This report presents the national efforts carried out in 2017 and 2018 towards implementation of the land degradation neutrality in Montenegro.

Podgorica, June, 2018
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The views and content expressed in this document are solely those of the authors of this document and do not necessarily represent the views of the LDN TSP or any of its partners.
# Contents

1 SUMMARY .................................................................................................................. 6

2 LEVERAGING LDN .................................................................................................. 9

2.1 Interest of country to commit to LDN and set LDN targets ......................... 9

2.1.1 Country profile .................................................................................................. 9

2.2 Link between LDN, achieving SDGs and other country commitments .... 10

2.3 Leverage opportunities identified ...................................................................... 11

2.4 LDN working group – issues discussed and agreed upon ....................... 12

3 ASSESSING LDN ....................................................................................................... 17

3.1 LDN trends and drivers ..................................................................................... 17

3.1.1 Land Cover/Land Use Change ....................................................................... 17

3.1.2 Land Productivity Dynamics ......................................................................... 18

3.1.3 Soil Organic Carbon ....................................................................................... 20

3.1.4 Watershed level analysis ............................................................................... 23

3.2 LDN institutional and legal environment ......................................................... 25

3.2.1 Soil/land degradation in Montenegro according to MNAP ......................... 25

3.2.2 LDN centred NAP SWOT Analysis ............................................................... 26

3.3 LDN baseline ......................................................................................................... 28

4 SETTING LDN TARGETS ....................................................................................... 30

4.1 LDN voluntary targets ....................................................................................... 30

4.2 Associated measures to achieve LDN ............................................................... 30

5 ACHIEVING LDN ........................................................................................................ 34

5.1 Leverage achieved ............................................................................................... 34

5.2 LDN transformative projects and programs opportunities identified .... 35

6 CONCLUSIONS ........................................................................................................... 37

7 REFERENCES .............................................................................................................. 39

8 ANNEX ...................................................................................................................... 41

8.1 List of LDN working group members ................................................................. 41

8.2 Dates of working group meetings and workshops ........................................... 41

8.3 LDN baseline tables ........................................................................................... 47

8.4 Reports on National Map of Selected LDN Hotspots ................................... 52
List of Figures

Figure 1 Land use categories in Montenegro for the centered years 2000 and 2010, with map of land use changes for these two periods .................................................. 18
Figure 2 Land productivity dynamics and soil organic carbon stocks in Montenegro obtained via global datasets ................................................................. 21
Figure 3 Thresholds of soil organic carbon stock in Montenegro .................. 23
Figure 4 Degraded areas in Montenegro according to LDN approach presented on watershed map from GAUL network .............................................. 24
Figure 5 National map of selected Hotspots ................................................. 42
Figure 6 The first national working group meeting in Podgorica .................... 43
Figure 7 Discussion during the first national working group meeting in Podgorica ... 43
Figure 8 Field visit during the first national working group meeting - Kokoti .......... 44
Figure 9 The second national working group meeting in Kolasin .................... 44
Figure 10 Discussion during the second national working group meeting in Kolasin 45
Figure 11 Field visit during the second national working group meeting - hotspot Sinjajevina ................................................................. 45
Figure 12 The third national working group meeting in Petrovac .................... 46
Figure 13 Discussion during the third national working group meeting in Petrovac 46
Figure 14 Trends in Net land productivity dynamics according to the land use/land cover category from 2000 to 2010 ...................................................... 50
Figure 15 Orjen, Bijela gora and Vilusi hotspots in the Karstic area of Montenegro . 53
Figure 16 Sinjajevina, Lola and Prekornica-Maganik hotspots .......................... 54
Figure 17 Treskavac-Durmitor and Golija hotspots ........................................ 55
Figure 18 Grbalj-Pastrovici and Lovcen hotspots ......................................... 56
Figure 19 Ulcinj area hotspot ........................................................................ 57
Figure 20 Podgorica area, Danilovgrad area and Zijovo-Kuci hotspots .......... 58

List of Tables

Table 1 Montenegro LDN national and specific voluntary targets ....................... 30
Table 2 Programs, actions and measures to achieve Montenegro LDN voluntary targets up to 2030 ........................................................................ 32
Table 3 IPCC (Level 1) and FAO LCML (Level 2) land use categories used in LDN TSP ............................................................. 47
Table 4 Summary table of sub-indicators framework obtained via global datasets for Montenegro ................................................................. 48
Table 5 Trend in net land productivity dynamics in the areas faced land cover conversions .......................................................................................... 49
Table 6 Change in SOC stocks according to conversions between land use categories for the period 2000/2010 ................................................................. 49
Table 7 Watersheds in Montenegro obtained from GAUL network; watershed area (km²), area of watershed in respect to the country area (%), degrading area in watershed (km²), total degraded area at the country level (%), total degraded area in watershed (%) and cumulative sum of national area (%) ................................. 51
Table 8 Potential hotspots in Montenegro ....................................................... 59
FOREWORD

The United Nations General Assembly adopted “The 2030 Agenda for Sustainable Development” in September 2015. The Agenda consists of 17 Sustainable Development Goals (SDG) and 169 targets. SDG 15 is related to the protection, restoration and promotion of sustainable use of terrestrial ecosystems. It covers forest management, desertification topics and biodiversity loss. Target 15.3 aims 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” by 2030 (UNCCD, 2016). The twelfth session of the Conference of the Parties of the United Nations Convention to Combat Desertification (UNCCD) endorsed target 15.3 and the concept of land degradation neutrality (LDN) as a strong vehicle for the implementation of the Convention. LDN is defined as “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”. LDN aims to maintain or enhance land-based natural capital compared to a reference state. The achievement of land degradation neutrality is monitored through the “proportion of land that is degraded over total land area”. All UNCCD country Parties are invited to formulate voluntary targets to achieve LDN. Montenegro ratified the Convention in 2007 and has worked on the LDN target setting process. This report summarizes the activities conducted related to land degradation neutrality in Montenegro during 2017.
1 Summary

Leveraging LDN


Leverage opportunities: LDN offers opportunities to create environmental, social and economic benefits, foster coherence among policies, push climate action and obtain various financing opportunities. The LDN target setting process is important as an engine for the promotion of sustainable land management, integrated landscape and water management. LDN TSP requests strong county ownership and the active involvement of all stakeholder groups involved in the land use sector.

NWG meetings/workshops: In the period from April 2017 to February 2018, the national working group held workshops in Podgorica, Kolašin, and Petrovac. The national working group consists of 25 members from 15 institutions.

