrality.

Land degradation assessments have been completed using combination of approaches including expert and land user's opinions and field monitoring. Land Degradation Neutrality was first introduced as a concept in the run-up to the Rio+20 conference.

In this context, the UNCCD Secretariat published a policy brief on a potential goal of "zero net land degradation"[31]. In the outcome document of Rio+20 entitled "The future we want", the heads of State and Government "recognize the need for urgent action to reverse land degradation. In view of

30. FAO 2015

31. UNCCD Secretariat 2012

this we will strive to achieve a land degradation neutral world in the context of sustainable development"[32] Key elements of the scientific conceptual framework for LDN proposed are:

- *LDN vision* – to sustain the natural capital of the land and associated land-based ecosystem services;
- *LDN frame of reference* – to set a baseline based on agreed indicators, which becomes the (minimum) target with the intention to maintain (or improve) this state;
- *LDN balancing mechanism* – to categorise and account for land-use decisions with respect to neutrality and establish principles to limit unintended outcomes;
- *LDN implementation pathways* – to provide guidance on the pathways towards achieving neutrality;
- *LDN monitoring & evaluation* – to provide guidance on assessing progress towards neutrality.

The LDN aims at supporting countries to:

- *Avoid* land degradation through proactive measures to prevent land degradation;
- *Minimize* land degradation through practical action, e.g. integrated landscape management (ILM) or sustainable land management (SLM);
- *Reverse* the productive potential and ecological services of degraded land, e.g. through the rehabilitation and restoration of degraded land (figure 7).

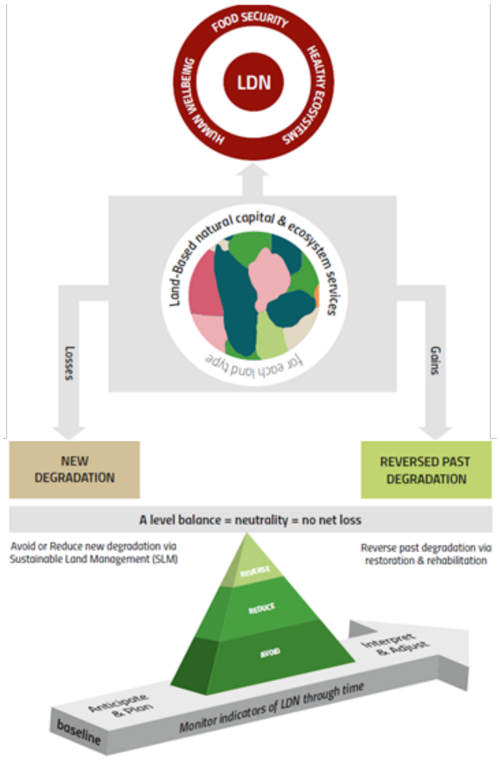
"Land degradation neutrality is a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems."[33]

The SDGs were adopted by the UN General Assembly in September 2015. After the adoption of the SDGs and the agreement on (most) indicators in March 2016, the High Level Panel Forum (HLPF) in July 2016 was the first milestone on the way to the implementation of the SDGs.

Target 15.3 also has strong linkages to the other Rio Conventions: the Convention on Biological Diversity (CBD) with biodiversity supporting many of the processes that underpin the ecosystem functioning of land, and the United Nations Framework Convention on Climate Change (UNFCCC) because of the manifold relationships between land and climate change adaptation and mitigation.

32. UN General Assembly 2015
33. IAEG-SDGs 2016

Figure 6. Key elements of the scientific conceptual framework for LDN34



LDN target setting pilot countries showed that the LDN target setting process contributed to the objectives of the UNCBD and UNFCCC[35].
The core and innovative part of this definition is that in order to "remain stable or increase" efforts for land restoration, rehabilitation and sustainable management are necessary if degradation processes cannot be avoided.
In addition, all past activities and future targets in forests, pastures, and farmlands were defined within the scope of overcoming the drivers of land degradation and desertification.
Key soil threats have already been recognized at the EU level. These are erosion, organic matter decline, contamination, salinization, compaction, soil biodiversity loss, sealing, landslides and flooding.
Albania is one of the most heavily affected countries by global warming and climate change which have been escalating particularly in the last century. Therefore, a series of intense efforts were initiated to mitigate the risks and alleviate the damages of desertification, land degradation and drought.
LDN is a simple idea but a powerful tool that aims:

- to avoid degradation of land,
- to promote sustainable management of soils,
- to enable massive improvement of the process of rehabilitation of degraded soils.

LDN aims to balance anticipated losses in land-based natural capital and associated ecosystem functions and services with measures that produce alternative gains through approaches such as land restoration and sustainable land management. It means securing enough healthy and productive natural resources by avoiding degradation whenever possible and restoring land that has already been degraded. At its core are better land management practices and better land use planning that will improve economic, social and ecological sustainability for present and future generations.
LDN provides significant benefits in terms of mitigation and adaptation to

34. Annette L. Cowie et al., 2018
35. Global Mechanism of the UNCCD 2016)

climate change. Land degradation can transform land from being a source of greenhouse gas emissions to a sink, by increasing carbon stocks in soils and vegetation.
Furthermore, LDN plays a key role in strengthening the resilience of rural communities against climate shocks by securing and improving the provision of vital ecosystem services.
To achieve SDG target 15.3, the following five elements have been identified:

- Setting targets and establishing the level of ambition;
- Catalyzing the multiple benefits that LDN provides from climate change mitigation and adaptation to poverty reduction;
- Rationalizing engagement with partners, overcoming fragmentation and systematically tapping into increasing finance opportunities, including climate finance;
- Designing and implementing bold LDN transformative projects that deliver multiple benefits;
- Tracking progress towards achieving the LDN targets.

Albania is among the countries that have committed to set a national voluntary LDN target, establish an LDN baseline, and formulate associated measures. The Ministry of Tourism and Environment partially provides the information to UN on 15.3 target "***by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world"[36].***

The LDN targets provide Albania with a strong vehicle for fostering coherence of policies and actions by aligning the national LDN targets with measures from the Nationally Determined Contributions and other national commitments.
The LDN conceptual framework can support monitoring and reporting for the UNCCD, the other Rio conventions, and work synergistically with other global initiatives such as the Sustainable Development Goals. Important opportunities for synergies include linking monitoring and reporting processes related to LDN indicators, collaborating to leverage existing systems to monitor socio-economic indicators, and the monitoring of key enabling environment factors such as governance, land rights and security.

"

Investing in LDN" *accelerates the advancement of SDGs due to the close linkages between land and other goals and targets, such as: Goal 1 (No poverty), Goal 2 (Zero hunger), Goal 5 (Promote gender equality), Goal 6 (Clean water and sanitation), Goal 8 (Decent work and economic growth), and Goal 13 (Climate action).*

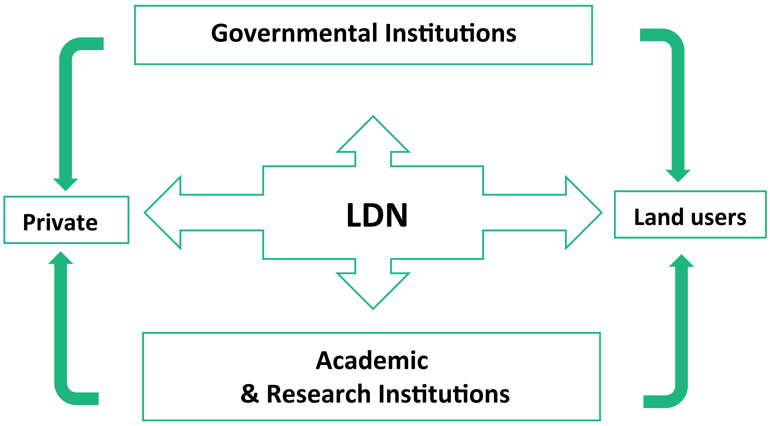
3.2 Actors for the LDN implementation and monitoring

Taking into account the variety of functions of land, a wide range of stakeholders and sectors must be involved in the design and implementation of programs and projects to achieve the goal of LDN in Albania. The responsibilities for

36. Albania, report on the harmonization of sustainable development goals with existing sectoral policies, 2018

meeting the LDN targets are related to a number of institutions and other stakeholders at national, regional or local level (figure 8).

Figure 7. Key actors in the process of LDN implementation



- *Governmental institutions and agencies* are in charge of developing and implementing policies and plans on land related issues at the national and sub-national levels.
- *Land users* who make direct decisions on land management based on the type of land ownership rights they hold. This diverse group includes small and large-scale farmers/pastoralists, forest harvesters and private companies. Many land users are also active outside the agricultural sector in the mining, urbanization, energy, roads and infrastructure industries.
- *Private Service* providers who support land users and are involved indirectly in land management. This diverse group includes banks; suppliers of seed, fertilizer and machinery; energy and communication service providers; traders, manufacturers and chambers of commerce.
- *Civil society organizations* (NGO) who connect other stakeholders on land-related issues at every level, cooperating with local land users, their associations and governmental agencies.
- *The multilateral and bilateral stakeholders* who provide financial and technical support to those involved in land management.
- *Academic and Research Institutions* who offer scientific advice on good land use practices and related policy options, such as national agriculture research institutes, universities and institutes.

Many institutions in Albania have responsibility for and authority on desertification and land degradation, but works are conducted primarily through three ministries: the Ministry of Tourism and Environment,

the Ministry of Agriculture and Rural Development and The Ministry of Infrastructure and Energy.
Within these three key Government institutions, there are various directorates each having specific responsibilities.

Ministry of Tourism and Environment (MTE)
The Ministry of Tourism and Environment is the institution engaged in and responsible for the protection of environment and natural resources including land as one of the most important country's resources.
It is responsible for negotiations of international environmental agreements and, as appropriate, initiating or causing the initiation of a process of ratification. MTE has the duty to follow the LDN agenda through the national focal points of the Rio Conventions and associated funds, e.g. the Global Environment Facility (GEF) and the Green Climate Fund (GCF).
The ministry is also responsible for the preparation and implementation of the cross-cutting development strategies. Thus, the ministry is in charge of coordinating all the project activities that will be implemented in the selected pilot sites.
The National Environment Protection Agency (NEPA) and the respective Regional Environmental Departments (RED) will be responsible in implementing the action plans in collaboration with the different local and international NGOs operating in the selected areas. Also, they are involved in project development and implementation right from the stage of project identification through community consultation, establishment of baselines and development of different land improvement and management.
REDs will conduct the monitoring plan prepared jointly with NEPA and its experts to work closely with the respective government and non-government organizations to monitor what is being implemented and what land changes are being obtained following the interventions. They will give feedback to the implementing partner and also report the monitoring process to MTE. The Ministry of Tourism and Environment will conduct the LDN study and establishes permanent monitoring system.

Ministry of Agriculture, Rural Development (MARD)
The Ministry of Agriculture and Rural Development is the main national decision-making institution with regard to the protection and sustainable administration of agricultural land. MARD is responsible for developing policies and laws for the development, management, and conservation of natural resource of the country as well as for land administration and land use.
The ministry has its relevant departments and other structures responsible for the policies concerning the protection agricultural land.
This ministry is responsible and key actor during the process of inter-sectorial strategies drafting and implementation. The ministry and regional

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The State Inspectorate of Land Protection is the central state institution that carries out its activity in accordance with the laws on land protection and decisions of the Council of Ministers on protection of agricultural land.

departments under the ministry are consulted from the beginning of program and project proposal preparation to the implementation and monitoring and evaluation of the programs and projects. They are responsible for provision of technical guidance to communities through their extension services. They are also responsible to monitor the changes in land cover and the land productivity dynamics together with the community, for conducting training of farmers in natural resources management aspects and development sustainable resource harvesting programs that ensure a sustainable flow of benefits to communities while improving the ecological integrity of the natural systems.

The Ministry of Agriculture and Rural Development supervise the State Committee on Land Protection (SCLP) and the State Inspectorate of Land Protection (SILP). The State Committee on Land Protection is composed of representatives from the line ministries and national central institutions, and is chaired by the Minister of Agriculture and Rural Development.

The duty of the SCLP is to coordinate the activities among the Ministry of Agriculture and Rural Development, the Ministry of Tourism and Environment, other institutions and local government bodies concerning all actions carried out on the agricultural land, related to it and which may affect its protection. The SCLP examines the proposals of state institutions and their subordinate bodies concerning transfer and changes in the state of agricultural lands, pursuant to Article 14 of the Law No. 9244, dated 17/06/2004, "On protection of agricultural land", as well as protects all agricultural land from illegal constructions.

The State Inspectorate of Land Protection is the central state institution that carries out its activity in accordance with the laws on land protection and decisions of the Council of Ministers on protection of agricultural land. The SILP carries out programmed and occasional controls on the activities carried out by the Regional Commission on Land Protection and the Regional Inspectorate of Land Protection, as well as other state structures charged by law for the implementation of the legal provisions on land protection.

Ministry of Infrastructure and Energy (MIE)

The Ministry of Infrastructure and Energy is responsible for the policies and programs of infrastructure and energy development and has the role during the planning and implementation of infrastructure and energy projects. This Ministry has the key role and responsibility of protecting the soil from erosion and degradation with regard to the roads, hydro power plants, dam's construction and cascades management. MIE will be a key player in designing and implementing a monitoring program that is rigorous enough to meet required standards.

The Regional Councils (RC)

RCs are decision-making and executive bodies at the regional level. Among their main functions are also those related to the protection and management of agricultural land. Such duties and responsibilities are regulated by the

Decision of the Council of Ministers No. 121, dated 17/02/2011, "On the manners of exercising functions by the Land Administration and Protection Directorates in the regions, and by the Land Administration and Protection Offices (LAPO) in the communes and municipalities".

Regional Commission on Land Protection (CLP)

CLP is a decision-making body on issues and problems related to regional land management. Its organization and functioning is carried out according to the decision of the Council of Ministers concerning agricultural land commissions. The organization, direction and functioning of the Regional CLP consists of the following:

Regional Inspectorate of Land Protection (ILP)

ILP is the regional institution that carries out its activity under the laws in force on land protection, the Decision of the Council of Ministers on the organization and functioning of land commissions and under the law on state inspectorate.

The Municipal Council (MC)

MC is another important decision-making institution on land administration and management issues. Given the reorganization of the territory, these councils receive even more responsibilities because all the 61 municipalities, without any exception, have agricultural land and LDN expected outputs/outcomes

LDN national working groups should bring these stakeholders together and serve as platforms for information exchange among representatives of all interested parties directly connected to land degradation processes and able to contribute to the achievement of LDN. National level coordination mechanisms should be screened in order to identify suitable platforms to serve as LDN working groups.

Agricultural University of Tirana (AUT)

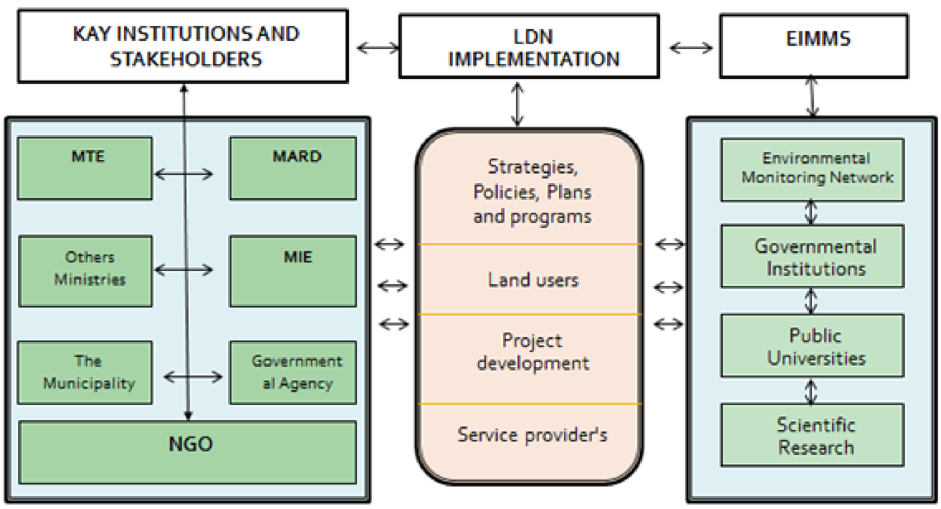
LDN requires the development of new science based knowledge to better detect and understand land degradation at the earliest stage possible, to generate appropriate technological alternatives to current unsustainable practices causing degradation and to elaborate enhanced monitoring systems and regulatory measures. Land degradation results from a complex set and interaction of economic, social and ecological causes, so it needs to be analysed from different disciplines and perspectives, depending on a specific state of land degradation in a country. AUT monitor soil quality and soil erosion and offers scientific advice on good land use practices or related policy options.

Non-Governmental Organizations (NGO)

The local and international non-governmental organizations found in the country are supporting the development activities of the government of Albania through different programs and projects aligning with the government's priorities. In a similar manner the NGOs working in different parts of the country will be engaged in the projects and programs that will be implemented to achieve the LDN targets in the country. The main role and responsibility of NGOs will be directly implementing the different programs and projects designed to achieve the LDN targets and, reporting the progresses and achievements of the implementation process.

Implementing partners
Apart from implementing the projects and programs, implementing partners will also be responsible to closely monitor project activities on regular basis. Therefore, implementing partners will conduct monitoring assessment on the performance of project implementation and the changes achieved on the selected progress indicators using a template that will be developed by NEPA. Based on the monitoring process the partner will report to the RED or NEPA. The following figure shows the schematic overview of LDN implementation.

Figure 8. Schematic overview of LDN implementation

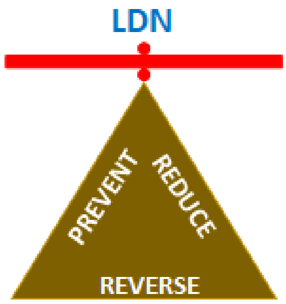


3.3 LDN expected outcomes/outputs

Implementation of the LDN at county level will be aligned to country priorities and the national development agenda, including SDGs. National LDN work plans will be prepared taking into account the steps outlined in the draft Technical Guide for LDN Target Setting[37].
The LDN aims at supporting countries to prevent land degradation; to reduce land degradation and to restore of degraded land (figure 10).

37. https://www.google.es/search?q=Technical+Guide+for+LDN

Figure 9. The concept of land neutrality against degradation



3.3.1 Outcome I : National LDN baselines established

Output 1. Define national LDN baselines.

In line with the adoption of the SDGs, the default baseline is recommended to cover a 10-15 year epoch ending in 2030 in order to provide information on the current situation and conditions related to land degradation.

Albania will cooperate with international organizations, including members of the Group on Earth Observations (GEO) such as space and specialized agencies to access suitable data sets with regard to the LDN indicators.

It is important to carry out an assessment of historic land degradation trends in order to understand the current situation, reveal anomalies and identify degraded areas.