Assesing LDN

LDN trends and drivers: A retrospective assessment of LDN trends and drivers was carried out using global datasets on LDN sub-indicators and information from local levels. ESA land cover data for the years 2000 and 2010 indicate the loss of 800 ha of forests and their conversion to shrubs and conversion of 1700 ha of forests to croplands. In total, 74,331 ha were found to be in three JRC land productivity dynamics classes with negative connotation. It means that potentially degraded land in Montenegro, according to the LPD dataset, is around 5.44%. Data on soil organic carbon (SOC) were provided by ISRIC. The average SOC stock for the entire country is 125.1 t/ha. According to the FAO GAUL network, the Moraca watershed was found to be the most degraded with 31041 ha, followed by Neretva-Trebišnjica watershed with 26613 ha, and Drina watershed with 15226 ha of degraded land. Fifteen potential hotspots were identified by means of global data and field visits. The most represented type of land degradation is biological degradation caused by wildfires.

LDN institutional and legal environment: The SWOT analysis of legal and institutional frameworks dealing with the environment at the national scale, together with the UNCCD NAP, is a corner stone of this process. The major strength of the institutional and legal framework is the existing Montenegro National Plan to Combat Desertification with the Action Plan (MNAP), which refers to a strategy on sustainable use of national resources, has political and institutional support through the scientific community and mostly covers the LDN concept. Laws and strategies in Montenegro mostly cover environmental issues. The most important weaknesses are the lack of awareness on land degradation problems, lack of long-term activities to combat land degradation and insufficient human, technological as well as financial resources.

LDN baseline: Global data on sub-indicators were used to establish the LDN baseline, due to lack of national data. The intention is to collect national data on sub-indicators in the forthcoming period. Land use/cover and land use change data was used from the ESA dataset with the possible option to include CORINE land cover data in the analysis. Land productivity dynamics data were used from JRC dataset since there are no national data on this sub-indicator. Soil organic carbon stock data was used from ISRIC dataset and will be used until the official compilation of all
existing SOC data in the country and collection of new data from new SOC campaigns will be available.

Setting LDN targets
LDN targets: The national voluntary target is to achieve LDN as compared to the baseline by 2030. The NWG defined four specific voluntary targets given in Box 1.

Associated measures to achieve LDN: Twenty-five measures were defined to achieve LDN in Montenegro by 2030. Different measures are related to enhancement of the LDN baseline in Montenegro, environmental legislation, direct measures to prevent or minimize land degradation and restore degraded land, sustainable agriculture and forestry, land use changes and social awareness.

Achieving LDN
Leverage achieved: The Ministry of Sustainable Development and Tourism encouraged the establishment of a national working group which consists of stakeholders dealing with land related issues who investigated legal and institutional frameworks and environmental conditions in Montenegro.

LDN transformative projects and programmes opportunities identified: Three specified measures are recognized as potential LDN transformative projects and programmes. Those measures are: (a) design of micro-accumulations in order to cope with wildfires and water scarcity in cattle breeding and perennial plants, (b) production and use of biochar in sustainable land management and study of its effect on soil improvement in the agro-forestry sector through raising new orchards, and (c) improvement of the agro-forestry sector through raising new orchards in the areas subjected to fires. Measures are related to Target 2 and Target 3, and responsible institutions are: the Ministry of Agriculture and Rural Development, the Ministry of Sustainable Development and Tourism and the Biotechnical Faculty, depending on the measure. Specified investments include support for experimental works in restoration activities, cattle breeding and perennial plant growing and experimental work on the establishment of new orchards on areas degraded by wildfires. Pilot projects in the land degradation sector would result in gaining knowledge on the problems in land restoration after wildfires. These measures are overlapping and synergetic and could further result in an international project or programme of broader significance.

Conclusions
LDN is recognized as a concept that could create environmental, social and economic benefits. Fifteen hotspots were identified, and a set of targets and measures were defined. Wildfires were identified as drivers of biological degradation, and three measures to achieve LDN in Montenegro could start with pilot projects/programmes to further become transformative projects with broader significance. LDN should be embedded into the MNAP, proposing actions to improve policy, legislative, institutional and coordination frameworks. It could be a trigger to increase investments in land degradation and to establish land degradation neutrality related partnerships. LDN TS should be embedded in national development policy processes. The strong and active involvement of all land stakeholders is required to achieve LDN.
### Box 1: National and specific voluntary LDN targets

<table>
<thead>
<tr>
<th>Target number</th>
<th>Achieving LDN by 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Avoiding, minimizing land degradation, and redirecting land use changes</td>
</tr>
<tr>
<td></td>
<td>Increase of land productivity - reduction of soil degradation</td>
</tr>
<tr>
<td>2</td>
<td>Protection of natural ecosystems from wildfires</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of soil monitoring system</td>
</tr>
</tbody>
</table>
2 Leveraging LDN

2.1 Interest of country to commit to LDN and set LDN targets

Land degradation is caused by mutual and very complex interactions of various human activities and natural circumstances. Land degradation happens within specific social, spatial, temporal and economic contexts. It is therefore important to identify land degradation types and the indirect and direct drivers causing it. According to the World Overview of Conservation Approaches and Technologies (WOCAT), the main forms of land degradation are classified into six types: soil water erosion, soil wind erosion, deterioration of soil physical and chemical characteristics, water degradation and biological degradation. Mentioned degradation types are found in Montenegro in different spatial extents and intensity, and with different drivers causing them (Fustic, Topalovic and Knezevic, 2005).

On May 4th 2016, around 15 days after the Letter of Invitation from the UNCCD was received, Montenegro committed to join the voluntary national Land Degradation Neutrality Target Setting Process (LDN TSP). A letter of commitment was signed by the General Directorate for European Integration and International Relations, which is a part of the Ministry of Sustainable Development and Tourism. The response to the Letter was sent to UNCCD Executive Secretary, Ms Monique Barbut.

In its response, the General Directorate for European Integration and International Relations informed the UNCCD Executive Secretary of the country’s interest in participating in the LDN TSP. The General Directorate for European Integration and International Relations also stressed the fact that Montenegro actively participated in the process of formulation and ultimate adoption of the Sustainable Development Goals (SDGs). The country has committed, together with the broader international community, to make these goals a reality. Accordingly, the General Directorate for European Integration and International Relations agreed that SDG target 15.3 to achieve LDN by 2030 is a strong motive for driving implementation of the Convention and believes that this process will contribute to additional benefits on top of the already important results achieved over the past 20 years. Therefore, Montenegro committed to be a part of the support programme, which is established to assist Parties in defining national baselines, measures and targets to achieve LDN by 2030. Montenegro’s willingness to stand at disposal on this matter was announced in the response letter.

2.1.1 Country profile

Organization: Parliamentary Republic
Total area: 13,812 km²
Area occupied by water: 1.5%
Location: Southeastern Europe (41° 52’ 32” 43 - N lat and 18° 26’ 21” 20 - E long)
Total population: 622,218
Population density: 45.1inhabitants/km²
Capital: Podgorica, Historical capital: Cetinje
Administrative divisions: twenty-one municipalities
Nominal GDP (2017 estimate): 6 354 € per capita
Currency: euro
Agricultural land: around 37.4%, 515.740 ha (0.79 ha per capita)
Forest area: 53.4%,
Protected areas: 9.9% of the country territory

2.2 Link between LDN, achieving SDGs and other country commitments

The National Strategy for Sustainable Development of Montenegro until 2030 (NSSD) was adopted by the Government of Montenegro in 2016. This document promotes the sustainable development policy in Montenegro and establishes a comprehensive framework for the national response to upcoming challenges. The strategy is based on the implementation results of the previous NSSD and on the requirements for the accession process of Montenegro to the EU. The NSSD until 2030 sets the platform for translating global objectives and tasks prescribed in the Agenda for Sustainable Development by 2030 into the national framework.

Out of the 169 individual tasks, structured in 17 sustainable development goals, 167 of them were translated into measures of the Action Plan in the NSSD, in accordance with national circumstances and defined future needs.

SDG 15.3 states that “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.” This aim is recognized in the NSSD and a number of implementing measures are recommended in order to support the realisation of this goal.

The NSSD to 2030 contains a list of sustainable development indicators, which in addition to those from the UN list also determine indicators that are significant in relation to specific national needs. In determining national indicators, it was taken into account that these indicators are already monitored or may be introduced into a monitoring system in a relatively short period of time. Also, the degree of compatibility with indicators monitored within the existing system of reporting to the relevant international organizations was taken into account.

The global indicator (15.3.1) is the “Proportion of land that is degraded over total land area” (ECOSOC, 2016). NSSD states that the institution responsible for this indicator is the Ministry of Agriculture and Rural Development and that it is one of the indicators that needs to be introduced into the national framework in the period 2018-2024.

The new Law on Spatial Planning and Building Construction was adopted on September 30, 2017. This law regulates the system of spatial planning, the manner and conditions for construction facilities, the legalization of illegally constructed structures and other issues of importance for spatial planning and construction of facilities. Montenegro passed the Law on Spatial Data Infrastructure on 09.06.2017. This law regulates the establishment and maintenance of the spatial data infrastructure as well as other issues of relevance to the spatial data infrastructure.

The spatial data infrastructure consists of: metadata, network services and technologies used for the exchange of spatial data, methodology for sharing, access and use of spatial data, conditions for using spatial data, geoportal of national spatial
data infrastructure (NSDI). NSDI comprises digital geodata and appropriate geodata services in Montenegrin territory, which are jurisdiction of organs of state and public administration; organs of local government; legal entities that perform tasks of public interest; legal entities that are entrusted with management of geodata and legal entities that use data and services comprised by NSDI and provide public services based on those geodata.

2.3 Leverage opportunities identified

The LDN Target Setting Process aims at enabling interested countries to define national baselines and to identify voluntary targets and associated measures to achieve LDN by 2030. It offers a possibility to create multiple benefits, to foster coherence among policies, to push climate action and to recognize financing opportunities.

Multiple benefits of LDN TSP in Montenegro might be related to environmental, social and economic sectors. The LDN target setting process can be important as an engine to explore the status of national resources, national databases, off-site effects of land degradation, link of soil degradation, biodiversity, and climate issues. Social aspects of LDN are related to human wealth and health in relation to land degradation, as well as the importance of rural to urban migrations, unemployment, food security, the triggering role of off-site land degradation on humans, and improvement of social awareness and knowledge on land degradation. It is very important to map and determine the impact of land degradation on the economy, to find a mechanism to financially support the rehabilitation of degraded areas, to promote sustainable development, and to determine economic losses derived from land degradation off-site effects.

LDN is an opportunity for leverage and coordination across line ministries. It should build on and leverage national initiatives and be integrated into national policy processes, including national land use planning, the national SDG process, other relevant national policy processes at national and sub-national levels, NAP/UNCCD implementation and national UNCCD alignment process, or other relevant land-based initiatives in which LDN could be integrated. Strong cross-sectorial collaboration and high-level political commitment are key for the success of LDN target setting and implementation. In Montenegro, the LDN program may be an opportunity to foster policy coherence between the Ministry of Sustainable Development and Tourism and the Ministry of Agriculture and Rural Development, as well as to enhance the impact of scientific institutions, such as the University of Montenegro, on policies. LDN offers a possibility to develop a synergetic action plan on LDN and climate change adaptation and mitigation activities. It also matters in terms of searching financial possibilities to cope with land degradation, other than those from UNCCD.

Sustainable land use requires the active involvement of a multitude of sectors and stakeholders, who must be involved in the LDN target setting process. LDN offers leverage for national development programmes, priorities and objectives through harmonization of objectives in the NAP. The country commitments and engagements are an evaluation of the contribution of LDN and NAP activities into the
The achievement of the targets and priorities of the three Rio Conventions. The LDN target setting process offers a possibility to analyze the connection between LDN and the EU Common Agricultural Policy regarding Good Agricultural Practice.

In order to demonstrate the leverage opportunities of LDN, as indicated in the chapter on LDN trends and drivers, it is necessary to observe the indicators in detailed resolution. After this, the LDN concept could be successfully practically applied in specific activities such as:

- **Spatial planning** - to apply the principle of LDN in construction activities, i.e. limit the construction conditions to non-fertile or poorly fertile land, and to compensate for urbanization and soil sealing by restoring degraded land and improving soil properties in some other locations.
- **Agricultural activities** - regular monitoring of LDN indicators can help identify areas where good agricultural practices are not implemented and push the use of those practices.
- **Forestry** - monitoring the conditions of the forests and determining fire risks or diseases development.

After obtaining the data with the appropriate resolution and creation of adequate tools, it is necessary to start the activities in the mentioned directions.

### 2.4 LDN working group – issues discussed and agreed upon

The National Working Group for LDN was the same Working Group established for drafting of the National Action Plan to combat land degradation, which was adopted by the Government of Montenegro in 2015. The same Working Group will also be involved in the UNCCD reporting process. The members of the Working Group will participate in delivering data for the UNCCD report, as well in evaluating the Report before submission to the UNCCD Secretariat.

Stakeholder involvement was coordinated through the NWG. The NWG is a platform where stakeholders can exchange information and views on the LDN target setting process. The LDN NWG was established in May 2017 and it consisted of all groups of stakeholders. The NWG was integrated into all stages of the LDN target setting process and it provides information to the stakeholders, represents stakeholders at national level, presents a negotiation platform among stakeholders, reviews and validates national reports, including LDN baseline, land degradation trends and drivers assessments, LDN targets and associated measures, support for national outreach and communication activities related to LDN target setting, support for mainstreaming of LDN target setting in national policy processes, creates awareness among stakeholders on LDN, monitors and evaluates the LDN target setting process.