However, the exact definition of the baseline period will depend upon the availability of data series at the national level.

3.3.2 Outcome II : National LDN targets and associated measures defined

Output 2.1. National LDN targets and associated measures established

Key intervention will be identified to achieve LDN by addressing the drivers of land degradation. Identified measures should take into account the LDN response hierarchy: avoid, minimize and reverse land degradation.

The analysis of the LDN indicators will enable Albania to identify possible priority areas for LDN implementation.

Possible targets include:[38]

- LDN at the national scale
- LDN is achieved by 2030 as compared to 2020 (no net loss)
- LDN is achieved by 2030 as compared to 2020 and an additional area of the national territory has improved (net gain)
- Specific targets to avoid, minimize and reverse land degradation complementing national targets

38. UNCCD, 2016a

Possible measures :

- Improve productivity and SOC stocks in cropland
- Rehabilitate of degraded and abandoned land
- Rehabilitate of degraded forests and increase green land cover
- Reduce the rate of soil erosion
- Agronomic measures: measures that improve soil cover, measures that enhance soil organic matter or soil surface treatment
- Vegetative measures: plantation/reseeding of tree and shrub species or grasses and perennial species
- Structural measures: terraces, bunds, banks), dams, pans, walls barriers etc.
- Management measures: change of land use type, change of management/intensity level, major change in the timing of activities, control/change of species composition.

Output 2.2. Transformative LDN projects/programmes and innovative financing

Potential LDN investment opportunities that will support the identification of investment opportunities that could be turned into financeable proposals for transformative LDN projects/programmes through innovative financing mechanisms such as the Green Climate Fund established under the UNFCCC or the LDN Fund spearheaded by the UNCCD Global Mechanism. The transformative LDN projects/proposals should address the identified measures for LDN implementation at national level.

3.3.3 Outcome III: The actors commit together in target setting process

Output 3.1. LDN Partnership established

Identify and engage with relevant international or/and regional organizations. including i) financing partners for the LDN target setting process ii) internationals' institutions or other donors and partners.

3.4 Support to establish and monitor LDN through partners and donors

The LDN TSP provides a unique opportunity to support countries in a systematic way and at global scale to define national LDN targets and associated measures in order to achieve LDN by 2030 as agreed under the SDGs.

This can provide substantial support to the implementation of the SDG agenda at country level and provide an additional contribution for UNCCD implementation. The LDN is fully aligned to UNCCD decisions as well as agreements made in the context of the SDG process.
The project will blend financial contributions received from various funding sources, including multilateral and bilateral donors. The LDN will help guiding action of cost effective land based solutions and increase the synergy between all land based investments undertaken for climate change adaptation and mitigation, biodiversity conservation, disaster resilience and water and food security, by promoting sustainable land management at appropriate spatial and temporal scales.

- International Union for Conservation of Nature and Natural Resources (IUCN) has dedicated programmes of work on Forests, Water and Wetlands and Ecosystem Management that are highly relevant to the achievement of Land Degradation Neutrality. IUCN is among the best positioned organisation to ensure that LDN measures and targets will take into account the imperatives of biodiversity conservation (IUCN, undated).
- The red list of endangered species is probably the most valuable scientifically grounded metric of the loss of biodiversity. IUCN is a major partner of the implementation of the global network of protected areas and therefore a key player in the needed establishment of biological corridors that must interconnect all protected areas to allow the free migration of species, in order to avoid massive extinctions in the context of climate change and correlative modifications of bio-geographical boundaries.
- The IUCN-UNCCD partnership facilitated by the GEF as Implementing and Executing Agencies will ensure engagement of a wide range of stakeholders in the LDN target setting process. Outreach activities at major events such as the IUCN World Conservation Congress and UNCCD COPs and CRICs will further strengthen the dissemination of information related to the LDN project.

At national level, the national UNCCD focal point institutions and a functioning LDN working group will be a key to ensure institutional sustainability. Without project, national processes to achieve LDN as outlined under SDG target 15.3 would be slower and would risk to be fragmented and uncoordinated.
They are identified 13 types of soils in the Albania territory. Five soil types cover about 90% of the surface and 2 of them Luvisols and Cambisols cover around 55% of the territory (table 1).

"

Albanian institutions (MTE) need to identify and implement a LDN project. This project will contribute to achieve LDN by addressing clear targets related to land degradation processes where land degradation is a major direct and indirect cause of both climate change and loss of biodiversity. The priority areas for immediate transformative measures and corresponding investments will be identified.

04

Methodology for assessment of LDN baselines

Table 1. Albania soil type

WRB Classification	Land (km²)	%
Histosols	22.42	0.08
Leptosols	2536.90	8.82
Vertisols	132.28	0.46
Fluvisols	1571.69	5.47
Solonchaks	120.86	0.42
Gleysols	135.69	0.47
Kastanozems	37.40	0.13
Phaeozems	3009.54	10.47
Calcisols	216.45	0.75
Luvisols	7273.25	25.30
Cambisols	8790.75	30.58
Arenosols	564.30	1.96
Regosols	3788.88	13.18
Waters area	387.62	1.35
Bare rocks	136.15	0.47
Urban area	24.11	0.08
TOTAL	28748.28	100.00

To characterize the soil fertility the indicators used are: texture, pH, organic matter, total nitrogen, exchangeable potassium, available phosphorus etc. Soil texture is an important indicator of soil fertility.

The UNCCD indicators for assessing trends in land degradation were agreed

The indicator 'Land cover' is capable of identifying vulnerable transitions between natural and human-managed land cover classes. The indicators 'Land productivity' and 'Carbon stocks' measure the biophysical state, above ground and below ground organic carbon content, of the different types of land cover.

upon at the LDN inception meeting. It consists of three indicators that measure trends in land cover as well as the land productivity and carbon stocks associated with the different land covers[39].

The indicator **'Land cover'** is capable of identifying vulnerable transitions between natural and human-managed land cover classes. The indicators **'Land productivity'** and **'Carbon stocks'** measure the biophysical state, above ground and below ground organic carbon content, of the different types of land cover. Both land productivity and soil organic carbon (SOC) stocks are directly affected by land management and are vulnerable to land degradation.

4.1 Indicator I: Land cover and Land Use change

According to the UN Land Cover Classification System (LCCS), land cover refers to the observed biophysical cover on the earth's surface. It is one of the most commonly used indicators for human-induced or natural impacts on ecosystems and is also used to report to the UNFCCC.

This indicator can detect transitions between land cover if it is analyzed in time-steps, and may indicate degradation (UNCCD 2015c) when changes are the following:

- natural and seminatural land cover types (e.g., forest, shrubs, grasslands, sparsely vegetated areas) change to agricultural land and artificial surfaces (e.g., urban, infrastructure, recreation);
- agricultural land changes to artificial surfaces; or might indicate signs

39. UNCCD 2016b

of recovery if agricultural land (and artificial surfaces) change to natural and semi-natural land cover type.

It is important to establish a solid baseline for these changes. The measurement unit should be in hectares, and the classification be based on Food and Agriculture Organization's (FAO) Land Cover Meta Language (LCML) is recommended to ensure global comparison is possible (UNCCD 2016a).

Figure 10. Albania land cover (2006)

The European Space Agency's (ESA) Climate Change Initiative Land Cover dataset (CCI-LC) (www.esa-landcover-cci.org) is the first option for land cover set by UNCCD (UNCCD 2016a).

The development of Albanian landscape in the period 2000-2006 has been clearly dominated by urban residential sprawl over agricultural land. Sprawl areas are distributed mainly in surroundings of the capital city Tirana, along the main transportation network to other big cities, as well as along the Adriatic coast (figure 11).

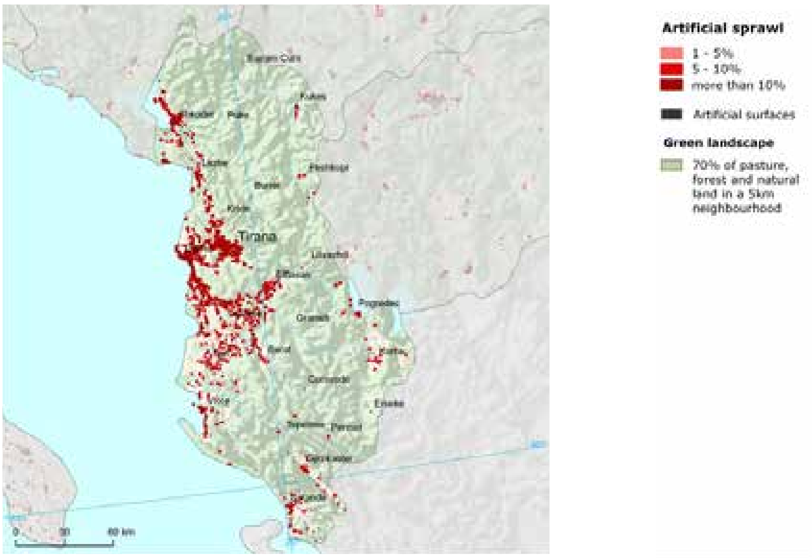
The formation rate of new artificial areas is extremely high reaching more than 50% of initial artificial area (4.96% per year).

Concerning the other land types, only forested land, wetlands and water bodies have positive balance.

However, total formation area of these land cover types is very small, compared to artificial surfaces. In contrast, both arable/crop land and pastures have significantly negative balance of net change related to urban sprawl. Forested land represents the land cover type with highest internal dynamics, but in fact the consumption and formation processes seem to be well balanced. Second major drivers of change in Albanian landscape, beside residential sprawl, are forest creation and management causing 39% of all changes. Changes in forested land are distributed over mountainous continental part of the country.

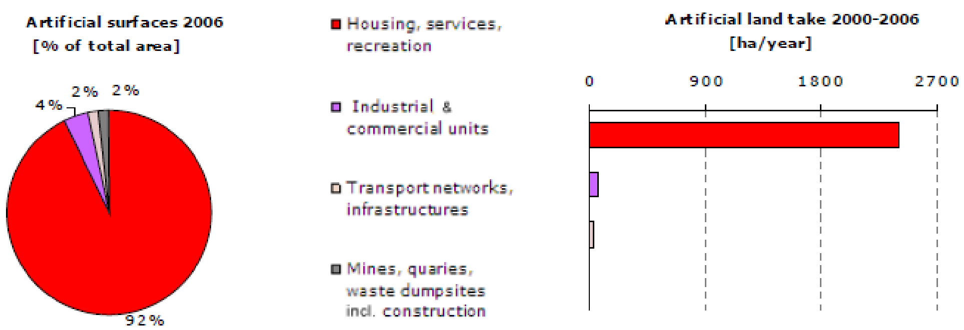
The dominant driver of the extremely high annual rate of artificial land take (4.96%) in Albania is discontinuous residential sprawl, accompanied only to a very low extent by industrial/commercial sprawl. On the consumption side, mostly agricultural land have been taken, with prevailing share of pastures and mosaics (almost ¾ of total up-taken area), followed by semi-natural vegetation and forested areas to a lesser extent (figure 12).

Figure 11. Land covers change 2000-2006



As already mentioned, percentage rate of artificial formation is extremely high, compared to other European countries. For better understanding, more than 50% increase of initial artificial area represents almost land take of 10 football pitches a day! Main built-up area increase is seen in close proximity to the capital Tirana, on the outskirts of other big agglomerations and along the transport main network. Expansion of urban areas is clearly visible also along the coast.

Figure 12. Artificial land take 2000-2006

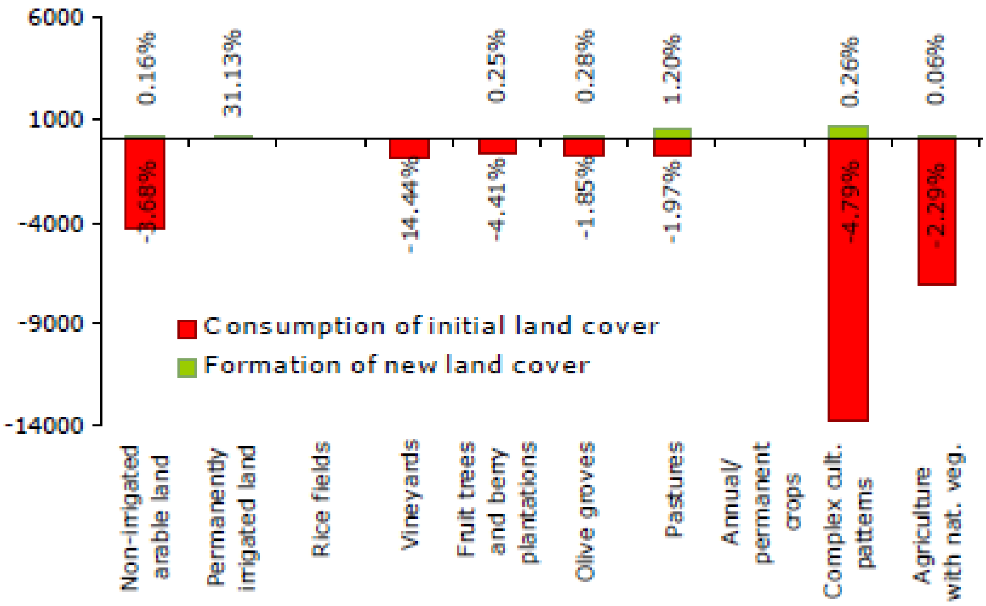


All agricultural classes have negative balance of net change, with largest consumption of area by complex cultivation patterns, followed by agriculture with natural vegetation and arable land. In percentage values, vineyards lost most of its initial area (almost 15%), followed by complex cultivation patterns with almost 5% consumption rate. Agricultural areas have been consumed mostly by diffuse residential sprawl and also by sprawl of economic sites and infrastructures and withdrawal of farming with transitional woodland creation to a lesser extent. Only small amount of new agricultural land has been created through conversion from wetlands, dry semi-natural land or forest.

Agriculture in Albania is characterised by high share of agricultural land with significant areas of natural vegetation and complex cultivation patterns. The rest of agricultural land consists mainly of arable land, olive groves and pastures.

Compared to intensive external consumption of agricultural land, the amount of internal changes in agricultural areas is almost negligible. Extension of pastures (mainly diffuse) is the prevailing internal agriculture flow, partly balanced by opposite diffuse conversion from pasture to arable/crop land (figure 14). Besides, there also occurs relative high rate of conversion from non-irrigated arable land to permanently irrigated land, but very small in absolute numbers.

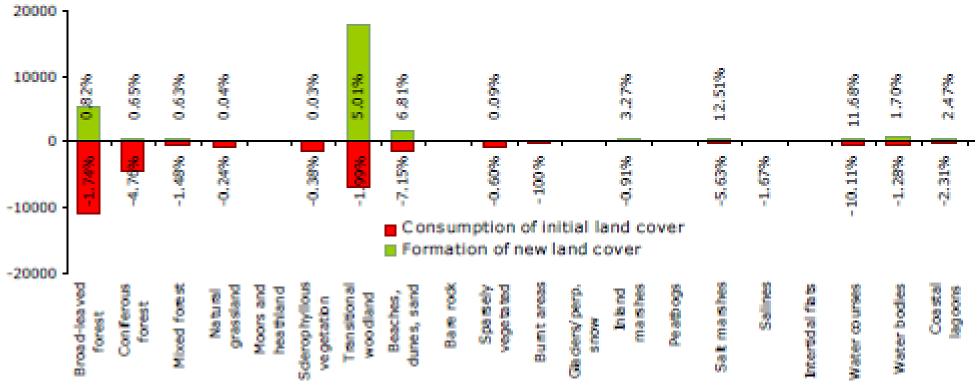
Figure 13. Development of agricultural areas 2000-2006 detailed balance (ha)



Forest and nature areas in Albania consist mainly of forested land (with predominant share of broad-leaved forest and transitional woodland), followed by semi-natural vegetation (mainly sclerophyllous vegetation and natural grasslands) and sparsely vegetated areas (figure 15).

Changes of natural land cover consist mostly of internal changes of forested land. The other significant drivers of natural land cover change are withdrawal of farming with woodland creation and residential land uptake, followed by forest creation over dry semi-natural areas, conversion of burnt areas into transitional woodland and water bodies and water courses extension over beaches and agricultural land.

Figure 14. Development of forest and nature areas 2000-2006 (ha)



With an annual land cover change rate of 0.11 %, the overall pace of landscape development in Albania is much slower, compared to the previous period 2000-2006. This rate also means, that the intensity of land cover development in Albania is about half of the European average.

The development is driven mostly by changes due to natural and multiple causes, represented in particular by forest and shrub fires, and forest creation and management, mostly recent felling and transition.

On the other hand, the intensity of urban residential sprawl, which was the main driver of land cover change in previous period, decreased rapidly and the artificial development is driven only by sprawl of economic sites and infrastructures in the period 2006-2012 (figure 16).

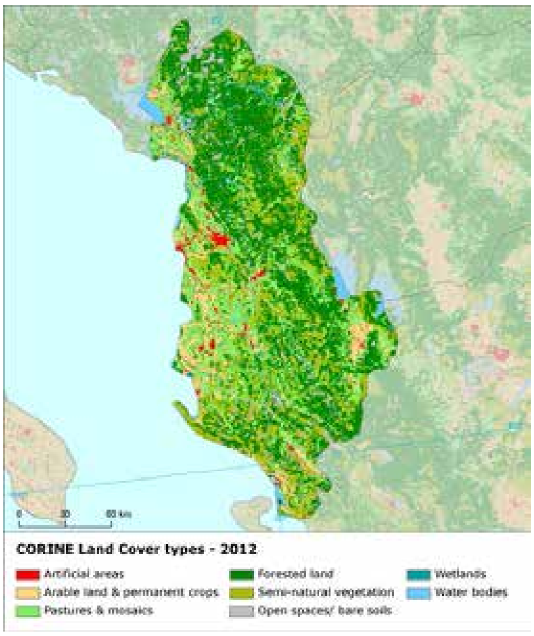


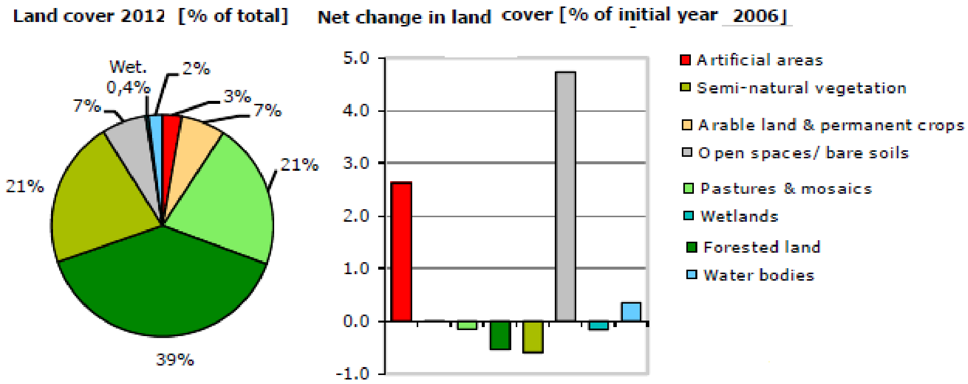
Figure 15. Albania land cover (2012)[40]

This means also rapid decrease of overall sprawl intensity, compared to the previous period. The value of annual land take rate fell from 4.69% in

40. www.eea.europa.eu

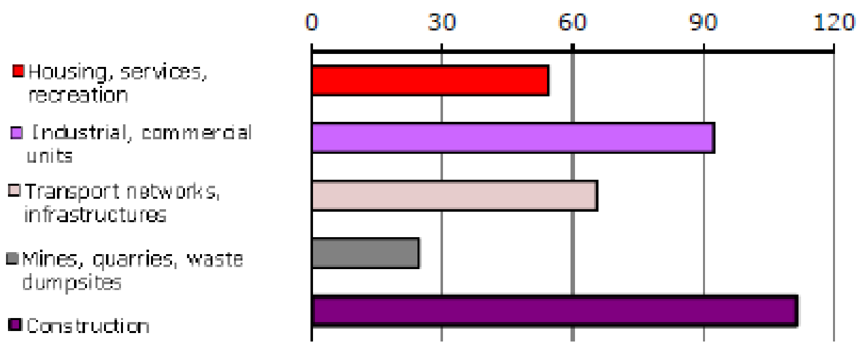
2000-2006 to 0.47% in 2006-2012, which, however, is still slightly above the European average.[41]

Figure 16. Land cover and land change 2006-2012



The artificial development in Albania encountered a huge slowdown, compared to the previous period. This is caused by slowdown of residential sprawl, which was the main driver of urban land take as well as of overall land cover development in the country during the previous period. The residential sprawl was concentrated in the western part of the country, with smaller concentrations on the east and south. In the period 2006-2012, the sprawl was driven mostly by construction of highways in the northern part of the country and also by extension of industrial and commercial units in the surroundings of the capital city of Tirana and also around the Durres city, located on the Adriatic seashore near Tirana.[42]

Figure 17. Artificial land take 2006-2012 (00 ha/year)



The overall intensity of agricultural land exchange in Albania is rather low, with prevailing internal flows. Extension of pasture, set aside and fallow land lost most of its intensity, compared to the previous period, and diffuse conversion

41. The results presented here are based on a change analysis of 44 land cover types mapped consistently on a 1:100.000 scale across Europe over more than a decade, between 2000-2006-2012 - see Corine land cover (CLC) programme for details. Number of years between CLC2006-CLC2012 data for Albania

42. www.eea.europa.eu

from pasture to arable and permanent crop land became the major driver of agricultural internal exchange in 2006-2012. Because of the slowdown of residential sprawl, also the intensity of consumption of agricultural land (mainly pastures) is much lower recently, comparing with the period 2000-2006. The internal structure of agricultural land consumed remains similar, prevailing share of complex cultivation patterns (45%), agriculture with natural vegetation (30%) and non-irrigated arable (21%) – which pretty well mirrors the structure of agricultural land in the country.

The most extensive drivers of landscape change in the country are forest and shrub fires. They consumed mostly sclerophyllous vegetation, broad-leaved forest and transitional woodland and shrubs. The total area destroyed by these fires in the period 2006-2012 was about 9000 hectares, located mostly in the south-western part of the country. In the previous period 2000-2006, these fires were not observed in Albania. The second most significant flow in both natural and overall land cover development is recent felling and transition. However, the intensity of this flow is significantly lower than in the period 2000-2006 and the opposite internal forest exchange – conversion of transitional woodland to forest – almost disappeared from the country. From other natural flows, extension of water courses and water bodies' creation was also present in Albania in the recent period[43].

4.2 Indicator II: Land Productivity status and trends

Land productivity is a measure of above ground net primary productivity (NPP), and is defined as the difference between the total photosynthesis and the total plant respiration in an ecosystem, or as the total new organic matter produced during a specified interval. It is reported in tons of dry matter per hectare per year (tDM/ha/year)[44].

Primary productivity of plants shows distinct dynamics over different temporal scales; daily variability due to the position of the sun, intra annual variability due to seasonal effects and inter-annual variability due to changes in climate, or changes in management and land use.

In order to detect degradation from temporal series of NPP, it is therefore important to filter out the effects of the vegetation's natural dynamics, that is specific for the type of ecosystem in question[45].

The LDN TSP (UNCCD 2016a) guides land productivity to be disaggregated by type of land cover it occurs in and productivity is therefore a proxy for management, land use intensity, and potentially degradation. If organic matter is extracted faster than it is produced NPP will decrease and is an indication that the ecosystem is being degraded.[46]

43. www.eea.europa.eu
44. Clark et al. 2001
45. Dutrieux et al., 2016; Jacquin et al., 2010
46. Haberl et al. 2001

Proxies for NPP, such as the much used Normalized Difference Vegetation Index (NDVI) from MODIS, basically account for the quantity of the standing biomass at a given time. Although biomass and productivity are closely related in some systems, they can differ widely when looking across land uses and ecosystem types.[47]
In such a scenario, an increase in NDVI means that land degradation is occurring, where normally an increase of productivity would indicate the opposite. Similarly, intensive mono-cropping systems with fertilizer application could also produce a false positive, i.e. an increase in productivity that is not associated with a decrease of land degradation. In this case, fertilizer use can mask the real state of the land under production.[48] These scenarios need to be evaluated in the context of the region of the LDN baseline assessment.[49]
Also, there are discussions about whether NDVI tends to saturate when applied over densely vegetated areas, which is a concern when using NDVI to estimate NPP in forested regions, or when applying it to forest degradation).[50]
NDVI has also been suggested as a simple proxy for overall land degradation in areas where precipitation is not the main driver of vegetation dynamics, e.g. in humid tropics.[51] However, the relationship of NDVI and – for example – soil erosion, which is a major land degradation process, is very weak.
Given some of the challenges with NDVI-derived products mentioned above, there are some commonly used vegetation indices that can be used as an alternative or an addition to traditional NDVI products.

The Land Productivity Dynamics (LPD) data has been proposed as a default dataset by UNCCD (2016a) when countries do not have better alternatives available. This dataset is based on a 15-year time series of NDVI observations, and as such already includes the trends. It is produced at a spatial resolution of 1 km and data are classified into five productivity classes depending on the state of the system. A global map of LPD was furthermore derived by using 15 year SPOT VEGETATION 1999-2013.

4.3 Indicator III: Soil organic carbon status and trends

Soils that are losing organic carbon are experiencing degradation and SOC is thereby a key indicator of soil health. The organic carbon also plays an important role in the biogeochemical cycles that can restore soil health. Soil carbon sequestration is therefore recognized as an important strategy for both, climate change mitigation as well as adaptation.
Indicator 3 reports on organic carbon stock above (biomass and leaf litter) and

47. Lohbeck et al., 2015
48. UNCCD 2015c
49. UNCCD 2016a
50. Huete et al., 1999
51. Yengoh et al., 2014

below ground (soil), however since above ground organic carbon is already to some extent reported through the UNFCCC, and there is no operational total terrestrial carbon estimation methodology to date, this baseline assessment will concentrate on Soil Organic Carbon (SOC). Furthermore, SOC has so far mostly relied on modeled trends based on LUCs.[52]

SOC is to be reported as tons of carbon per hectare (t/ha C). There are a number of existing methodologies and datasets available to measure soil organic carbon. They differ in the sampling framework used, field sampling methods and observations, laboratory analytical methods, uncertainty and change detection, and costs.

Most important, is making sure the sampling framework and associated measurements comply with the objectives of the study at the appropriate scale. Furthermore, one should carefully match the type of analysis with the appropriate sampling strategy. In fact this is a continually debated subject in the soil science community.

Two widely used analytical methods to measure soil carbon concentration are the chemical oxidation and dry combustion. Dry combustion is generally the recommended reference test for soil carbon.

Methods for mapping of SOC concentrations and stocks at different spatial scales are under rapid development, with significant progress being made based on the systematic collection of data on SOC stocks, combined with remote sensing and novel approaches for statistical modeling, such as machine learning algorithms.

The IPCC methodology could be applied to assess the soil organic C stocks, on the basis of initial and final land use SOCs.

$$\Delta C \Delta C_{Mineral} = \frac{SOCo - SOCo{-}T}{T} \cdot A \qquad (1)$$

Where:

- $C_{Mineral}$ = annual change in carbon stocks in mineral soils
- SOCo = soil organic carbon stock per hectare in the last year of an inventory time period [t C ha-1]
- SOCo-T = soil organic carbon stock per hectare at the beginning of the inventory time period [tC ha-1]
- T = default time period for transition between equilibrium SOC values [yr]
- A = area [ha]

The soil organic content can be calculated based on the organic matter content. A conversion factor of 1.724 has been used to convert organic matter to organic carbon based on the assumption that organic matter contains 58% organic.[53]

Organic C (g) = Organic Matter (g) /1.724 (2)

52. LDN-MN 2015, IPCC 2006

53. Nelson and Sommers, 1996

"

ISRICs *main objective is to provide the international community with information on global soil resources, focusing on soil data and soil mapping, as well as the application of soil data.*

However, there is no universal conversion factor as the factor varies from soil to soil, from soil horizon to soil horizon within the same soil, and will vary depending upon the type of organic matter present in the sample.
Conversion factors range from 1.724 to as high as 2.5.[54] Broadbent (1953) recommended the use of 1.9 and 2.5 to convert organic matter to total organic carbon for surface and subsurface soils, respectively.

Soil infrared spectroscopy (IR) is another (emerging) technology that makes large area sampling and analysis of SOC feasible. The use of IR produces consistent (and reproducible) predictions of SOC and allows for increased sample densities in order to capture the high spatial variability of SOC across landscapes. The use of IR data can be integrated with geospatial statistics and remote sensing for estimation of SOC concentrations and stocks at scales that range from local (within farm) predictions to continental assessments.
The default option set by UNCCD (2016a) to measure soil organic carbon is the SoilGrids database from the International Soil Reference and Information Centre (ISRIC) (http://soilgrids.org). In terms of the indicators relevant to LDN processes, the SoilGrids database provides predictions on soil properties and classes at a resolution of 250m.

The SoilGrids system is freely available and can be used by countries that don't have more accurate national or sub-national data available. ISRICs main objective is to provide the international community with information on global soil resources, focusing on soil data and soil mapping, as well as the application of soil data.
This means that the soil maps are based on the best global fit and might need field verification on a national or subnational scale to increase accuracy. However, SoilGrids is based on a continuously increasing number of soil profile descriptions and covariates so that accuracy is increasing rapidly. Besides providing baseline maps of soil organic carbon, the mapping framework is built to accommodate shared soil data from different sources. Existing and newly gathered soil data (including soil spectroscopy data) for an area of interest can be uploaded – e.g. through the SoilInfo App (http://soilinfo.isric.org) – to improve the accuracy of predictions.

54. Nelson and Sommers, 1996; Soil Survey Laboratory Methods Manual, 1992

Soil organic carbon is predicted for six different depths, allowing for the calculation of carbon stocks, which can be used as approximations for baseline values for carbon monitoring. These baseline maps can also be used for optimization of sampling strategies for future carbon monitoring. Regular model runs will use the new sets of observations or measurements contributed, and automatically produce new maps for the area of interest.
The Harmonized World Soils Database (HWSD)[55] was created by UNEPWCMC and JRC. The dataset has a spatial resolution of 1km and estimates SOC content (tC/ha) for a depth of 1m, divided into 0-30cm topsoil layer and a 30-1m subsoil layer. The SOC is modelled using existing/legacy maps from FAO, IIASA, ISRIC, and ISSCAS for best global fit. The HWSD is no longer updated, nor does it have time-steps for trend assessment.

Multiple sources of combined data are likely to be most precise, as was the conclusion from earlier land degradation assessments.[56] This is especially relevant if assessments must capture changes over time in at fine scale with heterogeneous land uses, compared to changes at large spatial scales.

55. http://eusoils.jrc.ec.europa.eu/ESDB_Archive/octop/Global.html
56. LADA/GLADIS 2009, Sommer et al. 2010, Reed et al. 2011

05 Drivers of Land Degradation

5.1 Soil a natural resource under pressure of degradation

The soil formation is a very slow process and the soil is regarded as nonrenewable resource or as conditionally renewable resource. Land degradation may be defined as long term loss of ecosystem function and productivity caused by disturbances from which land cannot recover unaided.[57] Land degradation which is also seen as a decline inland quality caused by human activities, has been a major global issue since the 20th century and it has remained high on the international agenda in the 21st century.

In the last decades, humans have been changing the world's ecosystems to meet the growing demands for food, freshwater, timber, fiber, fuel and minerals. Degradation is the consequence of physical, chemical and biological shifts driven by environmental, social and economic pressures. These include economic growth, demographic dynamics, urbanisation and different human activities such as tourism, agriculture, transport, industry and energy activities. These trends can eventually result in degradation processes through changing intensity of land use. For example, urbanisation and urban sprawl are the most important drivers of soil loss due to soil sealing. These processes are in turn driven by complex socio-economic factors including the land development

57. Z. G. Bai , D. L. Dent , L. Olsson& M. E. Schaepman 2008. Proxy global assessment of land degradation. Soil Use and Management, September 2008, 24, 223–234

policies, migration from urban areas and economic growth.
An increase in population results in an increased demand for housing and other facilities, such as offices, shops, and public infrastructure. This, in turn, can lead to an increase of soil surface with impervious materials as a result of urban development and infrastructure construction and deforestation.
The economic growth is followed by the growing need for new commercial and industrial buildings. Further, economic growth creates new jobs and thus attracts more workers, leading to population growth, and construction of new houses and infrastructure. A change in the price of agricultural or forest products can, furthermore, affect landowners' decisions to keep land in those uses.
Also, policies aimed at supporting agricultural prices provide an incentive to keep land in farming. While agriculture does not necessarily lead to soil degradation, there is some evidence that the move to intensive agriculture has aggravated the impact on soil quality.
International, national, regional, and local planning and policies influence greatly the rate at which land-use and land-cover changes, which in turn can result or avoid certain degradation processes. Furthermore, certain policies aim specifically at protecting soil.
Technological developments influence the intensity of activities e.g. agricultural mechanisation, improvements in methods of converting biomass into energy, use of information-processing technologies in crop and pest management, and the development of new plant and animal strains through research in biotechnology.
Such developments often alter the usefulness and demand for different types of lands. Extension of basic transport infrastructure such as roads, railways, and airports, can further take up land resources and result in their overexploitation and degradation.
Research suggests that climate change induced land degradation will vary geographically. Climate change induced land degradation is expected through: changes in the length of seasons; recurrence of droughts, floods and other extreme climatic events; changes in temperature and precipitation which in turn reduces vegetation cover, water resource availability and soil quality; changes in land-use practices such as conversion of lands, pollution, depletion of soil nutrients[58]. On the other hand, there is increasing evidence that land degradation is a driver of climate change.

Climate change, as explained above, is an issue of paramount importance for societies and the links between climate mitigation and adaptation with the quality of our lands and the services they provide will need further consideration into the future. For example, the effects of soil erosion will worsen in the future due to changes in climate influencing rainfall patterns.

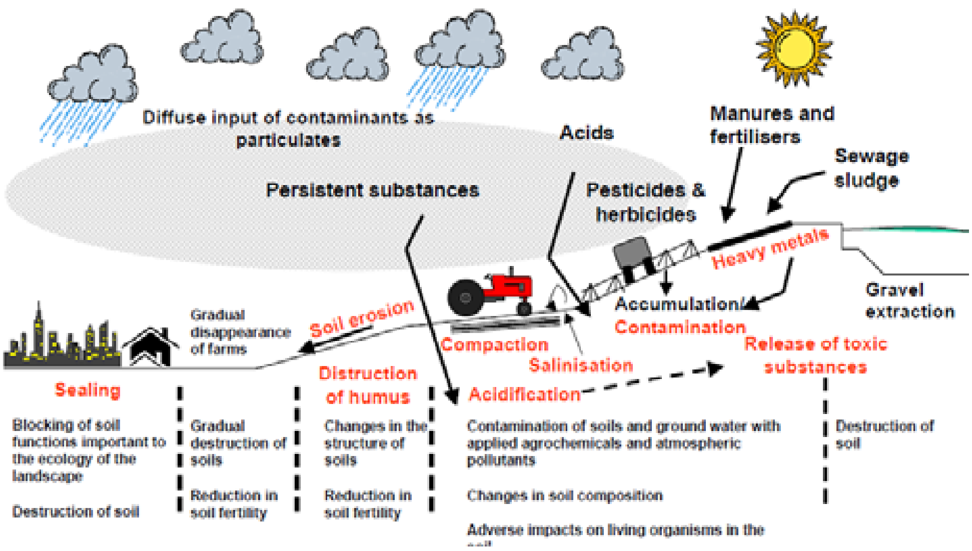
58. Eswaran et al., 2001

Meanwhile, the scale of extreme events associated with climate change, could be exacerbated by a failure to protect lands structure and hydrological flows. Actions exerting pressures upon soils and land include emissions of pollutants to air, water and land, land abandonment, agricultural intensification and management practices, deforestation, forest fires, waste disposal, inappropriate water management and extraction of natural resources. The world map on the status of human-induced soil degradation known as the GLASOD (Global Assessment of Soil Deterioration), a general classification of soil degradation was developed by ISRIC (International Soil Reference and Information Centre), in cooperation with FAO and UNEP. In this classification, all forms of soil degradation are grouped into four major types, each including several subtypes:

- Water erosion (i.e. loss of topsoil, terrain definition/mass movement);
- Wind erosion (i.e. loss of topsoil, terrain deformation, over blowing);
- Chemical degradation (i.e. loss of nutrients and/or organic matter, salinisation, acidification, pollution);
- Physical degradation (i.e. compaction, sealing and crusting, water logging, subsidence of organic soils).

Key soil threats have already been recognized at the EU level. The Communication of the Commission to the European Parliament and the Council "Towards a Thematic Strategy on Soil Protection" identifies eight main soil degradation processes. These are erosion, organic matter decline, contamination, salinisation, compaction, soil biodiversity loss, sealing, landslides and flooding (figure 19).

Figure 18. The impact of human activities on soil[59]



59. Montanarella, 2006

The main problematic issues in the area of land management in NEAP –2001 have been identified as follows:[60]

- Land degradation (erosion, lowering of land yield, salinity)
- Land pollution (urban and industrial)
- Slides and floods
- Unsustainable use of land
- Lack of plans for integrated use of land
- Unclear competencies of responsible institutions
- Incomplete legislation and weak law enforcement
- Uncontrolled urbanization

The soil scientists agree that the main soil degradation processes occurring in Albanian are:

1. Soil erosion
2. Sealing
3. Loss of organic material
4. Pollution & contamination
5. Salinization
6. Slides and floods

5.2 Anthropogenic pressures driving land degradation in Albania

Albania's land pressures driving land degradation before 1990s were linked to state policy to increase the agricultural surface area. Over the decades, many lagoons and wetlands were adapted as lands for agricultural use damaging habitats and special value ecosystems.