Overall national and international engagement is important for LDN TSP in Montenegro.

The first and one of the main groups of stakeholders is land users who ultimately make decisions considering the land. Some of the recognized stakeholders in the LDN TS process in Montenegro include the Company “13. Jul Plantaže”, Winery
“Lipovac” and company Green Room s.l.r. Other important stakeholders are bodies that control the production process, i.e. Monteorganica.

The next group of stakeholders consists of governmental agencies at national and sub-national levels dealing with development and implementation of (sub)-national policies and plans on land-related issues. In Montenegro, key line ministries involved in land management are the Ministry of Sustainable Development and Tourism, the Ministry of Agriculture and Rural Development, the Environmental Protection Agency of Montenegro, the Statistical Office of Montenegro (MONSTAT), and the Real Estate Administration.

**The Ministry of Sustainable Development and Tourism** is a key ministry for UNCCD processes in Montenegro with the Directorate for Environment responsible for the implementation of the Convention. The Ministry of Agriculture and Rural Development plays an important role with its Directorate of Forestry, Hunting and Timber Industry and the Directorate of Agriculture. Montenegro has national focal points for the Rio Conventions (CBD, UNCCD, UNFCCC) and the Global Environment Facility (GEF). The country has a Law of environmental protection, a new Law on soil as an agricultural resource is in preparation, whereas a Law on Soil Protection is planned to be developed in the future.

Next group of stakeholders are national and international research institutes which provide scientific advice to all stakeholders about proper land use practices and related policy options. In Montenegro, the Biotechnical Faculty of the University of Montenegro is the most important academic institution dealing with soil and land issues. Senior researchers from the Centre for Soil and Amelioration of the Faculty took active participation in the creation of Montenegro’s NAP and are engaged in several national and international projects related to soil and water resources management in agriculture. They are also involved with the Centre of Excellence in Bioinformatics (BIO-ICT) on a project regarding use of the latest ICT applications in the area of agriculture, marine biology, environmental protection and human health.

Civil society organizations (CSO) represent the fifth most important stakeholder group and are often the link between the above stakeholders in support of national land users. NGO “ProES” – Protection of Environment and Soil, is the CSO involved in the LDN TSP, and is actively acting as a bridge among stakeholders and with UNEP as one of the potential international development partners. Stakeholders are JP National Parks of Montenegro, the Institute for Hydrometeorology and Seismology, Geological Survey of Montenegro, the Municipality of Nikšić - Service of Agricultural Development and possible ones - Company Green House Jovović (GHJ), Coal Mine A.D. Pljevlja, Union of Municipalities of Montenegro and CSO Centre for Development of Agriculture.

The objective of the working group is to steer the LDN target setting process and promote LDN mainstreaming into national policies and plans. LDN is a planning principle and land use planning has a crucial role in implementing LDN and the ultimate objective of LDN can only be realized with proper land-use decisions. Therefore, LDN must be mainstreamed into existing environmental, agricultural, infrastructure and overall development policies and plans, including UNCCD MNAP.
The list of individual stakeholders is given in chapter 8.1 (Annex).

The National working group had two meetings during 2017 and one meeting in 2018. In the first workshop in Podgorica (Figure 6 - Figure 8), the country consultant presented the land degradation target setting process and the leverage plan to the working group. The presentations were conceptually organized to introduce LDN to the working group and consisted of various branches: LDN baseline, assessment of land degradation trends, identification of land degradation drivers, definition of national and specific voluntary targets, LDN mainstreaming in land use planning, measures and actions to achieve LDN, and monitoring and reporting. The discussions were mainly related to agricultural land management and organic production, forest land management, designated areas, Skadar Lake and other national parks. The concept of land degradation neutrality was explained by means of land degradation types, land degradation trends and drivers of land degradation. Country consultant, Mr. Mirko Knezevic from the Biotechnical Faculty, emphasized that the main direct drivers of land degradation and desertification in Montenegro for the last two or three decades have been: urbanization and infrastructure development, improper management of the soil in agricultural production, deforestation and removal of natural vegetation, soil sealing, industrial activities, waste deposition and mining activities, disturbance of the water cycle, and natural causes such as water scarce periods, extended rainfall events and temperature variations. In addition, increased number of hot and cold days result in forest fires and freezing conditions, higher occurrence of floods, torrents and landslides. Mr. Knezevic also said that the main indirect drivers of land degradation and desertification in Montenegro for the last two or three decades have been population pressure, migration from rural to urban areas, increase of touristic capacities, land tenure changes, poverty, labor availability and lack of financial inputs.

Furthermore, the presentations were then followed by an introduction on appropriate measures to combat land degradation and the role of legal and institutional framework in the land degradation neutrality concept, and in defining land degradation neutrality voluntary targets in Montenegro. The members of the working group discussed the LDN baseline, potential global and existing national datasets. At the end of the first workshop, the work plan was adopted, future activities were presented as well as LDN implementation strategies. During the second workshop day, members of the national working group visited a pomegranate nursery in the village of Kokoti. This production site presents an ideal example of application of reclamation measures on low productive soils. The nursery was designed on shallow calcareous soils with very low productivity and many exposed bedrocks on the top of the ground. The owner of the pomegranate nursery transports residual earthy material from construction sites in Podgorica. Earthy material was used to overlay the ground. By this measure, he was able to increase soil depth and initiate organized production in certain areas, with plans to enlarge the production. This is an example of conducted reclamation measures underpinned with planning principles endorsed by LDN TSP.

In the second workshop organized in Kolasin (Figure 9 - Figure 11), Ms Biljana Kilibarda - UNCCD focal point for Montenegro discussed the conclusions from the regional LDN meeting held in Turkey. She also stated that Montenegro adopted a national action plan to combat land desertification and mitigate the effects of drought
in December 2015. At this workshop, the national consultant presented global data on LDN indicators to the working group. Director General of the Directorate of Forestry, Hunting and Timber Industry of the Ministry of Agriculture and Rural Development of Montenegro pointed out that land and vegetation are tightly bounded, and that we strive to find an appropriate managing model. He also presented that 60% of the territory of Montenegro is under forest, whereas 70% is under forests and forest land.

The Methodological Guidelines for Establishing National Voluntary Land Degradation Neutrality Targets Using the UNCCD Indicative Framework was presented and guided the process in Montenegro, taking into account the use of national data. Representatives of MONSTAT emphasized that attention should be paid to the methodology and data collection, as well as to the differences between the principles of EU and UN methodologies. Working group members agreed upon the choice to utilize global data sets to establish the LDN baseline because of the lack of good quality national data.