Adaptation of these natural areas to the agricultural land increased the salt concentration to the soil and coastal erosion. New farmland has expanded to cover natural habitats covered before by shrubs or forests throughout the country. Deforestation also included hillsides creating terraces. It is estimated that for about 4 decades the area of agricultural land in Albania has increased twice. This governmental policy led to increased land erosion, soil degradation due to the disorder of the multi-annual regime of ecosystems. The land use change from natural to agriculture is estimated to be about 300000 ha.

After the 1990s, with the change of regime, other forms of pressure driving land degradation appeared. The land was privatized by distributing to the about 500,000 households with an average of about 1.2 ha divided into more than 2 million parcels. The right of use "without legal restrictions" was taken by the new owners. For about two decades the "Albanian state" does not

60. Albania National Report Convention on Combat Desertification, 2002

exercise control over the territory by showing pressures that include the entire territory of the country as follows:

- The emigration of the rural population towards the capital and the other cities in the coastal lowland
- Lack of state control over the country's territory
- Uncontrolled constructions in the absence of territorial development plans
- Massive deforestation for several years
- Unfavorable use of the river for raw materials
- Climate change and increased risk of flooding and forest fires
- Degradation of protective structures against erosion and not their renewal
- Discharge polluted water and urban waste into the country's rivers
- Discharge of industrial waste in the open environment and the country's rivers
- Use of the salt groundwater for irrigation
- Abandonment of land due to immigration and other social conditions

Accelerated soil erosion, deforestation, overgrazing, soil pollution, re-salinization, acidification, waterlogging, flooding, urbanisation, nutrient mining, and loss of soil fertility are perhaps the most alarming environmental problems in Albania.[61]

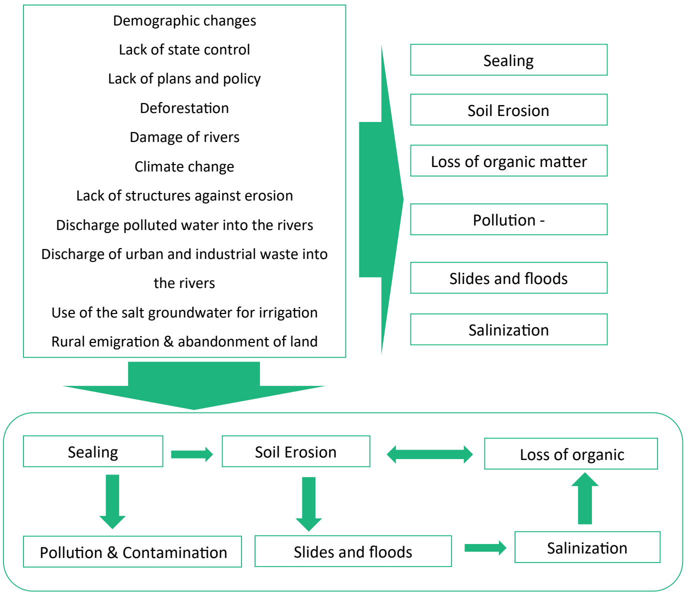
It is estimated that in Albania, in only one year, erosion washes away 1.2 million tons of organic carbon, 100,000 tons of nitrate salts, 60,000 tons of phosphates, and 16,000 tons of potassium salts while the total amount of fertilisers imported or produced by local industry is far less. Other studies[62]) show that soil fertility is decreasing mainly because of reductions in organic matter content, nitrogen, and potassium compared to 20 years ago, resulting in nutrient mining of the soils. The degrading area includes 2334 km^2 by affecting 137861 peoples.

Table 2. The soils with restricted fertility[63]

Nr.	Soils with restricted fertility	Surface (ha)
1	Saline Soils	12875
2	Acid Soils	61731
3	Serpentine Soils	12464
4	Fragmentary Soils	74479
5	Marshy Soils	9969
6	Other unfertile soils	411
	TOTAL	

61. Zdruli P, 1994
62. Qilimi B, 1996
63. Kristo I et al, 2013

Figure 19. Pressures driving land degradation and soil threats in Albania



Following figures are from activities or pressures driving land degradation in Albania during the last decade.

Figure 20. The exploitation of raw materials on the Mati River (2015)

Figure 21. The impakt of river exploitation on the infrastructure (Shkumbini River 2016)

Figure 22. The deforestation of Lura

Figure 23. Flood caused by the Vjosa River

Figure 24. Fire in the Seman forest

Table 3 is a summary of pressures driving land degradation in Albania, soil degradation and regions where this phenomenon is present.

Table 3. Pressures Driving land Degradation in Albania

Anthropogenic Pressures Driving land Degradation	Soil degradation process	Region and level of significance effect64
The emigration of the rural population towards the capital and the other cities in the coastal lowland	Lack of plans for integrated use of land Uncontrolled urbanization Sealing Unsustainable use of land	Tirana***** Durres**** Fier*** Vlora*** Shkodra** Lezha** Pogradec***
The transition period& lack of state control over the country's territory	Sealing Deforestation Erosion Contamination Uncontrolled urbanization Land pollution (urban and industrial) Unsustainable use of land	Tirana***** Durres**** Fier*** Vlora*** Shkodra** Lezha*** Pogradec**** Saranda*****
Uncontrolled constructions in the absence of territorial development plans	Soil erosion and disaggregation Sealing Contamination Compaction Uncontrolled urbanization	Tirana***** Durres**** Fier*** Vlora*** Shkodra** Lezha*** Pogradec**** Saranda*****
Massive deforestation for several years	Soil erosion and disaggregation Slides and floods Loss of organic material Biodiversity loss	Puka***** Dibra***** Tirana*** Librazhdi**** Korca*** Berati ***

64. * low level ***** the highest level of significance

Unfavorable use of the river for raw materials	Soil erosion Slides and floods Loss of organic material Biodiversity loss	Shkodra***** Lezha***** Durrës*** Lushnje*** Fier*** Vlore*** Elbassan***	
Climate change and increased risk of flooding and forest fires	Soil erosion Slides and floods Forest fires Loss of organic material Biodiversity loss	Shkodra**** Lezha***** Durrës*** Lushnje*** Fier*** Vlore*** Elbassan***	
Degradation of protective structures against erosion and not their renewal	Soil erosion and disaggregation Slides and floods Loss of organic material Slides and floods	Hilly and mountainous area***** Coastal area*** The sides of the rivers***	
Discharge polluted water and urban waste into the country's rivers	Contamination Biodiversity loss Soil degradation	Shkodra**** Lezha**** Tirana*** Durres**** Fier***** Berat*** Elbasan***** Vlore***	
Discharge of industrial waste in the open environment and the country's rivers	Contamination Biodiversity loss	Shkodra**** Lezha**** Tirana*** Durres**** Fier***** Berat*** Elbasan***** Vlore***	
Use of the salt groundwater for irrigation	Salinisation Biodiversity loss Desertification	Shkoder*** Lezha**** Fier**** Lushnje***** Vlore***	
Abandonment of land due to immigration and other social conditions		soil erosion and disaggregation loss of organic material	Kukës***** Dibër**** Korça**** Berati*** Elbasan***

5.3 Soil threats in Albania

5.3.1 Soil Erosion

Soil formation and restoration on the geological substrate take thousands of years, whereas the processes of soil degradation and soil loss are sometimes much more rapid and might occur in a matter of seconds or minutes, such as is the case with soil erosion (figure 26).

Figure 25. View from soil erosion in Albania

Erosion is primarily the result of inappropriate land management as deforestation, overgrazing, forest fires, and construction, and is affected by climate change and land use practices. As soil is slow to form, significant amounts of erosion can seriously impede soil functions, since it entails the loss of soils.

Soil erosion is almost immeasurable at source; it is hard to identify the area of origin and complicated to manage due to their spatial and temporal variability, complex transport pathways and strong relations to hydrology and soil properties. Wherefore, erosion is typically captured as erosion risk or erosion sensitivity.

In the case of soil erosion by water, both rainsplash and water running over the soil surface detach and then move the detached particles, but rainsplash is the most important detaching agent whereas running water is the principal transporting agent. The transport of soil particles resulting from the direct impact of falling raindrops is designated as rainsplash erosion, while the transport of soil particles by running water is commonly divided into interrill and rill erosion. Interrill erosion then refers to water running as a shallow sheet ("overland flow") and removing a relative uniform thickness of soil, whereas rill erosion refers to water running as concentrated flow and removing soil by "digging out" channels of increasing deepness and/or width. In turn, rill erosion is generally divided into rill and gully erosion depending on channel dimensions.

Not only water running over the soil surface as described above but also water moving laterally through the soil matrix in downslope direction ("interflow") can detach and transport soil particles, including as concentrated flow in macro-pores or subsurface pipes.

Soil loss via water erosion in Albania is a widespread phenomenon. Soil loss is 2-3 times higher in Albania than in other Mediterranean countries and 10 to 100 times greater than in many other European countries[65].

- The typical Mediterranean climate is one of the most aggressive ones in terms of erosion (heavy rainfall intensities, high rainfall amounts, drought as a permanent phenomenon, etc.).
- The topographic and soil conditions (steep slopes, silty soils, low humus content) already classifies about more than 50 % of the total area in Albania as naturally erosive.
- The anthropogenic impacts (forest cutting, cultivated steep slopes, up-down cultivations, bare soils after harvesting, overgrazing, absence of erosion protection measures) resulting in significant soil loss rates.

Local measurements on hydrology and erosion are extremely scarce and mostly historical. However, the international scientific literature contains several estimates on the erosion and sediment transport in the Mediterranean region. Nevertheless, the various authors report a wide range of soil loss and sediment transport level of the country.

National average soil erosion rate of 27.2 tons per hectare and year, which results in an annual sediment flux of 60 million tons carried by the Albanian watercourses. The evaluation of soil erosion for the whole country, they computed a soil loss rate more than 10 tons per hectare and year for a remarkable part (in the center and south) of the country and even more than 100 tons per hectare and year at three smaller regions also in the south[66].

Authors reports a soil loss range of 20-100 tons per hectare and years for Albania and they computed for the north, middle and south-east region of the country an annual average agricultural erosion rate of 15, 5 and 37 tons per hectare and year, respectively.

Figure 26. View from soil erosion monitoring (2012)

65. Soil Monitoring Raport, AUT, 2012
66. Soil Monitoring Raport, AUT, 2014

About 83 million tons per year suspended sediment fluxes transported by the main Albanian rivers into the Adriatic and Ionian seas. River flow can reduce by 40-50 % in dry years and increase by 40-70 % in wet years.
The erosion module of the PhosFate model was applied for the whole territory of Albania considering long-term average conditions. To perform a countrywide assessment on erosion and sediment transport a GIS database was compiled according to the model demands. The necessary digital maps (***e. g.*** topography, soil characteristics, humus content, land cover and vegetation) and climate data (rainfall, meteorology) were collected from different international data sources. Data for the modeling were collected from international databases and publications on the erosion and its related and important fields.[67]
There is significant soil loss in the whole Albania territory, but it is especially important in three main regions, which are located in the north, in the central part of the country and in the south. In these regions, soil loss can be found with values more than 10 tons per hectare/year, but values even more than 100 tons per hectare/years appear also quite frequently.
Countrywide average soil loss rate is 31.5 tons per hectare per year, which is far above the tolerable limit of 10 tons per hectare/years. The average rate means totally 90.5 million tons soil eroded annually in the country.
Distribution of the higher soil loss classes is demonstrated in table 4. About 1.8 % of the territory produces tolerable erosion, and 22 % (6399 km2) has higher soil loss rate than the tolerable limit. However, this 22 % of the total area is responsible for the majority (93 %) of the soil erosion.

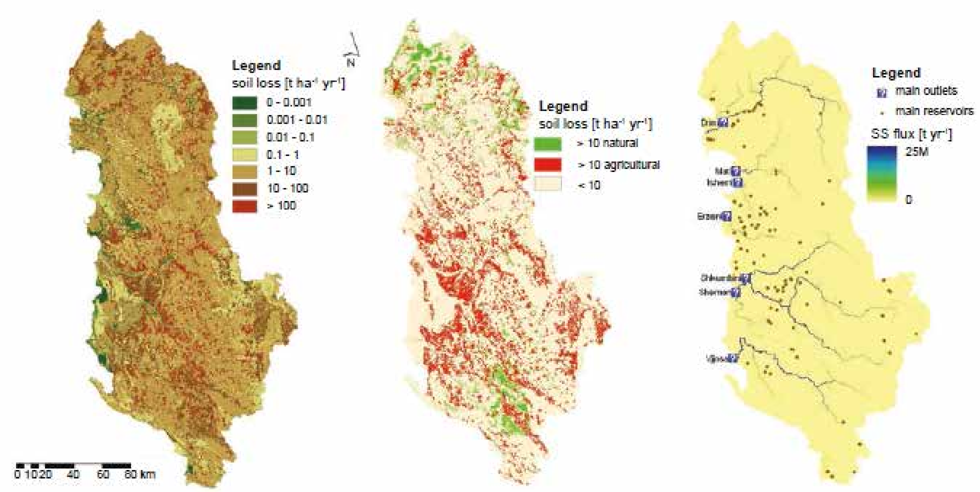
Table 4. Area, total amounts and proportions of the specific loss rate classes in Albania[68]

Soil loss rate t ha-1 year-1	Area km2	Area proportion %	Total soil loss 106 t year	Soil loss proportion %
< 1	6556.3	22.8	0.2	0.3
1-10	15795.2	54.9	6.3	7.0
10-100	4121.6	14.3	12.6	13.9
> 100	2277.0	7.9	71.4	78.9

Figure 28 shows the potential soil loss source areas, which have higher erosion rate than a tolerable or critical value. Red color indicates the sources being under agricultural cultivation, while green areas represent the naturally covered regions, which can also produce significant erosion. 76 % of the source areas (4875 km^2) is agricultural land. The natural areas (1523 km^2) cause the background SS loads of the river system.

67. Adam S. Kovacs et al. 2012
68. AUT, Monitorimi i erozionit te tokës

Figure 27. (a) Calculated long term average soil loss rates in Albania (b) Agricultural and natural source areas of soil erosion in Albania (c) sediment transport by the main watercourses of Albania



Moderate slopes up to 7 % do not generate high soil losses for both specific and total values. Over 7 % slope the soil loss values ate increasing and reaching a value more than 40 tons per hectare and year. Over 24 % the specific value is slightly rising only, however, due to the high share of the steep regions in the country, the total soil loss volume is much higher in the steepest class (about 57 million tons per year) than in the others. 63 % of the total soil loss comes from the steepest regions of the country, while below 12 % steepness the contribution to the total erosion is very low.

5.3.2 Soil sealing

Soil sealing refers to the destruction or covering of soils by buildings, structures, and partially or completely impermeable materials. Soil sealing is a serious threat because it entails the complete loss of soil functions, and is usually irreversible. Between 2000 and 2006 the amount of sealed area across Europe increased by about 2.7%. Soil sealing is especially an issue in Western Europe[69].

Through sealing and thus interrupting the exchange in between the soil system and other ecological compartments, including the biosphere, hydrosphere and atmosphere, all processes in the water cycle, biogeochemical cycles and energy transfers are affected[70]. This leads to a number of negative effects (figure 29):

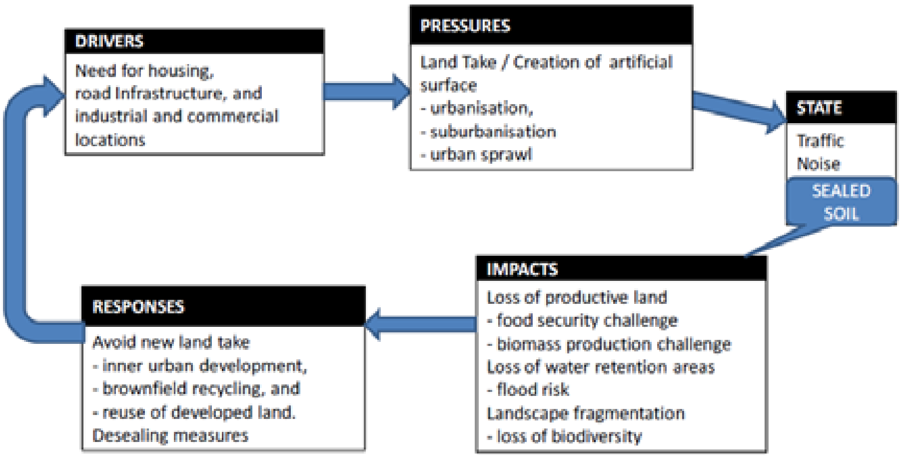
- Less availability of fertile soils for future generations.
- Reduction of soil functions such as soil as sink and diluter for pollutants and transformation of organic wastes and a reduction of the water storage capacity that leads to ground water renewal.

69. FAO and ITPS 2015

70. European Communities, 2011

- Loss of water retention areas and at the same time increase in surface water runoff, which leads to additional flood risk and in some cases to catastrophic floods.
- Less soil carbon sequestration and carbon storage.
- Landscape fragmentation and loss of biodiversity through reduction of habitats and remaining systems too small or too isolated to support species
- Unsustainable living patterns such as the increase of spread buildings leading to traffic and air emissions, infrastructure costs for the municipality concerned and urban development on high quality agricultural land that leads to a lack of productive soils for food and other biomass production.
- Sealed surfaces have higher surface temperatures than green surfaces and alter the micro climate in particular in highly sealed urban areas. Large sealed areas become even more problematic in view of climate change and increasing temperatures

Figure 28. Soil Sealing in the context of driving forces, negative effects and possible responses[71]



Soil sealing is generally measured in the amount or share of built-up land (e.g. in area of built-up land divided by total land area.), or the increase in built-up land across a given span of time (e.g. % increase or absolute increase over previous year).

71. Umweltbundesamt, 2010

Figure 29. Buildings in the suburbs of Tirana after the 90s

The Land Cover observations include the documentation of artificial surfaces, which refer to residential structures, industrial land use, infrastructure but also recreational land use types. The Land Cover data are generated by remote sensing technologies based on satellite images. In particular interpretation of artificial surfaces is very sensitive, since this land cover type includes very small and dispersed structures which are highly dependent on the mapping intensity of local experts.