The national consultant presented potential hotspots in Montenegro that were identified by processing obtained default data. He also presented the possible causes of soil degradation. For the Sinjajevasina mountain hotspot, all working group members visited Javorje (Bare). In discussing with the local population, they understood that serious fires in pastures in Krnja Jela (Sinjajevasina) stated occurring a few years ago and this was the driver of the negative trend in land productivity in this area. In another location, LPD decline was due to livestock management. At the end of the workshop, the working group actively discussed national and specific voluntary targets in Montenegro based on historical knowledge. Members of the group agreed that the construction of water accumulations in mountainous regions could indirectly enhance the agricultural development, for at least five to ten years. Soil experts from the working group added that the SOC is a very unreliable indicator because of the high variability of this data in one field, rather than on larger areas. The NWG reached some conclusions related to the LDN baseline and specific voluntary targets. The social aspect of land degradation was linked to increased urbanization and rural to urban migration. Rural to urban migration was recognized as a driver of environmental changes, both positive and negative. The group adopted a few ideas such as the development of the irrigation sector and the fire protection sector, which can be enhanced by building small water accumulations. Those accumulations should be constructed adjacent to hotspots, i.e. the places where they are most needed. This is a measure to catch rainfall and decrease surface runoff, because rainfall is not scarce in the territory of Montenegro.

In the third workshop organized in Petrovac (Figure 12 - Figure 13), the national map of selected LDN hotspots with watershed level analysis and the LDN-centered NAP SWOT analysis were presented. The main results of the third workshop consisted in decisions on national and specific voluntary targets and associated measures related to targets. Mr Adem Fetic, Director General of the Directorate for forestry, hunting and wood industry of the Ministry of Agriculture and Rural Development of Montenegro, pointed out the negative impact of serious wildfires affecting the country. He stated that the national working group should try to find a way to stop and improve this situation. He also presented unofficial data on burnt
areas in Montenegro in 2017. He said that wildfires affected 13570 ha of area, and more than 55% of the area belonged to the coastal zone of Montenegro.

The working group members agreed that the main type of degradation occurring in Montenegro is biological degradation due to wildfires, which consequently leads to: deterioration of the soil’s physical, chemical and biological characteristics, decline in soil organic matter, deterioration of soil structure, decline in soil biodiversity, reduced soil infiltration and enhanced runoff, soil water and wind erosion, degradation by water, torrential floods and floods, soil sealing, landslides, soil pollution from industrial, agricultural and mining activities and acidification. Around 80% of the degraded area was affected by wildfires followed by urbanization. Working group members agreed that the global dataset did not detect areas degraded by soil water erosion in the watershed of River Lim and other locations because of methodological limitations regarding used resolution. After the discussion on the drivers of land degradation in Montenegro, participants of the third workshop determined national and specific voluntary targets and measures, which are presented in Chapter 4.

The NWG organized five field trips to fifteen potential hotspots. Field visits helped to better understand the problems. Hotspots in Montenegro can be grouped by land degradation drivers. There are ten potential hotspots where the reduction in land productivity was caused by fires. These hotspots are located at Lovcen, Vilusi, Bijelagora, Orjen, Golija, Lola, Prekornica-Maganik, Sinjajevina, Zijo-J-Kuci, and Treskavac-Durmitor. The other group of hotspots has multiple drivers of land degradation, such as in the areas of Ulcinj and Podgorica where combined effects of fires, agricultural abandonment and urbanization take place. In the Danilovgrad hotspot, urbanization and agricultural abandonment were found to be the most significant causes of land degradation, while in the Pastrovici-Grbalj hotspot, land degradation appeared from the combined effect of urbanization and fires. In the Pljevlja hotspot, mining activity followed by agricultural abandonment caused land degradation. Twelve of fifteen potential hotspots were prone to wildfires in recent times. Therefore, wildfires are identified as the most critical type of land degradation in Montenegro. The methodology applied in LDN TSP is more spatially dominant and observes wider areas, represented by pixels on the map, but is not suitable for recognition of many soil water erosion problems in the north of Montenegro, like gullies and rill erosion.
3 Assessing LDN

3.1 LDN trends and drivers

3.1.1 Land Cover/Land Use Change

The most important land use categories in Montenegro are pastures and meadows, forests, croplands, mosaic natural vegetation, water bodies, orchards and vineyards, mosaic agricultural land, artificial areas, marshes and barren lands. Each land use category has its own characteristic processes and different categories are subject to different specific forms of land degradation. Soil is a nonrenewable resource, which is not well treated compared with other resources, thanks to its high buffering capacity. Soil formation is usually very slow, whereas soil degradation could occur in a very short time. Land degradation types and drivers should also be observed by means of soil types as a central mapping unit. Agricultural land in Montenegro covers 37.4% of the total surface area (2011) and presents an important economic attribute of the country. Arable land, orchards and vineyards occupy only 62,154 ha or 12% of total agricultural area, whereas the pastures and meadows are dominant categories.

Land cover refers to the observed physical cover of the Earth’s surface (IPCC, 2003). It is a fundamental surface parameter which assists in the interpretation of the other two sub-indicators from the UNCCD indicator framework and their stratification. Changes in land cover are the first indication in vegetation behavior, fragmentation of habitat or land conversion. Land cover can be obtained from Earth observations. The European Space Agency (ESA) provided global data on land cover for the centered years 2000, 2005, and 2010. The ESA Climate Change Initiative Land Cover dataset (CCI-LC) covers the globe and has a spatial resolution of 300 m. This initiative recommended FAO land cover meta language (LCML) (FAO, 2016). A proposed hierarchical classification is based on level 1 IPCC (2006) categories and level 2 FAO LCML (United Nations, 2014) categories. The 37 CCI-LC classes are aggregated into the level 2 classes. In the Table 3 in Annex, Level 1 and 2 categories are given.

Land cover changes may be characterized as positive or negative. Negative critical transitions are generally considered as conversions from natural or semi natural land cover classes to cropland or settlements, or from forest land to other land cover classes, as well as urbanization. The interpretation of changes in land cover is ultimately the responsibility of national and local authorities which should explain why changes are evaluated to be positive or negative in the given context.

ESA land cover data are presented in this report on Error! Reference source not found. as maps for the two epochs around year 2000 and 2010, and as land cover change between these two periods. These data indicate the loss of 800 ha of forests and their conversion to shrubs and the conversion of 1700 ha of forests to croplands (see Annex).