Changes in the land cover in Albania are well documented. The reduction of forests has happened during 1950–1990 with about 18%. Of a great importance is the total deforestation in the lowland area of elm forest (***Ulmus foliaceae***), ash forests (***Fraxinus angustifolia***), English oak forests (***Quercus robur***) and the largescale deforestation for the plant production of oak forest in the hill areas of Hasi (Kukës) and Dumre (Elbasan). About 15 000 ha of shrub area have been converted to cultivated pastures that led to intensive soil erosion.[72]

During this period, about 200 000 ha of swamps and wetlands are converted to cultivation, and the pastures have dramatically decreased from 816 000 to 417 000 ha and degraded for the same reasons (table 5).

Table 5. Land-use change in Albania for the period 1950–2009 (1000 ha)[73]

Classification	1950		1990		2001		2009	
	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%
Land, total	2875	100	2875	100	2875	100	2875	100
Agricultural soil	1207	42	1121	39	1139	39	1137	39
– arable soil	391	14	704	24	699	24	696	24
– pastures	816	28	417	15	440	15	441	15
Forests	1282	45	1045	36	1024	36	1041	36
Other land	386	13	709	25	712	25	712	25

Table 6 and 7 provides an overview of available data, their source, geographical coverage, and time reference for Albania.

72. Marku and Gjoka 1999
73. MoAFCP, 2010

Table 6. Summary balance table 2000-2006[74]

	Artificial areas	Arable land & permanent crops	Pastures & mosaics	Forested land	Semi-natural vegetation	Open spaces / bare soils	Wetlands	Water bodies	TOTAL [hundreds ha]
Land cover 2000	**507**	**1783**	**6388**	**11267**	**6360**	**1762**	**102**	**626**	**28797**
Consumption of initial LC	3	66	216	233	19	29	3	15	584
Formation of new LC	280	5	14	239	2	17	7	20	584
Net Formation of LC	**277**	**-61**	**-202**	**6**	**-17**	**-12**	**4**	**5**	**0**
Net formation as % of initial year	*54.6*	*-3.4*	*-3.2*	*0.1*	*-0.3*	*-0.7*	*3.6*	*0.8*	
Total turnover of LC	**283**	**71**	**231**	**472**	**22**	**46**	**10**	**34**	**1168**
Total turnover as % of initial year	*55.8*	*4.0*	*3.6*	*4.2*	*0.3*	*2.6*	*9.7*	*5.4*	*4.1*
Land cover 2006	**784**	**1722**	**6186**	**11274**	**6343**	**1751**	**106**	**631**	**28797**

Between 2000 and 2006 (table 6) the amounts of artificial surface increase by 27700 ha of which 96% for construction (hausing, services, industrial units etc). Table 7 shows that the intensity of soil sealing decreases. Between 2006 and 2012 the amounts of artificial surface was 2100 ha.

Table 7. Summary balance table 2006-2012[75]

	Artificial areas	Arable land & permanent crops	Pastures & mosaics	Forested land	Semi-natural vegetation	Open spaces / bare soils	Wetlands	Water bodies	TOTAL [hundreds ha]
Land cover 2006	**792**	**1864**	**6204**	**11360**	**6227**	**1801**	**109**	**592**	**28948**
Consumption of initial LC	3.6	5.0	11.1	128.5	37.9	5.3	0.2	0.5	192
Formation of new LC	24.4	5.0	1.7	67.2	0.6	90.5	0.0	2.6	192
Net Formation of LC	**20.8**	**0.0**	**-9.4**	**-61.3**	**-37.2**	**85.2**	**-0.2**	**2.1**	**0**
Net formation as % of initial year	*2.6*	*0.0*	*-0.2*	*-0.5*	*-0.6*	*4.7*	*-0.2*	*0.3*	
Total turnover of LC	**28.0**	**10.0**	**12.8**	**195.7**	**38.5**	**95.8**	**0.2**	**3.1**	**384**
Total turnover as % of initial year	*3.5*	*0.5*	*0.2*	*1.7*	*0.6*	*5.3*	*0.2*	*0.5*	*1.3*
Land cover 2012	**813**	**1864**	**6194**	**11298**	**6190**	**1886**	**109**	**594**	**28948**

The land take around Tirana and coastal cities is expected to grow continually, despite the fact that the best agricultural land is located there. The problem is clearly visible and several measures it is necessary to undertaken to avoid further soil loss by sealing.

5.3.3 Loss of soil organic matter (SOM) or soil organic carbon (SOC)

The loss of soil organic matter (SOM) is the result of both the mineralization process and soil erosion. The changing of soil organic carbon loss or gain due to cultivation or management practices is usually slow, with the exclusion of losses due to landslides or erosion.

74. The results presented here are based on a change analysis of 44 land cover types mapped consistently on a 1:100.000 scale across Europe over almost two decades 1990-2006

75. The results presented here are based on a change analysis of 44 land cover types mapped consistently on a 1:100.000 scale across Europe over more than a decade, between 2000-2006-2012

Carbon is the prime element present in SOM, comprising 48%-58% of the total weight. Other elements include hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P) and sulphur (S) with an average C:N:P:S ratio of 100:10:1:1. Chemical components of SOM encompass those derived from plant, animal and microbial residues, and their transformation products, termed as humic substances.

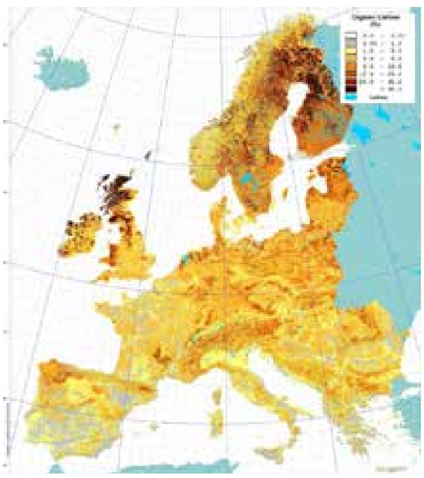
Soil, after the oceans, is the largest pool of carbon on earth. The SOC pool is about twice the size of the atmospheric carbon pool and about three times the size of the biotic carbon pool. The global SOC pool to a depth of 1m is estimated at 1,500 billion tons.[76]

Cultivated or disturbed soils tend to lose soil organic matter or carbon, whereas permanent grasslands and forests can be expected to gain soil organic carbon over time. About 45% of soils in the EU have low soil organic carbon[77]. The Mediterranean region is particularly at risk of soil organic carbon losses, as high temperatures and droughts can accelerate soil organic carbon decline. Loss of soil organic carbon can be measured over a given time period using soil samples.

Soil organic matter (SOM) decline has been widely recognised as a major threat for sustainable soil management because of the pivotal role played by the organic material on many soil functions, like food and biomass production, storage and filtering, biological habitat and gene pool, etc. There is great uncertainty about SOM/SOC stocks in Europe and trends therein. To detect SOC changes at a regional level there are very few long-term soil monitoring networks with sufficient number of sampling sites and contrasting SOC trends among countries are often reported[78].

"Cultivated or disturbed soils tend to lose soil organic matter or carbon, whereas permanent grasslands and forests can be expected to gain soil organic carbon over time. About 45% of soils in the EU have low soil organic carbon.

Figure 30. Topsoil (0-30 cm) organic carbon content (%) in Europe79



European topsoils (0-30 cm) store around 79 Gt of organic carbon, of which 73 Gt are stored in the EU-28. The figure 31 clearly showed the broad distribution of SOC across Europe with a decreasing gradient from north (high levels correspond to peatlands) to south. Spatial analysis of the European database suggests that 30% of the EU topsoil SOC stock (around 22 Gt C) is in agricultural soils, of which 15-17% (around 13 Gt C) relates to cropland and 12% (around 8 Gt C) to pasture (as defined in the CORINE

76. Batjes, 1996
77. FAO and ITPS 2015
78. Saby et al., 2008
79. Jones et al., 2005

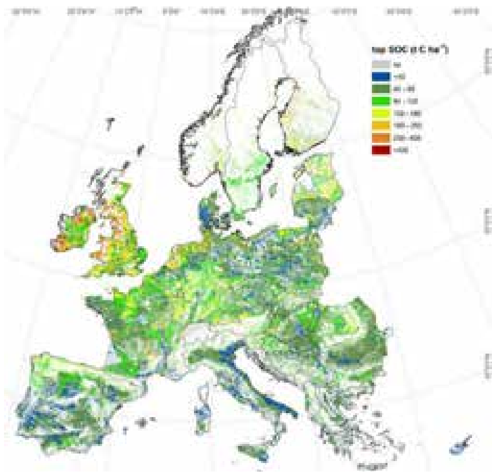
Land Cover database). By comparison, nearly 50% of the total EU stock is located in woodland soils.

The 2009 LUCAS[80] Topsoil Survey included a component of soil sampling, with around 20 000 sampling sites in 25 EU Member States (except Romania and Bulgaria). LUCAS soil samples were taken from all land use/ cover types but with a focus on agricultural areas.

The objective of the soil sampling was to improve the availability of harmonized data on soil parameters in Europe. The analysis results formed the LUCAS soil database including SOC content in top soil (0–30 cm), expressed as g/kg. A data quality assessment was performed on the dataset, taking into consideration the main climatic zones, regions, land cover classes and management practices. The lowest levels of SOC were observed in the Mediterranean climatic region; this general pattern confirmed that SOC content is higher in northern than in southern parts of the continent.

The evolution of EU policies on C accounting and sequestration may be constrained by the lack of accurate SOC estimations and the lack of tools to conduct scenario analyses, especially for agricultural soils. Therefore, a comprehensive model platform was established at a pan- European scale and Albania using the agroecosystem SOC model CENTURY. Almost 164 000 combinations of soil-climate-land use were analysed, including the main arable crops, orchards and pasture. The model was implemented with the main management practices (e.g. irrigation, mineral and organic fertilization, tillage) derived from official statistics.

Figure 31. SOC stock in the top-soil layer (0–30 cm) of European agricultural soils[81]



The results showed that topsoil SOC values varied significantly across the EU. The lowest values occurred in the Mediterranean region (often below 40 t C ha−1) while the highest values occurred in north-eastern Europe (on average between 80 and 250 t C ha−1).

SOM amounts in the soil depend on biotic processes essentially the photosynthates and respiration as well the erosion. In natural ecosystems, the climate condition, the climate change, the vegetation type, the soil type and the agricultural management are the main driver affecting of SOM content (tabele 8).

80. Land Use/Cover Area frame Survey-EU project
81. Source: Lugato et al., 2014

In Albania, about 75.2 % of total land (not only agricultural) exert an organic carbon (OC) content ≤ 2% and 23.6% of total land have organic carbon (OC) > 2%[82].

Table 8. Drivers affecting SOM content in Albania

Drivers & pressers	Regions most affected
Climate conditions	Shkoder, Lezhe, Durres, Fier, Vlore
Topography &soil erosion	Diber, Kukes, Shkoder, Tirane, Berat, Korçë
Soil type (texture and structure)	Shkoder, Lezhë, Durrës, Fier, Vlorë
Land cover	Dibër, Burrel, Tiranë, Berat, Korçë
Land management	Country level
Agricultural practices	Country level
Deforestation	Dibër, Kukës, Berat, Korçë, Tiranë
Soil pollution	Elbasan, Fier, Berat
Economic growth	Tiranë, Durrës, Fier, Vlorë, Shkodër, Lezhë
Infrastructure and energy sector	Shkodër, Dibër, Kukës, Berat, Fier, Gjirokastër

The SOM cycle is also affected by other external drivers and pressures such as government policies (e.g. agrienvironment, energy), technological developments, climate change and demographic trends, etc. mainly through changes in land use and agricultural management. SOM decline has strong implications for other soil threats and, in particular, soil erosion, compaction, biodiversity and desertification.

Simple applications of the Universal Soil Loss Equation (USLE) show that peaks in soil erodibility can be observed in soils with clay and SOM contents of around 10-20% and 1-2%, respectively, while an increase in SOM from 2% to 4% halves the predicted soil losses.

SOM depletion can also have negative consequences for the filtering and buffering capacities by reducing the soil capability of adsorbing and/or biodegrading pollutants.

SOM plays a crucial role on soil function of biological habitat and gene pool. SOM depletion is usually associated with a lower biological activity and diversity even if it is not still clear if there exists a threshold level of SOM that is required to maintain all the functions of the microbial population. A maximum level of biodiversity is reached when sufficient levels of water and energy and low-to- medium level of nutrients are encountered.

Biodiversity is also related to the nature of organic matter since each type of soil organism favours different substrate and nutrient sources. SOM depletion has negligible effects on soil functions of "physical heritage", "platform for man-made structures" and "provision of raw materials".

82. Hinsinger, 2014

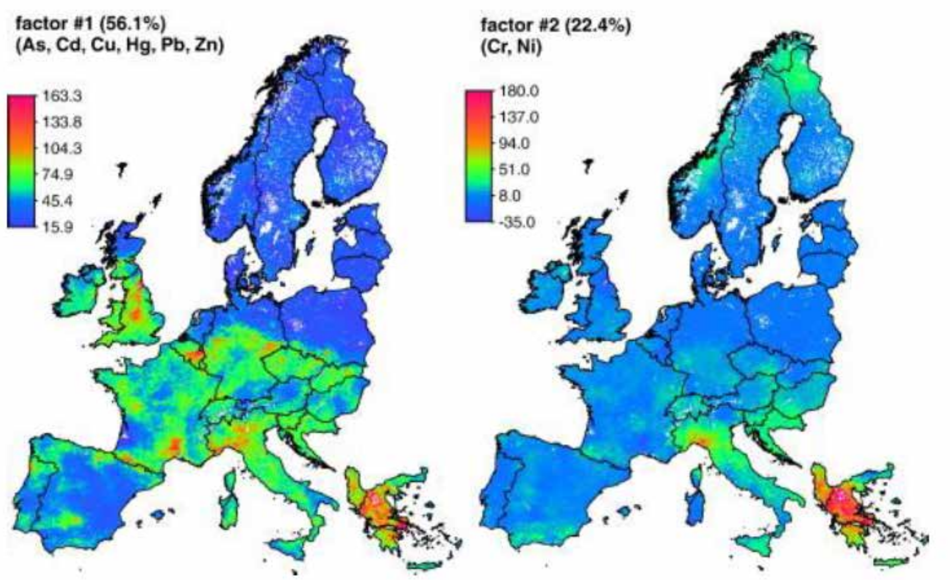
5.3.4 Soil contamination and pollution

The terms contamination and pollution are often used interchangeably. When a distinction is made, two main aspects are often considered:

- pollution as an activity that causes contamination
- contamination being the presence of a foreign substance, not necessarily harmful, while pollution indicates that harm is being done.

Soil contamination can result from natural causes or from human activities such as mining, agriculture, transport, and industry etc. Contamination covers a broad spectrum of pollutants, including heavy metals, organic chemicals, nutrients, or pharmaceuticals, and can be either point source, i.e. from a single identifiable source such as a mine, or diffuse, e.g. from agricultural activities.
Contamination can have major negative impacts on the environment, e.g. on water quality or biodiversity, especially if a soil's filtering capacity is exceeded. Contaminated sites may become un-usable for agriculture or other purposes. Albania's industrial history has left behind many polluted sites.[83]. The presence of heavy metals in soil is one of the factors that causes intake of these metals by vegetable species. Heavy metals are of crucial importance for the optimal growth of many plants, however higher concentrations become toxic for plants itself as well as for consumers.

Figure 32. Heavy metal content in European soils[84]



High values of Cr and/or Ni are mainly found in central Greece, northern Italy, the central Pyrenees, northern Scandinavia, Slovakia, Croatia and Albania. High quantities of Cd, Cu, Hg, Pb and Zn are present in Central Europe and are mainly related with agriculture and with quaternary limestone (figure 33).

83. Shallari 1998
84. Lado et al. 2008

The use of fertilizers, manure and agrochemicals are important sources of these elements.

Albania has a large surface covered by serpentine soils and the country is characterised by a high density of mines and metal smelters. The geology of Albania has a fundamental two fold division, with a western domain of monotonous sediments and an eastern domain of basic and acid volcanic rocks and ultramafic massifs[85].

Shallari 1998 show that Ni, Cr and Co are present at high concentration at serpentine sites and at industrial sites, which were mostly abandoned at the time of the sampling; Cd, Cu and Zn in soils were also detected at high concentration (figure 34).

More than 3000 different types of pesticides have been used in the European agricultural environment in the past 50 years. It has been estimated that less than 0.1% of the pesticide applied to crops actually reaches the target pest; the rest enters the environment, contaminating soil, water and air, where it can poison or otherwise adversely affect non-target organisms[86]. Furthermore, many pesticides can persist for long periods in an ecosystem organochlorine insecticides, paraquat, deiquat for instance, were still detectable in surface waters 20 years after their use had been banned.

Figure 33. Location of the sites prospected in 1995 in Albania

Seven metals (Cd, Co, Cr, Cu, Ni, Pb and Zn) were analysed in soil samples collected on the eight sites (table 9). Each sample exhibited a high concentration in one or more metals. The Cd content in soils varied between 2 and 14 mg kg-' DM and was rather high compared to the values generally observed in agricultural soils and considered as toxic.

The highest value was observed at the industrial site of Prrenjas. Cobalt and Cr concentrations in soils were also elevated as a result of both natural and anthropogenic sources and varied from 91 to 3865 mg kg-' DM. Again, the sample from Prrenjas exhibited the highest concentration of Co (476 mg kg-') and Cr (3865 mg kg-'). Copper concentrations in soils were lower than 73 mg kg-', except for the Rubik site where the Cu concentration was 1107 mg kg-' DM, as a result of the former activity of the site (copper smelter).

85. Shallari 1998

86. Pimentel and Levitan, 1986

High Ni and Cr concentrations were observed only at the serpentine sites where soils were derived from gabbros and ultrabasic rocks rich in Fe, Ni and Cr. The site of Prrenjas appeared the most polluted by Cd, Co, Cr, Ni and Pb. Chromium and Ni were present at high levels in the soil of Elbasan.

Table 9. Heavy metals concentration in soils (ppm)[87]

Site	Cd	Co	Cr	Cu	Ni	Pb	Zn
Korce	4	184	513	6	1737	80	52
Puke	4	289	574	27	1104	87	49
Pogradec	5	259	635	8	2442	98	63
Prrenjas	14	476	3865	36	3579	172	93
Elbasan	3	130	491	14	447	80	61
Mirdite	9	338	256	1107	66	135	2495
Kukes	2	143	91	73	54	103	111

Authors show that soils around the Elbasani metallurgical complex are highly polluted up to 15 km away from the plant[88] (figure 35, 36).