In Montenegro, the CORINE land cover (CLC) dataset are available for the years 1990, 2000, 2006 and 2012. Data for 2018 are in preparation. This dataset has better resolution, but its use is limited by the need to have regular acquisition of future data, which are necessary for further analysis and monitoring. The CLC has 44 classes of land cover in nomenclature, 25 hectares minimum mapping unit and 100 meters minimum mapping width. For the purpose of LDN TSP, this dataset
should be converted into IPCC and FAO LCML land use/cover classes. Unfortunately, the use of these datasets is currently constrained with the possibility to compare land use/cover between two or more epochs. Also, these epochs do not coincide with the epochs of ESA dataset provided by UNCCD. ESA land cover dataset was not able to recognize land cover conversions in sub-urban areas, as well as conversions of croplands to abandoned areas.

Based on all above mentioned, we have decided to use global data on land cover and land cover changes, and the results are presented in the Annex (Table 4).

Figure 1: Land use categories in Montenegro for the centered years 2000 and 2010, with map of land use changes for these two periods

3.1.2 Land Productivity Dynamics

Land productivity is defined as the total above-ground net primary productivity. It is computed as the difference between the energy fixed by plants (assimilation) minus the energy released by plants (their respiration). Land productivity is expressed in tons of dry matter per hectare per year (t DM/ha/year). It captures changes in the system relatively fast. To achieve land degradation neutrality, the productivity of ecosystems should be maintained or enhanced in a sustainable manner. LDN TSP uses the land productivity dynamics (LPD) dataset prepared by the Joint Research Centre of the European Commission as a global data source for land productivity. This dataset is obtained through the elaboration of SPOT vegetation normalized difference vegetation index (NDVI) observations in the period 1998-2013. This dataset has a spatial resolution of 1 km. Remotely sensed images were collected in 10-days intervals during the 15-year period. The results of this analysis are five qualitative classes of land productivity trends. These classes are qualitative explanations of changes captured in the system. They indicate the intensity and
persistence of negative or positive trends and changes in the photosynthetically active vegetation cover. It is actually the trend in land productivity. Land productivity classes described in the dataset show: “declining productivity”, “early signs of decline”, “stable, but stressed”, “stable (not stressed)” and “increasing productivity”. This dataset is further stratified by means of the six main land cover categories.

Land productivity dynamics data indicate decline in land productivity on 4500 ha of croplands and 3888 ha of shrubs, grasslands and sparsely vegetated areas (Table 4 Annex). Decline in LPD was observed in artificial areas on 1206 ha, and on 360 ha of forests. Total decline in LPD in the territory of Montenegro was found on 10224 ha. The other two classes of LPD, “early signs of decline”, and “stable, but stressed”, were also observed in the country. It is important to note this data for these two classes could be potentially grouped into degraded areas. Early signs of decline and stable but stressed classes cover 64107 ha. A total of 74331 ha of Montenegro territory were found to be under these three classes. It means that potentially degraded land in Montenegro according to LPD dataset is 5.44%, concretely 8.50% of croplands, and 7.33% of shrubs, grasslands and sparsely vegetated areas.

**In Montenegro, there are no national data on LPD prescribed according to LDN concept.** The spatial presentation of LPD trends is given in Figure 2. In Table 5 (Annex) and Figure 14 (Annex) trends in net land productivity dynamics are presented according to the land use/land cover categories from 2000 to 2010. Table 5 in Annex presents the results of LPD changes according to land cover changes. These results show inconsistency. It is well seen that conversion from forests to cropland did not result in negative LPD trends for all converted area. Hence, 21.2% of converted area faced some kind of LP negative change, mostly belonging to stable, but stressed LPD class. Similar findings are found for conversion of forests to shrubs, grasslands and sparsely vegetated areas. Here, only 16.7% of the converted area faced a negative LPD trend, which on greater part of the area belongs to stable, but stressed LPD class.

**Global data on LPD can be used in Montenegro, since the country does not have national data.** The results of LPD for the period 1998-2013 are presented in Table 4 and Table 5 in the Annex.
3.1.3 Soil Organic Carbon

Carbon stocks above and below ground present the measure of quantity of carbon in a system which has the capacity to accumulate or release carbon. Above and below ground biomass, dead organic matter and soil organic carbon are terrestrial carbon pools and together contain the total terrestrial carbon pool. At the start of the LDN TSP, soil organic carbon (SOC) stocks were used instead of total carbon stocks until the latter becomes operational. Measuring units are tons of carbon per hectare.

SOC is one of the most important indicators of soil quality. Data on soil organic carbon were provided by ISRIC – World Soil Information. Data refer to SOC stocks up to reference depth of 30 cm, in 250 m grids. Soil organic carbon stock (SOC) in t/ha up to a depth of 30 cm is computed following equation 1 (Poeplau et al., 2017) using data on SOC content (% weight), coarse fragments (volume partition), bulk density (t m⁻³) and soil thickness (0.3 m).

\[
SOC \text{ stock} = 100 \cdot SOC \text{ content} \cdot \text{bulk density} \cdot (1 - \text{Coarse fragments}) \cdot \text{Depth}
\]  
Equation 1

ISRIC soil grids were obtained by modeling techniques with low amounts of measured data. They could be more accurate if sharing more data on soil profiles and intend to collect soil data necessary for calculations directly, not only through indirect methods. Interpretations of SOC trends are positive when SOC stocks values increase, or they may be negative when SOC stock values decrease. Hence, this could be defined otherwise by local authorities.

Figure 2 presents soil organic carbon stocks for the territory of Montenegro in the year 2000. An average amount for the entire country is 125.1 t/ha. SOC stocks are the highest in forests, 129.9 t/ha, followed by shrubs, grasslands and sparsely vegetated areas, 124.9 t/ha, and croplands, 124.3 t/ha. The latter value is very high, probably not very common at a global scale, and it is related to the fact that many of the natural grasslands of Montenegro (having high SOC stocks) were categorized as croplands in ESA land cover datasets. SOC stocks for six main land use classes are presented in Table 4 (Annex). National data on soil organic carbon exist in the database of the University of Montenegro – Biotechnical Faculty by means of humus content. These data are sometimes very old and rarely georeferenced. These procedures rarely correspond to the methodological approach of the LDN TSP. In order to produce SOC stock values some crude assumption should be defined which however creates additional errors in data. SOC data were not obtained from SOC campaigns, but rather from the campaigns with different purposes.
Figure 2: Land productivity dynamics and soil organic carbon stocks in Montenegro obtained via global datasets.
Therefore, the NWG has decided to initially use baseline SOC data from global datasets, which are centered on year 2010. It is important to say that a very large part of Montenegro territory is covered with rock outcrops and coarse surface fragments, Nudilithic and Lithic Leptosols, shallow and/or extremely gravelly soils (Fustic and Djuretic, 2000). A great gap in SOC assumptions is evident on these areas. Changes in SOC for the two periods of time are given on a basis of IPCC methodology (IPCC, 2006), which is related to land cover change. These are very crude assumptions (Table 6 in Annex). Hence, it was concluded that no good quality data is available for the baseline period. Global SOC map of Montenegro should be corrected using good quality national data obtained according to the methodology and including data for the last 10-15 years. Global data on SOC stocks do not accurately present the actual situation, while national SOC stocks data should be systematized in order to be presented spatially with a high degree of confidence.

Tentative SOC threshold map for Montenegro is shown in Error! Reference source not found.. Threshold values for the classification purposes were not explained by providers of the map. These values cannot be the same under different bioclimatic conditions. SOC stocks in Montenegro are presented in this report on two different maps. In Figure 2, SOC stocks values are classified in eight classes in order to show more visible distinctions between SOC values across the Montenegrin territory. Error! Reference source not found. presents SOC values classified by means of defined threshold values. According to this classification SOC values between 0 – 50 t/ha indicate reduced soil structure conditions, fertility and water retention. This class has the highest risk of wind/water erosion and SLM practice should include soil structure stabilization and keep ground litter/cover on the top surface, agro-forestry restoration and silvo-pastures. Moderate soil structure, fertility and water retention are defined by this methodology within SOC class between 50 – 110 t/ha. This SOC values should only consider sustainable forestry, sustainable grazing, agro-forestry, and measures to maintain/improve SOC levels. SOC class between 110 – 200 t/ha indicate maximized soil structure, fertility and retention, and within this class sustainable forestry, agroforestry and grazing should be considered with measures to maintain SOC stocks.

The complexity of the landscape, climate conditions and soil cover in Montenegro make it impossible to use such a simplified SOC stocks classification (classes), and defined threshold values. The classes should be defined within similar edaphic and orographic zones after a detailed survey of SOC issues on the field, and after gathering a high number of data.
3.1.4 Watershed level analysis

The LDN TSP provided watershed boundaries to Montenegro using definitions of the FAO GAUL network. First, it is important to say that these watershed boundaries have two great oversights. The first is related to the name of watersheds and its boundaries, which do not correspond to local officially used boundaries. The second is related to a watershed called Neretva-Trebišnjica, which actually covers the Karstic North-Western part of the country. The Karstic area has more vertical water movement (deep percolation) than runoff and cannot be observed as it is. All seven watersheds cover almost 100% of the country area, but the first three in the list, Moraca, Neretva-Trebisnjica and Drina watersheds, cover 95.2% of the country.
Degrading areas in watersheds were computed by summing LPD classes 1-3 in area units and areas facing critical transitions in respect to land use conversion.

Figure 4: Degraded areas in Montenegro according to LDN approach presented on watershed map from GAUL network

Around 12.0% of Moraca and Bojana watersheds are degraded according to this approach. In the Moraca watershed, 31041 ha of the area are degraded, which is the highest rank in Montenegro, whereas 26613 ha of the Neretva-Trebisnjica watershed are degraded, along with 15226 ha of the Drina watershed. The Drina watershed is the largest watershed in the country according to this network, and around 2.5% of this watershed is degraded. Table 7 (Annex) presents data for seven watersheds in Montenegro covering almost 100% of the country territory.
Watershed and hotspots analysis have been useful and in agreement with the expert opinion.

3.2 LDN institutional and legal environment

3.2.1 Soil/land degradation in Montenegro according to MNAP

Montenegro ratified the United Nations Convention to Combat Desertification (UNCCD) in 2007 and thereby undertook the obligation to implement and report on compliance with obligations under the Convention in accordance with its objectives related to sustainable land management and land degradation prevention. In 2007, the UNCCD adopted a new strategy for enhanced implementation for the period 2008-2018 and requested the country Parties to upgrade their National Action Programs (NAP) for the implementation of the Convention, aligned with a 10-year Annual Strategy. The Ministry of Sustainable Development and Tourism, as an institution with jurisdiction over UNCCD issues, supported by the United Nations Environment Program (UNEP) offices in Vienna, in accordance with the undertaken international obligations, prepared a National Action Plan to combat desertification that is in line with that strategy for improved implementation for the period 2008-2018.

The adoption of the Montenegro National Action Plan to Combat Desertification, an international commitment undertaken by the ratification of the UNCCD, is fulfilled. The main components of MNAP are: an analysis of soil degradation in Montenegro (described through the pressures of individual sectors) and the activities to combat land degradation in Montenegro, including strategic and operational goals.

In line with its basic goals, the UNCCD directs country Parties through their national action programs to evaluate the impact of land degradation on social and economic processes, with the building of appropriate institutional capacities and legislation, propagating and raising public awareness, and developing education and science, establishing appropriate policies, involving the public in decision-making, as well as creating the necessary synergies with other Conventions relevant to land degradation.

In the MNAP, within four strategic goals established at the Convention level, the following activities are defined:

**Strategic Goal 1 – Improving the living conditions of the vulnerable population**
- Activity 1.1. Establishment of the Association for Soil Research in Montenegro and improvement of cooperation through joint activities
- Activity 1.2. Introduction of the segment of soil protection and its functions in formal education and all aspects of environmental protection
- Activity 1.3. Introduction of a new study program (e.g. master’s program), which would concern land and spatial planning for successful agricultural production and the prevention of land degradation.
- Activity 1.4. Organizing workshops, courses, seminars, tribunes on soil degradation and conservation and marking of international dates regarding environmental protection
- Activity 1.5. Remediation and removal of unregulated waste disposal sites at the level of local communities
– Activity 1.6. Continuation of drought monitoring in line with the Drought Management Centre for Southeastern Europe (DMCSEE) and priorities in Montenegro

Strategic Goal 2 – Improving the status of endangered ecosystems
– Activity 2.1. Adoption of regulations on the treatment and application of biodegradable waste in agriculture
– Activity 2.2 Protection of soils with the best quality land from urbanization and unauthorized use
– Activity 2.3. Providing the conditions for the analysis and determination of indicators for the monitoring of the status of ecosystems
– Activity 2.4. Set up the monitoring of the soil quality and the integrated database for soils affected by various forms of pollution
– Activity 2.5. Study, map and protect vulnerable soil types
– Activity 2.6. Control of the use of fertilizers and pesticides

Strategic Goal 3 – Generating the global benefits through the effective implementation of the UNCCD
– Activity 3.1. Implementation of the joint scientific and research initiatives and research projects
– Activity 3.2. Support to the establishment of the Regional Center for Combating Land Degradation