Figure 34. Heavy metals concentration around the Elbasani metallurgical complex (Zn and Ni))[89]

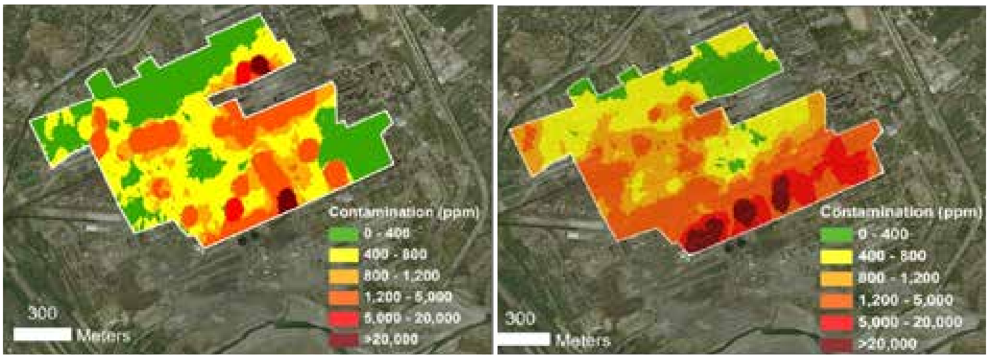
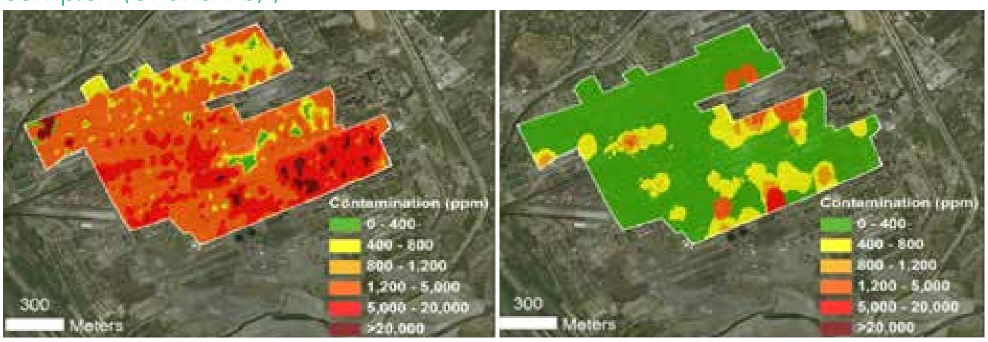


Figure 35. Heavy metals concentration around the Elbasani metallurgical complex (Cr and Pb)) [90]



87. Shallari S, 1998
88. Sallaku et al 2009
89. Tola et al 2012
90. Tola et al 2012

Table 10 shows data of sources pollution in Albania and the concentration of heavy metals in soils. [91]

Table 10. Source of contamination and heavy metal concentration in soils (ppm)

Nr.	Burimet e ndotjes	Zn	Mn	Ni	Cd	Cr	Cu	As	Pb	Fe
1	Kombinati Metalurgjik Elbasan	121. 7	547. 5	**478. 5**	2. 2	**573. 0**	**452. 1**	0. 0	**380. 3**	4. 3
2	Uzina e Superfosfatit Laç	159. 5	780. 6	**271. 5**	2. 7	**359. 8**	75. 9	0. 0	290. 0	2. 2
3	Uzina e PVC -Vlorë	90. 2	271. 7	69. 0	1. 7	170. 3	44. 8	0. 0	121. 8	2. 1
4	Uzina e Baterive Berat	117. 1	286. 5	70. 2	1. 3	189. 0	49. 0	1. 0	98. 3	1. 3
5	Uzina e Plasmasit Lushnje	114. 6	147. 8	73. 4	1. 2	184. 9	41. 5	0. 9	81. 2	1. 3
6	Fabrika e Letrës Lezhë	162. 5	925. 0	**335. 8**	1. 8	**207. 5**	78. 0	0. 0	109. 8	1. 9
7	Miniera e Hekur-nikelit Pogradec	123. 7	972. 5	**3237. 4**	1. 8	**329. 2**	**468. 7**	0. 0	**398. 7**	5. 1
8	Miniera e Hekur-nikelit Prrenjas	118. 2	888. 2	**3455. 7**	2. 0	**329. 4**	**467. 8**	0. 0	**390. 2**	6. 3
9	Miniera e Kalimashit Kukës	299. 0	619. 0	**474. 0**	3. 0	**342. 0**	**342. 0**	0. 0	205. 0	3. 0
10	Uzina e bakrit Kukës	272. 3	588. 7	**447. 7**	2. 3	**319. 7**	**307. 0**	0. 0	234. 0	2. 9
11	Uzina e ferrokromit Burrel	51. 3	294. 1	**306. 9**	2. 8	**684. 6**	**187. 6**	0. 0	299. 3	2. 5
12	Uzina e Plehrave Azotike Fier	90. 7	178. 3	74. 1	1. 0	189. 7	44. 8	1. 0	93. 1	2. 0

Agricultural production as a source of soil contamination is currently relatively less important. In the past, risks were related to the presence of cadmium or lead in phosphate fertilizers or waste liming materials or non-sustainable use of pesticides. However, uncontrolled application of municipal sewage sludge might cause transfer of contaminants to soil (metals, PCBs, dioxins, etc.).

Soil contamination affects biomass production. Obviously, a contaminated soil loses the productivity and the capacity to support plants properly. Like all living organisms, plants are often sensitive to the deficiency of some heavy metal ions as essential micronutrient, while for the same ions excess concentrations are strongly poisonous to the metabolic activities.

Soil is not only part of the ecosystem but also the survival of the rest of the environment depends on its productivity. Soil functions such as filtering, buffering, storage and transformation systems protect against the effects of contamination.

Soil microorganisms and soil microbial processes can also become disrupted by elevated concentrations of trace elements in soils[92]. As was indicated above, it is generally accepted that accumulated pollutants reduce the amount of soil microbial biomass

Soils affect human health, and in turn humans affect soil health. Both soil and humans must be in a state of well-being with respect to their physical, chemical, and biological characteristics.

The main drivers of soil contamination in Albania are anthropogenic in

91. AKM, 2014
92. Giller et al., 1998

character. They include the main sectors of the economy, such as industry, energy, waste management and agriculture (table 11).
Manufacturing processes are usually accompanied by certain contaminant release at a level dependent on production intensity, technologies used, and materials processed.

Table 11. The main drivers of soil contamination in Albania and the area affected

Source and drivers of soil contamination	Activities and impacts	Area affected
Mineral industry	Production of cement and lime Manufacture of ceramic products by firing, in particular roofing tiles, bricks refractory bricks, tiles, stoneware etc	Kruja, Lezha Tirana, Elbasani
Production and processing of metals	Metal ore roasting or sintering Production of iron or steel Processing of ferrous metals Operation of ferrous metal foundries Processing of non-ferrous metals Surface treatment of metals or plastic materials using an electrolytic or chemical process	Elbasani, Mirdita, Bulqiza, Kukes, Tropoje, Pogradec, Korcë, Berat, Durres
Oil extraction and processing industry and energy industries	Oil extraction Refining of mineral oil and gas Combustion of fuels	Berat, Fier, Vlorë
Waste management	Disposal of urban and hazardous waste Disposal or recovery of waste in waste incineration plants Landfills Temporary and underground storage of hazardous waste	Watershed of : Buna, Mati, Erzeni, Osumi, Semani, Devolli, Shkumbini, Vjosa, Gjallica
Waste water management	Discharge of urban and industrial wastewater into rivers Discharge of urban and industrial wastewater into open environment	Watershed of : Buna, Mati, Erzeni, Osumi, Semani, Devolli, Shkumbini, Vjosa, Gjallica
Agricultural practices	Use of fertilizers Use of pesticides	Agricultural area

5.3.5 Salinisation

Salinisation is the accumulation of salts in soils (the upper part of a soil profile, including the A and B horizons), and in Albania it is usually the product of inappropriate irrigation practices, irrigation with highly mineralised water, or poor drainage. Soils affected by salinisation can become unsuitable for growing crops, and the reversal of salinisation is a difficult and costly process requiring site specific solutions and often the use of high quality irrigation water to flush out salts.

The soil is considered saline if the electrical conductivity of its saturation extract (ECe) is above 4 dS m^{-1}. However, the threshold value above which deleterious effects occur can vary depending on several factors including plant type, soil-water regime and climatic condition.

Salinity usually becomes a land use issue when the concentration of salt or sodium adversely affects plant growth (crops, pastures or native vegetation) or degrades soil structure. It becomes a water issue when potential uses of water are limited by its salt content. The adverse consequences of salinity generally vary, depending on the form and stage of salinization; in early stages it affects the metabolism of soil organisms and reduces soil productivity, but in advanced stages it kills all vegetation and consequently transforms fertile and productive land to barren land. Soil salinity is a major factor limiting crop production and land development in coastal area. [93]

"Soils affected by salinisation can become unsuitable for growing crops, and the reversal of salinisation is a difficult and costly process requiring site specific solutions and often the use of high quality irrigation water to flush out salts.

For sodic soil, the structural degradation caused by too large concentrations of sodium (Na) is generally most important. As sodium salts are leached through the soil, some sodium remains in the soil bound to clay particles, displacing other cations such as calcium. A high proportion of exchangeable sodium attached to clay mineral exchange sites weakens the bonds between soil particles when the soil is wetted.

As a result, the clay particles swell and often become detached and disperse. A soil with increased dispersibility becomes more susceptible to erosion by water and wind. Sodic soils become dense, cloddy and structureless on drying because natural aggregation is destroyed.

The dispersed clay at the soil surface can act as cement, forming crusts that are relatively dense and hard but typically thin (up to 10 mm thick). The crust impedes seedling emergence and can tear seedling roots as it dries and shrinks. The degree of crusting depends on the soil textural composition, the mineralogy of the clay, the exchangeable sodium content, the energy of raindrop impact, and the rate of drying. Moreover, the genesis of some soils has resulted in sodic subsoils, often with a columnar structure. Sodic subsoils may be dense, with reduced soil water storage, poor aeration and increased soil strength, and can be susceptible to tunnel erosion.

Soil salinity that affects mainly the Mediterranean countries is regarded as a major cause of desertification and is therefore a serious form of soil degradation. Along the Mediterranean coast the problem of soil salinity is increasing due to scarcity of precipitation and irrigation with low quality water.

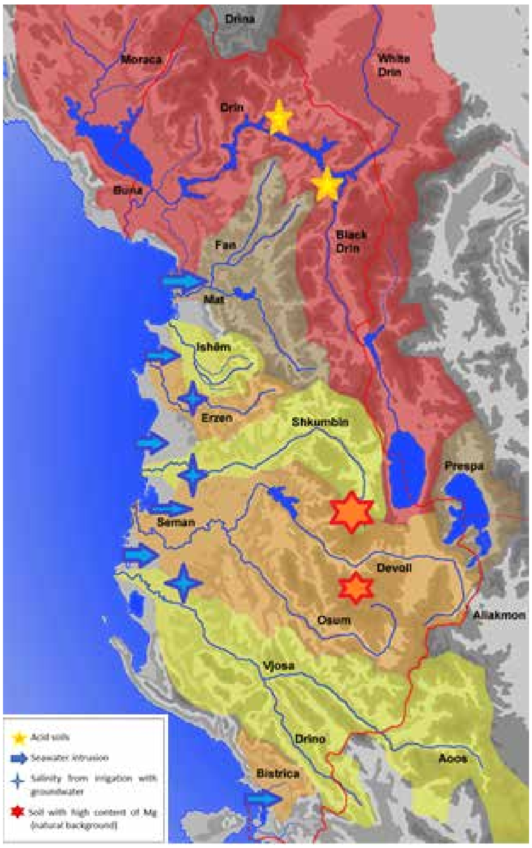
Saline soils are present mainly due to human activities, especially with the extension of irrigation and undisciplined use of saline water which has

93. Chesworth, 2008; Li et al., 2012; Sparks, 2003

caused over-pumping, and the consequent sea water infiltration into the groundwater layer. In the Mediterranean area 25% of irrigated cropland is affected by moderate to high salinisation leading to moderate soil degradation[94]. Furthermore, projected temperature increases and changes in precipitation characteristics in the Mediterranean are likely to enhance the problem of salinisation.

Saline soils of Albania are located on the Western lowland coastal plain and are under the influence of Mediterranean climate, which accelerates evaporation in summer and causes salts to concentrate on the surface (figure 37). The reverse phenomenon occurs in winter, when, because of heavy rainfalls, salts are leached down into deeper layers.

Figure 36. Sources and drivers of soil salinity in Albania



Typically salty soils occupy flat areas, often below sea level where saline conditions may also occur within the swamp and marsh soils. In recent years there is evidence of increasing salinization in those areas and unfortunately the trend is still continuing to be negative. Overall saline areas occupy about 30,000 hectares.

The saline soils in Albania occurred mainly in the west part from Lezha, Durres to Fier and Vlora. The soils with high presence of Mg in soil profile occupy an area of 12000 ha. These soils are mainly clay soils and suffer from high compaction, as result are unproductive soils[95]. Acid soils are mainly located in the north-eastern part of Albania and to a limited extent in the south-east. Acidity plays an important role in reducing crop yields. Since acidification is a natural process influenced by the parent materials and the climate of the area, there is concern that the acid soils may expand, even in those lands that were considered ameliorated

94. Geeson et al., 2003; Mateo-Sagasta and Burke, 2011
95. NCSA Stocktaking Report, 2005

Soils in salt-affected landscapes are less fertile and produce less biomass than non-saline soils resulting in less SOC and in turn more erosion, which further accentuates SOC losses due to the dominance of plant inputs in the accumulation of organic matter.

by using lime a few years ago. The estimated area of acid soils is about 60,000 ha, but that may reach values as high as 90,000 ha, according to some surveys of the Soil Science Institute[96].

Salinization primarily affects ecological soil functions. Soils in salt-affected landscapes are less fertile and produce less biomass than non-saline soils resulting in less SOC and in turn more erosion, which further accentuates SOC losses due to the dominance of plant inputs in the accumulation of organic matter.

Furthermore, soil biodiversity and microorganism activity declines as EC increases, thus impacting important soil processes such as respiration, residue decomposition, nitrification, and denitrification.

As a reciprocal effect of ecological functions, salinization affects a series of environmental interactions leading to reduced water infiltration and retention resulting in increased water runoff and erosion. Regarding non-ecological soil functions, salinization can also lead to damages to water supply infrastructure as well as transport infrastructure from shallow saline groundwater thus hindering the functions of soil a physical medium for build development[97].

5.3.6 Flooding and landslides

The flooding can be defined as the overflowing by water of the normal confines of a watercourse or water body and/or the accumulation of drainage

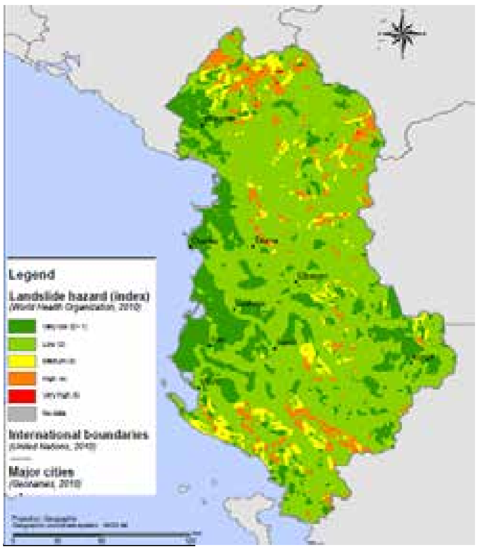
96. Zdruli P, 1995
97. Montanarella, 2007

water over areas which are not normally submerged[98]. The landslides are the gravitational movement of soil, rock, or debris down a slope. Landslides can be caused by a variety of natural factors including earthquakes or erosion of the base of a slope by rivers or waves, or by anthropogenic influences such as deforestation, cultivation, or construction.

Landslides are dominantly considered as a local soil threat in mountainous regions and on slopes. Their major driving force is gravity, but local management and controls can be responsible for preventing them. Among the most common local factors interacting with landslides are topography and the related relief characteristics; soil and bedrock and their specific mechanical and hydrogeological properties; soil depth; hydrological and hydrogeological conditions; vegetation; and anthropogenic activities. However, the most important triggering factor for landslides remains climate and, in particular, precipitation[99].

Flooding and landslides represent significant threats to man's activities and together with climate changes represents a particular challenge. The most landslide susceptible areas are cliffs and steep slopes of the mountain and hilly areas, unprotected river banks and the coast line from Durres to Velipoja. Flooding is increasingly becoming a problem especially in the northwestern part of the country. The same scenario is realistic for the many other lower part areas. Total estimated area under the threat of flooding is more than 40,000 ha of land. The regions of Shkodra, Lezha, Fushkruja, Fieri, Vlora and Korça., are more affected from the process of soil flooding (figure 38).

Figure 37. Landslide hazard index[100]



There is a chain reaction from overgrazing, deforestation and erosion culminating in the flooding, which is also accelerated by the poor maintenance of drainage canals and pumping stations. Waterlogging is reducing yields in those areas and the reverse phenomena of swamp and marsh formation is becoming evident.

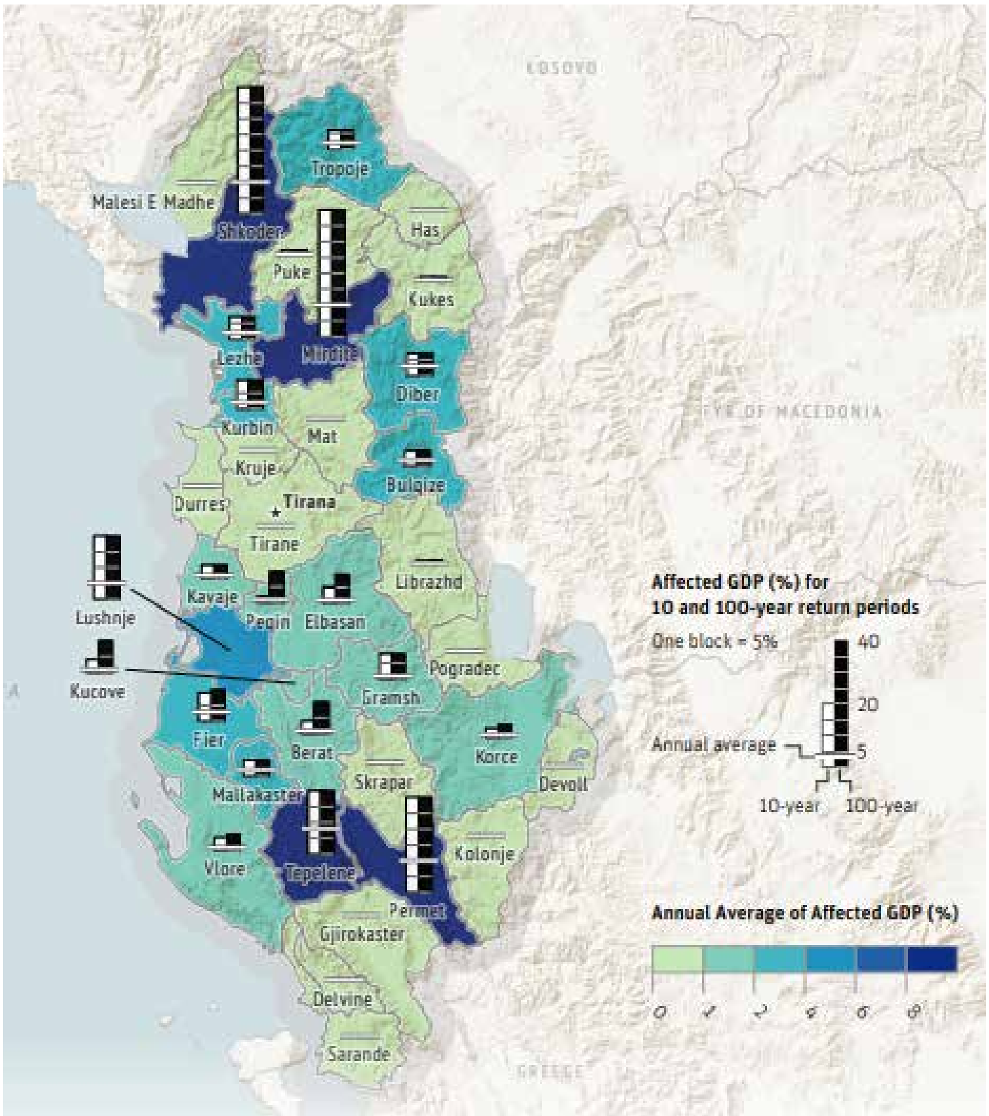
The annual average population affected by flooding in Albania is about 50,000 and the annual average affected GDP about $200 million.

98. WMO, 2012
99. Jan Szolgay et al 2015 (EU repport)
100. WHO, 2010

Within the various provinces, the 10- and 100-year impacts do not differ much, so relatively frequent floods have large impacts on these averages[101] (figure 39).

Floods may lead to a decline in soil biodiversity if anaerobic conditions cause the death of plant vegetation due to oxygen depletion in the rooting zone and the loss of plant-available soil nitrogen due to leaching or volatilization. Flood related water logging may potentially lead to local salinization in the coastal area.

Figure 38. Floods and economic impact in Albania



101. worldbank.org/en/799491483041822945/albania.pdf

06
Soil erosion in Albania

6.1 Soil erosion overview

Soil erosion affects farming, construction projects and homeowners living near rivers, seas and on terrestrial slopes. Excessive erosion is often caused by human activities, such as deforestation, road construction and intensive farming.

The rate of soil erosion in Albania have increased after 1990 because of dramatic changes of land use, uncontrolled and illegal deforestation, climatic change and overgrazing of pastureland. Natural levels of erosion are high in Albania because of steep slopes (27% average), high rates of rainfall (1,500 mm average yearly), and highly erodible soils (low levels of organic matter and high levels of silt and clay).

Scientific research data show that soil erosion levels vary from 10 to 70 tons / ha / year and in special cases also over 100 tons / ha / year that means a national average soil erosion rate of 27.2 tons per hectare per year, which is more than twice the level of "tolerable" erosion established by many countries. This also means that an average of 2.3 mm of valuable topsoil is lost each year. The loss of topsoil has reduced the yields of arable crops, forage, fruit trees, and vineyards, which are vital to Albania's food security. Many of the country's reservoirs are becoming filled with sediment, which lowers their storage capacity, damages turbines producing hydroelectric power, and augurs catastrophic flooding. Sediment has accumulated in drainage channels of reclaimed coastal land, causing flooding, accumulation of salts in the soils, and reduced agricultural productivity.

The environmental consequences of soil erosion include not only a loss in biological sustainability and diversity but also a decline in water quality and fish and wildlife habitats. Pollutants from agricultural, municipal, and industrial activities that accompany the sediment may threaten human health.
Therefore, it is necessary to protect productive agricultural land and bring the soil erosion which affects the structure of soils adversely under control. Also, it's necessary to determine the areas which are under the threat of soil erosion firstly for taking erosion protection measures.

The environmental consequences of soil erosion include not only a loss in biological sustainability and diversity but also a decline in water quality and fish and wildlife habitats.

6.2 Soil erosion measurement, norms and standards

6.2.1 Setting up Soil Erosion Monitoring System in Albania

The National Environmental Agency of Albania does not report full data on soil erosion over the past years. The high rate of soil erosion in Albania and the related issues make necessary to set up the Soil Erosion Monitoring System (SEMS) at the country level.
The soil erosion assessment is difficult due to the numerous factors that affect this process. The erosion rate measures the amount of soil mass lost over a specified time period. The soil erosion level can be determined at three scales:

- Site-specific,
- Watershed area,
- National level.

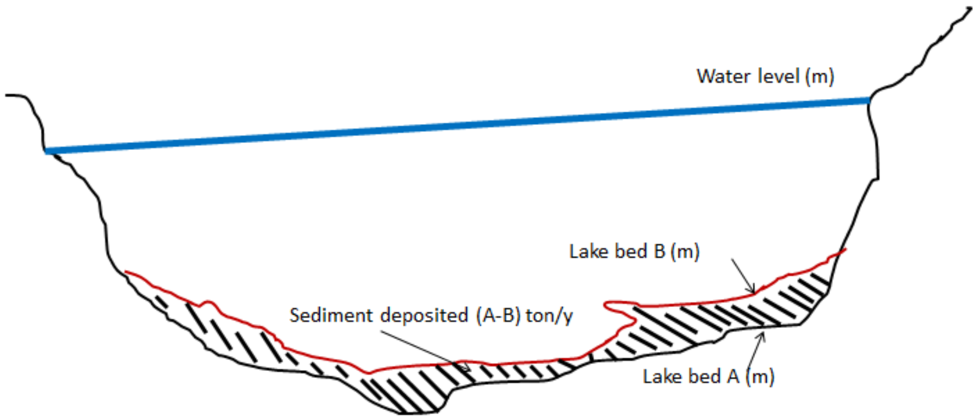
On a site-specific scale, soil erosion will be measured by collecting runoff and suspended sediment on a monthly basis from plots (4 replications) established at situ. The plots sites will be selected from districts with moderate, significant or/and critical levels of soil erosion (Fgure 39).

Figure 39. Experiment field plots for soil erosion assessment

The sites also will be selected according to factor values identified in the Universal Soil Loss Equation (USLE) including slope steepness (<25%, 25-

40%, and >40%), broad climatic zone (Mediterranean flat, Mediterranean hilly or sub-mountainous and Mediterranean mountainous), soil erodibility (very heavy clay, heavy clay, moderate clay, light, and sandy), cropping factor (wheat, maize, improved pasture, unimproved pasture, oak forest, olive trees, grape vineyards), and management practice (cultivated and minimum tillage).
To measure the rate of erosion on a watershed level, some reservoirs may be selected from any main rivers of Albania (Drini, Fani, Mati, Ishmi, Erzeni, Shkumbini, Osumi, Devolli, Semani, and Vjosa) Sediment cores will be collected to the base of the reservoir and sedimentation rate will be determined from the amount of sediment and the time of construction of the reservoir. Selected samples will be taken from different levels of the cores for analysis in the same way as on erosion monitoring plots.
The annual soil erosion rate can be determined from the amount of suspended sediment in the runoff summed from monthly collections. The representative sediment samples will be analyzed for humus content, available soil nutrients (nitrogen, phosphorus, and potassium), calcium carbonate, and sand, silt, and clay concentrations. The solutions will be analyzed for turbidity, pH, and electrical conductivity (i.e., total dissolved salts). One other way of assessing the amount of sediment deposited in the reservoir is through bathymetry (echo-sounding) measurements and calculating the quantity of accumulated sediment.

Figure 40. Schematic view of the amount of sediment deposited in the reservoir



The overall rate of erosion for Albania can be monitored by collecting monthly samples from the the main rivers, including the Drini, Fani, Mati, Ishmi, Erzeni, Shkumbini, Osumi, Devolli, Semani, and Vjosa. The particulate and dissolved constituents will be analyzed in the same way as on erosion monitoring plots. This work will be completed by Agricultural University of Tirana. The data will be analyzed using a geographic information system (GIS), and displayed on 1:50:000 district maps.

6.2.2 Methodology for land erosion assessment

The most widely used for the soil erosion assessment is "Universal Soil Loss Equation (USLE). USLE is an empirical equation derived from more than 10,000 plot-years of data collected on natural runoff plots and an estimated equivalent of 2,000 plot-years of data from rainfall simulators[102].

The annual soil loss is estimated from a number of factors that have been measured for all climates, soil types, topography and kinds of land. These factors are combined in a number of formulas in USLE, which returns a single number, the computed soil loss per unit area, equivalent to predicted erosion in ton hectare^{-1} year^{1}. This technique helps to predict erosion and orients farmers which farming methods to use. It also identifies erosion-sensitive areas, "but it does not compute sediment yields from gully, stream bank, and streambed erosion".[103] Although originally developed for agricultural purpose, use of USLE has been extended to watershed with other land uses. Mathematically the equation is denoted as:

A (tons/ha/year) = R * K * LS * C * P (1)

where,

A = Annual soil loss

R = Rainfall and runoff erosivity index

K = Soil-erodibility factor

L = Length of slope factor

S = Degree of slope factor

C = Cropping-management factor

P = Conservation practice factor

Rainfall Erosivity Factor (R)

R factor is the coefficient of the average erosion by rain (J/m^2). Rain is a direct impact to the surface of soil; its kinetic energy is destroying the soil structure and brings the soil components together with runoff water. According to Wischmeier and Smith (1978), the R coefficient is calculated based on maximum rain volume in 30 minute, the equation is following:

$R = EI_{30}/1000$ (2)

In which: E is kinetic energy of the rain (J/m^2) I is the maximum rain volume in 30 minute (mm/h). Annual rainfall data acquired over the last 35 years will be provided from the nearby rainfall stations with the study area.

The soil erodibility factor (K), represents both susceptibility of soil to erosion and the amount and rate of runoff, as measured under standard plot conditions***.*** Soil erodibility is computed as a function of such soil properties as texture, organic matter content, structure and permeability using following equation:

102. USLE guideline manual, Agriculture Handbook, 1978

103. Wischmeier and Smith, 1978

$$100K = \frac{[2.1 \cdot M^{1.14} \cdot (10^{-4}) \cdot (12 - OM) + 3.25 \cdot (S-2) + 2.5 \cdot (p-3)]}{7.59} \quad (3)$$

where:
K - erodibility factor (t ha h)
M-particle size parameter (adjusted by Goldman 1985) ($M = P_{silt} \cdot (100 - P_{clay})$
OM - organic matter content (%)
S - soil structure code
P - permeability class

The effect of topography on soil erosion in USLE model is accounted for by the LS factor. The slope length factor (L) is calculated using following equation:

$$LS = [0.065 + 0.0456 \cdot Slope + 0.0065 \cdot (slope)^2] \cdot \left(\frac{slopelength}{22.1}\right)^{0.5} \quad (4)$$

The LS-factor value can be computed for each grid cell, and then the LS-factor map for entire the study area.
The C factor is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow. It measures the effect of canopy and ground cover on the hydraulics of raindrop impact and runoff; of cover and management, the amount and rate of runoff; of coverage and management on soil structure, organic matter, soil tilth, evapotranspiration and other soil characteristics; of carryover from previous land use when land use changes; and of roughness from tillage or other disturbances[104]. The land use map can be used to analyze the C value. After changing the coverage to grid, a corresponding C value was assigned to each land use classes using ArcGIS method.
The C factor is computed based on the equation following:
C= A / R x K x LS x P (5)
For each erosion monitoring sample plot were estimated the USLE factors and then were used to calculate the values of C factor per land use classes. To estimate the C values per land use we grouped the monitoring sample plots in land use classes. Then C values for each sample plot were multiplied with their area and the sum was divided by land use area.

$$C = \frac{\sum_i^n c_i * A_i}{\sum A_i} \quad (6)$$

where:
c_i-C factor for each monitoring sample plot
A_i- area of each monitoring sample plot
Using the values of C-factor estimated for each land use class we can built the map of C-factor for study area. The C factor shows the ***influence of vegetation cover on soil susceptibility to erosion.***

104. Pierca, E. J. et. al., 1986

By definition, factor P in the USLE is the ratio of soil loss with a specific support practice to the corresponding loss with up and down slope culture. Improved tillage practices, sod-based rotations, fertility treatments and greater quantities of crop residues left on the field contribute materially to erosion control and frequently provide the major control in a farmer's field.[105] Assuming no support practice in the study area, it was not used in calculations (P factor = 1).

6.2.3 Soil erosion norms and standards

Soil scientists realised that a quantitative standard was needed to evaluate the effectiveness of erosion control measures and this standard is commonly named tolerable soil loss or T_{SL}. The soil loss tolerance rate (T_{SL}) is the maximum rate of annual soil loss that will permit crop productivity to be sustained economically and indefinitely on a given soil[106].
The tolerable loss rate, for a given soil unit and specified amount and time scale of yield reduction, is calculated in the model as follows:

$$\mathbf{T_{SL} = \{(Ra/Rm \times 100 \times B \times Dt) + 3T\} / T} \qquad (7)$$

where
T_{SL} = tolerable loss rate (t ha-1 year-1)
Ra = acceptable yield reduction (%)
Rm = yield reduction (%) at the given inputs level when the effective topsoil is all lost
B = bulk density of the soil (g/cm^3)
Dt = depth of effective topsoil (cm)
T = time (years) over which yield reduction is acceptable.

However, there are no norms or universal standard for land erosion assessment. Determination of the T_{SL} values level should be done case by case referred to local conditions.
Table 12 shows the norms or rates for soil erosion that can be used in Albania recommends by soil scientists.

Table 12. Recommended standards for soil erosion assessment in Albania

Soil Erosion category	Erosion standards	Soil loss (t/ha/y)
I	very low	< 2.45
II	low	2.46-5
III	moderate	5.1-10
IV	high	10.1-20
V	very high	> 20.1

105. Wischmeier and Smith, 1978
106. C. Di Stefano and V. Ferro, 2016

07

Ulza and Bovilla the priority areas for LDN action

7.1 Land use and environmental issues in Ulza watershed

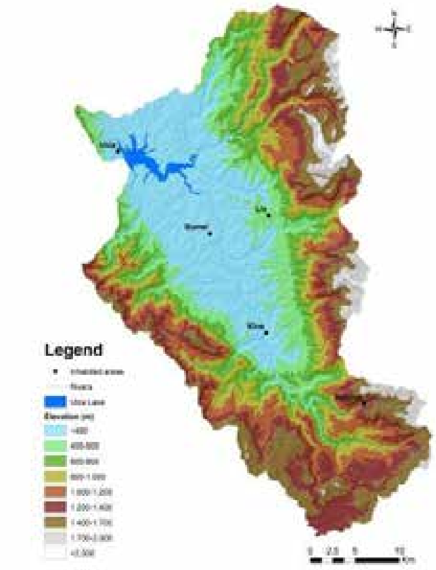
The Ulza watershed is located in the Mati river basin covering almost the Mati district of the Dibera region. The total area of the Ulza watershed is 122,435 ha or 1,224.34 km^2. The Ulza Lake, which is used as reservoir for the Ulza Hydro Power Plant (UHPP), forms the central part of the watershed together with the valley of the Mati River (figure 41, 42).

Figure 41. View from the Ulza Hydro Power Plant reservoir

The area slopes gently to the Mati river valley from approximately 500 m above sea level (asl) to approximately 80-120 m asl. The surrounding mountains forming the watershed reach to over 2000 m asl, with the highest peak at 2245 m asl.[107]

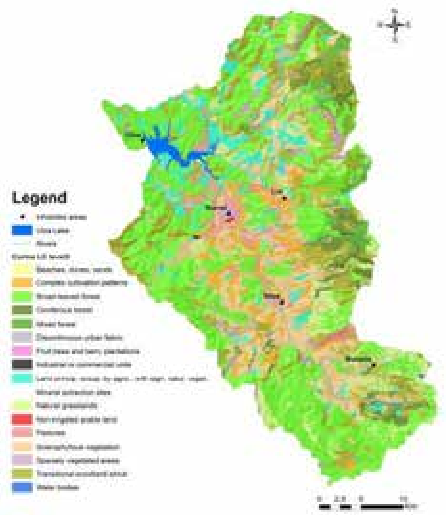
107. Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkan: Cross Cutting Issues and Summary of the Ulza Watershed Case, PROFOR, 2017

Figure 42. Map of Ulza watershed topography (PROFOR, 2017)



The forests are dominant in the Ulza watershed with 43%, the arable land is 11.5% and the transitional woodland is 29.3% of total surface (figure 43).

Figure 43. Map of Ulza watershed land cover (PROFOR, 2017)

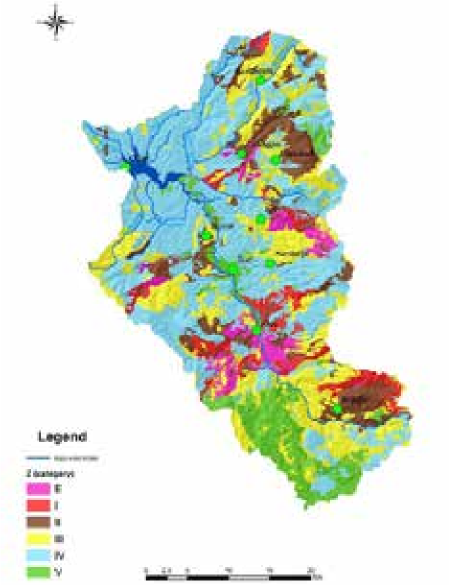


The Ulza watershed is a typical example in Albania of an area with high to extremely high erosion. This is causing direct land degradation, but in the Ulza case also leads to high sedimentation of the Ulza reservoir with a negative impact on the UHPP. It also creates damages and costs for water users in the watershed. It leads to damages of road and irrigation infrastructures and increased flooding. Significant sedimentation of the operational storage starts about 4 km upstream from the dam, while the larger part of the "dead storage" is already filled with sediment. The average annual quantity of deposited sediment (1,331,741 m^3/year for the whole watershed and 1,113 m^3/km^2/year) is at least three times the average in the region. Future sediments will deposit additionally in the operational storage because a significant part of the non-operational storage has been filled.

The potential erosion risk maps of the Ulza watershed indicate the different erosion sensitivity in the watershed. This information can be used to identify areas which would need specific measures for erosion control (figure 44).[108]

108. Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkan: Cross Cutting Issues and Summary of the Ulza Watershed Case, PROFOR, 2017

Figure 44. Potential Erosion map of Ulza Watershed (E the most extreme level of erosion)



The highest erosion occurs on 9.67% of the category I and E area (117 km^2), and is designated as territory where urgent erosion control works are necessary. Additionally, stronger erosion processes (II and III category) are spread on 36.35% or 440 km^2.

7.2 Land use and environmental issues in Bovilla watershed

The Bovilla watershed covers an area of 98 km^2 and was built to supply water to the city of Tirana. Bovilla watershed is part of the Dajti National Park since 2006. The total area of Bovilla reservoir is 4.6 km^2 and the maximal depth is 53 m. The climate closely resembles the climate of the Mediterranean with relatively cold, wet winters, and warm, dry summers. The mean annual temperature is 13.9°C, the rainfall is 1718.6 mm and the potential evaporation is 916 mm. Most of the precipitation falls during autumn and winter months being the main source of water supplier for the hydrologic network in the Bovilla watershed. The Bovilla watershed is considered an important one because it supplies potable water to the Tirana population (figure 45, 46).

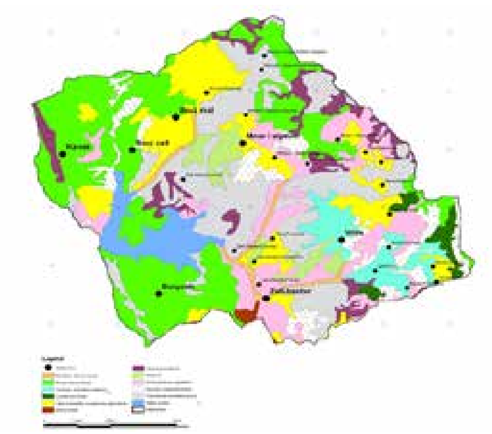
Figure 45. View from the Bovilla reservoir

In both these areas has been observed high rate of soil erosion due to the Land Use Change (LUC), deforestation and soil degradation process. Authors show that in the upper part of the Bovilla watershed was found high rate of soil erosion by depositing significant amounts of solid materials in the water reservoir that substantially reducing its service life.

Figure 46. Topographic map of the Bovilla reservoir

The main land use forms of Bovilla watershed area are: (i) broadleaves forests; (ii) riparian vegetation along the rivers and water streams; (iii) agriculture land and (iv) pastures. Beside the identification of vegetation cover we have estimated using ArcGis software the area occupied by each land use class inside the Bovilla catchment (figure 47).[109]

Figure 47. Map of Bovilla watershed land cover[110]



The deposited materials or waste in the Bovilla reservoir have caused many problems such as decrease of water capacity and affect water quality. The current natural resource management practices, in particular the forest degradation increase the rate of soil erosion and soil degradation.

The deposition of nutrients in the reservoir stimulates the growth of algae or other organisms and causes eutrophication of water. The low water quality of the reservoir requires additional treatments by increasing the cost of drinking water.

7.3 Ulza and Bovilla watershed area remediation and erosion control

Results of the erosion monitoring in Ulza showed that already 31% of the total reservoir storage is filled with sediment, with a significant part of the deposed sediment located in the ***"operational storage"*** area affecting the functioning capacity of the UHPP. The forests are dominant in the Ulza watershed with 43% of the total surface which causes 30.3% of soil erosion. With on-going natural regeneration and forest restoration, especially in the communal forest, a further reduction of erosion can be expected from the forest lands. The arable land is only 11.5% and basically on lower slopes, it contributes with 18.2% of erosion production in the Ulza watershed.

109. DIAVA consulting 2018

110. DIAVA consulting 2018

The Bovilla region is inhabited by 9 villages and the degradation of forests and shrubs combined with overgrazing is considered to be the main reason for the decrease of vegetation cover within the Bovilla watershed. The degradation of the vegetation cover estimated from satellite images is in the range of 12% to 22%.

The transitional woodlands are significant part of the Ulza watershed with 29.3% of total surface. These lands are usually covered with degraded wood vegetation or shrubs where wood and shrubs cover is less than 50% and usually there is no grass cover on the site. Very often there are gullies appearing at the spot. These areas are usually on slopes higher than 30%. This land use type is producing the largest quantity of erosion in to Ulza watershed with 38.9% of total erosion intensity.

The highest erosion occurs on 9.67% of the area or 117 km^2, and is designated as territory where urgent erosion control works are necessary. Investments to reduce erosion should therefore be concentrated on arable land and improved agricultural practices, on transitional woodlands, to restore them to sustainable forest areas, and on gully control measures[111].

The Bovilla region is inhabited by 9 villages and the degradation of forests and shrubs combined with overgrazing is considered to be the main reason for the decrease of vegetation cover within the Bovilla watershed. *The degradation of the vegetation cover estimated from satellite images is in the range of 12% to 22%.* The lower parts are the most exploited from by agricultural and livestock activities, degrading natural vegetation, pastures and forests. The agricultural practice close to the shore is not intense with only modest use of fertilizers and herbicides. Nevertheless, the water quality is influenced by wastes of people and animal manure that reach the streams and tributaries during precipitation events.

111. WB-PROFOR, 2014
(http://www.cnvp-eu.org/uploads/documents/149/PUB_23Ulza%20Watershed%20Crosscutting%20final.pdf)

Table 13. Data for the watershed of Bovilla and Ulza[112]

Description	Bovilla	Ulza
River basin	Terkuza	Mati
Catchment area	98km2	1224km2
Pasture	3.03km2	33.99km2
Cultivated areas	4.54km2	66.76km2
Land covered with crops or natural vegetation	12.47km2	73.91km2
Broadleaf forests	24.24km2	450.19km2
Conifer forests	1.49km2	46.72km2
Mixed forests	0.33km2	28.93km2
Herbaceous vegetation	5.18km2	
Sclerophyll vegetation	11.43km2	159.8km2
Transition areas from forest to shrub lands	19.64km2	177.43km2
Others	4.31km2	
Sparse vegetation areas	6.56km2	29.45km2
Natural grasslands	0	136.73km2
Beaches, sand dunes	0	3.92km2
Urban fabric, industrial units, mineral extractions	0	6.13km2
Non-irrigated arable	0	0.45km2
Aquatic areas	4.36km2	10.82km2

Erosion control can be achieved by reducing the erosive impact of rainfall and maintaining soil infiltration rates. This can be achieved by:

- Protecting the soil from rain impact, either with permanent vegetation cover or, in arable rotations by timely crop establishment.
- Improving the stability of the soil in the longer term by actively seeking to increase the organic matter content.
- Adoption of good agricultural practices for erosion control.

The environmental issues and those especially related to land degradation, climate change and biodiversity are multidisciplinary to understand and address. The forest and land degradation issues in Ulza and Bovilles watershed can be be addressed through projects that can be supported by the Albanian Government and other donors (table 14)

112. Assessment of sediment yield and identification of erosion hotspots in Bovilla watershed using RUSLE and GIS, MTE, 2017

Table 14. Proposed projects supported by GFC, EU and other donating partners

Environmental Issues	Project proposal	Objectives	Results/Outputs	Funding
Degradation of forests and increased erosion and land degradation; Destruction of ecosystem functions and biodiversity damage	Reforestation with autochthonous species, or re-digging of degraded soils with natural vegetation.	Rehabilitation of deforested areas or degraded forests.	Growth of forest area and reduction of degraded land Improvement of the environmental situation and reduction of GHS emissions as well	LDN-Fund, GEF, EU, FAO ALB
		Vegetation of degraded soils with natural vegetation	Reduction of degraded area 1500 ha	
		Reduction of ecosystems degradation.	Sustainable ecosystems and biodiversity protection	
			Reduction of soil degradation rate and reduction of GHS emissions	
Farming causes soil erosion, contamination and land degradation	Support of agriculture and adaptation of "Best practices in agriculture" which are environmentally friendly.	Land protection from degradation and erosion.	Correction of drainage and flood protection systems (dams and waterworks) with expected climate parameters	
		Improvement of agricultural practices.	Improvement of anti-erosion measure	
			Reduce the use of fertilisers and pesticides on agricultural land	
			Supporting the organic farming	
Waste is the source of environmental pollution and human diseases.	Sustainable waste management and improve access of the population to the sewage system.	Protecting the environment (soil, water, biodiversity) from the pollution that causes solid waste.	Waste collection and recycling	
		Protecting the environment and public health from pollution caused by sewage discharge.	Improvement of surface water and groundwater quality and reduction of eutrophic waters in watershed areas of Ulza and Bovilla.	

Annex

Data for soil quality in Albania

Table 15. Data on OM, Ca and Mg content in soils (2016)

No	Monitoring stations	Soil depth profile cm	OM %	Ca %	Mg%
1	Butrint	0-30	1.103	2.64	0.64
		30-60	0.987	2.53	0.25
2	Himare	0-30	0.547	3.65	0.54
		30-60	0.239	3.12	0.24
3	Karaburun	0-30	1.162	0.859	0.58
		30-60	1.027	0.658	0.36
4	Kote	0-30	0.654	0.364	0.65
		30-60	0.564	0.541	0.87
5	Karavasta	0-30	0.845	1.221	0.87
		30-60	0.457	1.223	0.98
6	Liqenas	0-30	0.982	0.945	0.81
		30-60	0.875	1.054	0.93
7	Gorice	0-30	1.254	0.854	0.68
		30-60	1.125	0.745	0.98
8	Dajt	0-30	1.132	1.365	0.98
		30-60	1.354	0.987	0.78
9	Rrotull	0-30	1.234	1.651	1.11
		30-60	0.987	1.125	1.13

Source: AUT, Soil monitoring rapport 2016

Table 16. Data on OM, Ca and Mg content in soils (2017)

No	Monitoring stations	Soil depth profile cm	OM %	Ca %	Mg%
1	Sinan Permet	0-30	0.987	1.965	0.412
		30-60	0.689	1.784	0.348
2	Tepelene	0-30	1.035	1.641	0.213
		30-60	0.897	1.784	0.368
3	Dumre, Elbasan	0-30	1.112	0.564	0.841
		30-60	0.895	0.451	0.643
4	Lin, Pogradec	0-30	0.745	0.356	1.345
		30-60	0.687	0.412	1.459
5	Qarrisht, Prrenjas	0-30	1.354	0.541	1.117
		30-60	1.123	0.654	1.389
6	Zogas, M. E Madhe	0-30	0.894	0.987	0.314
		30-60	0.698	0.643	0.418
7	Dardhe, Korce	0-30	1.489	0.451	1.698
		30-60	1.354	0.654	1.745

Source: AUT, Soil monitoring rapport 2017

Table 17. Data on OM, Ca and Mg content in soils (2018)

No	Monitoring stations	Soil depth profile cm	OM %	Ca %	Mg%
1	Vodic 1	0-30	1.03	0.081	0.063
		30-60	0.78	0.065	0.065
2	Vodic 2	0-30	0.99	0.029	0.046
		30-60	0.85	0.062	0.07
3	Profili-Vodic	0-10	0.90	0.125	0.069
		10-40	0.85	0.307	0.161
		40-70	0.85	0.128	0.106
		70-110	0.68	0.149	0.125
4	Miras 1	0-30	1.16	0.536	0.059
		30-60	1.00	0.522	0.055
5	Miras 2	0-30	1.07	0.575	0.062
		30-60	0.95	0.672	0.059

6	Profil Miras 2	0-30	0.96	0.492	0.057
		30-60	0.89	0.518	0.057
		>60	0.65	0.543	0.053
7	Lapan 1	0-30	2.23	0.49	0.058
		30-60	1.11	0.58	0.062
8	Lapan 2	0-30	0.93	0.67	0.059
		30-60	0.88	0.54	0.053
9	Profil Lapan	0-30	0.93	0.67	0.059
		30-60	0.93	0.67	0.059
		>60	0.84	0.52	0.058
10	Novosele 1	0-30	1.31	0.77	0.14
		30-60	1.08	0.72	0.135
11	Novosele 2	0-30	1.31	0.77	0.14
		30-60	1.08	0.72	0.135
12	Profil Novosele	0-30	1.56	0.762	0.083
		30-70	0.59	0.826	0.11
		>70	0.51	0.69	0.17
13	Ferras 1	0-30	1.42	0.81	0.11
		30-60	1.14	0.83	0.12
14	Ferras 2	0-30	1.42	0.81	0.11
		30-60	1.14	0.83	0.12
15	Profili Ferras	0-30	1.42	0.81	0.11
		30-70	0.59	0.826	0.11
		>70	0.51	054.	0.13
16	Ishull Lezhe 1	0-30	0.64	0.826	0.12
		30-60	0.44	0.69	0.16
17	Ishull Lezhe 2	0-30	0.55	0.826	0.10
		30-60	0.49	0.69	0.14
18	Profili Ishull Lezhe	0-30	1.22	0.72	0.81
		30-60	0.54	0.654	0.12
		>70	0.48	0.6	0.17

Source: AUT, Soil monitoring rapport 2018

Table 18. Data on heavy metals content in soils 2016 (ppm)

No	Monitoring stations	Soil depth profile cm	Cd	Cr	Co	Ni	Pb	Zn
1	Butrint	0-30	0.0	165	21.2	225	10	310
		30-60	0.3	52	23.2	38	154	298
2	Himare	0-30	0.0	36	11.1	65	232	170
		30-60	0.0	121	9.81	45	245	230
3	Karaburun	0-30	0.3	68	89.3	65	214	211
		30-60	0.1	78	3.6	37	139	160
4	Kote	0-30	1.1	91	63.21	67	321	201
		30-60	1.3	36	32.12	56	265	197
5	Karavasta	0-30	2.0	23	3.12	98	65	201
		30-60	2.3	12	1.14	78	37	187
6	Liqenas	0-30	2.0	87	98.22	34	120	254
		30-60	3.2	24	112.3	45	95	324
7	Gorice	0-30	0.0	45	32.21	31	98	235
		30-60	0.0	56	68.9	44	87	321
8	Dajt	0-30	2.1	84	78.6	47	74	234
		30-60	0.3	37	98.3	63	115	321
9	Rrotull	0-30	3.2	56	63.2	57	231	198
		30-60	2.3	71	65.7	69	244	325

Source: AUT, Soil monitoring rapport 2016

Table 19. Data on heavy metals content in soils 2017 (ppm)

No	Monitoring stations	Soil depth profile cm	Cd	Cr	Co	Ni	Pb	Zn
1	Sinan Permet	0-30	1.32	65.6	15.7	89.4	58.3	417.2
		30-60	1.02	87.6	23.8	65.3	64.1	358.6
2	Tepelene	0-30	2.14	45.7	14.6	45.7	47.6	354.1
		30-60	1.87	32.1	21.8	68.4	25.7	214.3
3	Dumre, Elbasan	0-30	0.32	654.3	157.3	1234.2	36.7	147.6
		30-60	0.05	458.1	184.2	784.6	78.4	383.2
4	Lin, Pogradec	0-30	1.12	1258.6	248.9	1458.7	121.7	247.2
		30-60	0.98	1874.3	314.7	1345.2	82.9	387.1
5	Qarrisht, Prrenjas	0-30	1.12	1322.8	320.2	1478.9	45.3	478.2
		30-60	0.78	1145.6	278.9	1345.1	32.4	124.1
6	Zogas, M. E Madhe	0-30	1.18	65.4	36.8	54.7	43.1	96.2
		30-60	0.65	41.2	12.7	56.8	34.2	74.8
7	Dardhe, Korce	0-30	0.45	862.2	314.7	876.4	74.2	364.6
		30-60	0.22	732.9	284.6	694.2	45.8	421.4
		30-60	2.3	71	65.7	69	244	325

Source: AUT, Soil monitoring rapport 2017

Table 20. Data on heavy metals content in soils 2018 (ppm)

No	Monitoring stations	Soil depth profile cm	Cu (ppm)	Mn (ppm)	Zn (ppm)	Fe (ppm)
1	Vodic 1	0-30	4.96	21.32	3.2	89.4
		30-60	7.71	8.68	0.78	60.3
2	Vodic 2	0-30	5.34	111.5	1.01	73.7
		30-60	7.71	117.4	0.88	73.9
3	Profili-Vodic	0-10	0.86	101.7	1.10	70.6
		10-40	19.59	67.76	0.79	70.3
		40-70	23.62	135.7	0.89	72.5
		70-110	38.46	155.7	0.94	56.9
4	Miras 1	0-30	1.79	47.56	3.97	111.1
		30-60	2.02	91.92	1.59	106.9
5	Miras 2	0-30	1.64	118.9	1.61	106.1
		0-30	1.96	129.9	1.56	109.5
6	Profil Miras 2	0-30	1.91	118.7	1.66	111.5
		30-60	1.87	128.2	1.63	105.5
		>60	1.31	108.3	1.50	108.3
7	Lapan 1	0-30	0.46	268.4	3.36	294.4
		30-60	3.56	437.4	2.52	236.6
8	Lapan 2	0-30	0.46	268.4	3.36	294.4
		30-60	3.56	437.4	2.52	236.6
9	Profil Lapan	0-30	2.57	207.3	0.58	237.5
		30-60	3.56	437.4	2.52	236.6
		>60	2.17	299.1	1.59	294.8
10	Novosele 1	0-30	4.66	106.6	3.17	69.9
		30-60	4.25	92.7	1.08	76.5
11	Novosele 2	0-30	4.66	106.6	3.17	69.9
		30-60	4.25	92.7	1.08	76.5
12	Profil Novosele	0-30	4.86	111.2	1.93	70.1
		30-70	4.20	101.8	1.39	89.3
		>70	2.76	83.3	1.16	89.2
13	Ferras 1	0-30	3.39	102.1	2.01	89.3
		30-60	3.34	97.4	2.48	92.4
14	Ferras 2	0-30	3.39	102.1	2.01	89.3
		30-60	3.34	97.4	2.48	92.4
15	Profili Ferras	0-30	3.39	102.1	2.01	89.3
		30-70	3.34	97.4	2.48	92.4
		>70	2.76	83.3	1.16	89.2
16	Ishull Lezhe 1	0-30	3.34	97.4	2.48	92.4
		30-60	3.39	102.1	2.01	89.3
17	Ishull Lezhe 2	0-30	3.34	97.4	2.48	92.4
		30-60	3.39	102.1	2.01	89.3
18	Profil Ishull Lezhë	0-30	3.39	102.1	2.01	89.3
		30-70	3.34	97.4	2.48	92.4
		>70	2.76	83.3	1.16	89.2

Source: AUT, Soil monitoring rapport 2018

View from land degradation processes in Albania

Figure 48. Landscape erosion view in South of Albania

Figure 49. Salted soil in the Vlora region

Figure 50. Soil with high content Mg; view from Domosdova field, Prrenjas

Figure 51. View from floods in Albania

Figure 52. View from floods in Albania

Figure 53. Rivers pollution from the discharge of urban waste and used waters

Figure 54. Forest fires and climate change impact

Figure 55. Map of Albania Forest fires

Figure 56. Soil erosion and infrastructure impacts

Figure 57. Coastal erosions

Figure 58. View of the deforestation process

Figure 59. Industrial pollution in Elbasan

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