Strategic Goal 4 – Mobilizing the resources to support the implementation of the Convention through the building of effective partnerships between national and transnational actors
– Activity 4.1. Preparation of regular reports on the implementation of MNAP for the UNCCD Secretariat
– Activity 4.2. Harmonization of the existing soil and environmental regulations with relevant EU and UN legislation

3.2.2 LDN-centred NAP SWOT Analysis

National policy is the main driver of LDN success. Without it, fruitful results cannot be expected. Legal and institutional frameworks for land degradation neutrality in each country could be assessed by analyzing their strengths, weaknesses, opportunities and threats. SWOT analysis of the national environment and elaboration of the UNCCD NAP are cornerstones of this process. The strengths and weaknesses are controlled by Government and considered as internal factors, whereas opportunities and threats require the mobilization of a broader range of stakeholders and are considered as external factors. The SWOT analysis includes identification of relevant documentation, review of the NAP, compilation of LDN synthesis report, with the main elements appearing to be strengths, weaknesses, opportunities and threats, discussion on the report, and SWOT validation by the national working group. The SWOT analysis provides insight into legal and institutional frameworks, links LDN and NAP, and identifies measures to achieve LDN.

The major strengths in institutional and legal frameworks are related the MNAP, which refers to a strategy of sustainable use of national resources. The MNAP has political support and institutional support via the scientific community and it mostly covers the LDN concept very well. Laws and strategies in Montenegro mostly cover environmental issues and a new law on soil as an agricultural resource is in preparation. The Ministry of Sustainable Development and Tourism (MORT) is a
structured organization that leads the target setting process and recognizes the problem of land degradation.

### SWOT Matrix

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearly defined activities of MNAP</td>
<td>There are no long-term activities for combating land degradation</td>
</tr>
<tr>
<td>MNAP refers to strategy of sustainable use of national resources</td>
<td>Insufficient human, technological and financial resources</td>
</tr>
<tr>
<td>The MNAP has political support and institutional support via the scientific community</td>
<td>There is no methodology to assess and monitor land degradation</td>
</tr>
<tr>
<td>The MNAP mostly covers the LDN concept very well</td>
<td>No revision and dissemination of results of the projects and measures have been conducted</td>
</tr>
<tr>
<td>Laws and strategies mostly cover environment</td>
<td>Lack of coordination among sectorial and cross-sectorial issues</td>
</tr>
<tr>
<td>New Law on Soil as an agricultural resource is in preparation</td>
<td>Generally, lack of awareness about land degradation</td>
</tr>
<tr>
<td>Ministry of Sustainable Development and Tourism (MORT) recognizes the problem of land degradation</td>
<td>There is no assessment of land degradation impacts on economy</td>
</tr>
<tr>
<td>There is a Center for Soil Research and Amelioration within the Biotechnical faculty in Podgorica at the University of Montenegro.</td>
<td>There is a system of funding to support some soil interventions, but it is not efficient</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-structured MNAP; developed infrastructure for implementation</td>
<td>There are not enough regulations to combat land degradation in Montenegro</td>
</tr>
<tr>
<td>Develop relevant regulations, laws, and norms related to land degradation</td>
<td>Possible delays in the elaboration of draft legal acts, discussions and approval procedures</td>
</tr>
<tr>
<td>LDN concept to strengthen institutional capacities and human resources</td>
<td>Competition with other environmental hazards for funding</td>
</tr>
<tr>
<td>Development of new technologies and tools to support LDN</td>
<td>Multi-sector approach can affect the management efficiency</td>
</tr>
<tr>
<td>Environmental institutions can support the LDN activities</td>
<td>The lack of awareness of the importance of land degradation</td>
</tr>
<tr>
<td>Results from LDN could be used for other purposes</td>
<td>Impact of potential changes in the global and national economies</td>
</tr>
<tr>
<td>New insights into agro climatic indicators</td>
<td>Stakeholder indifference in project organization, elaboration and implementation</td>
</tr>
<tr>
<td>Increase attention of stakeholders and media on soil degradation</td>
<td>Increased urbanization and soil sealing</td>
</tr>
<tr>
<td>Design of an integrated land degradation monitoring and evaluation system</td>
<td>High incidence of floods and droughts, impact of climate change and natural disaster</td>
</tr>
<tr>
<td>Design of an intervention plan at local level</td>
<td>Defining of clear targets in order to promote prevention of land degradation</td>
</tr>
<tr>
<td>Defining of clear targets in order to promote prevention of land degradation</td>
<td>Targeted mobilization of human, financial and technological resources</td>
</tr>
<tr>
<td>Partnership building; Education and training programs; Development of LDN economic index</td>
<td>Partnership building; Education and training programs; Development of LDN economic index</td>
</tr>
<tr>
<td>Development of mechanisms for information, technology and best practice exchange</td>
<td>Development of mechanisms for information, technology and best practice exchange</td>
</tr>
<tr>
<td>Easier way to find financial sources from international organizations</td>
<td>Easier way to find financial sources from international organizations</td>
</tr>
<tr>
<td>Engagement of national, regional and international actors in restoration actions</td>
<td>Engagement of national, regional and international actors in restoration actions</td>
</tr>
</tbody>
</table>

The most important weaknesses are recognized while facing the real problems in terms of land degradation. Hence, there are no long-term activities to combat land degradation and no established methodology to assess and monitor land degradation.
degradation. Besides, there are insufficient human, technological and financial resources. The funding system supports some soil interventions, but it is not efficient. Revision and dissemination of results from conducted projects and measures are not properly carried out. Since land degradation has its own spatial, temporal, economic and cultural context, a lack of coordination among sectorial and cross-sectorial issues is problematic. Accordingly, there is no assessment of land degradation impacts on the economy. Furthermore, involvement of local communities in the problem of land degradation is minimal. Generally, there is a lack of awareness about land degradation problems.

Plenty of opportunities could rise from the LDN target setting process. The major opportunities are related to a well-structured MNAP and developed infrastructure for its implementation. It is not difficult to develop relevant regulations, laws, and norms related to land degradation. The LDN concept strengthens institutional capacities and human resources and promotes the development of innovative technologies and tools related to land degradation. Environmental institutions can support LDN activities. This is especially important because the multidimensional nature of land degradation allows LDN results to be used for other purposes. It is important to raise attention of stakeholders and media on soil degradation. Proper LDN TSP streaming into policies could result in an integrated land degradation monitoring and evaluation system, or the design of an intervention plan at local level. The definition of clear targets promotes land degradation prevention and thus ensures targeted mobilization of financial and technological resources, which further promotes partnership building. This could enable the development of mechanisms for information, technology and best practice exchange. It could also result in the organization of training programs and an LDN economic index. Good outreach could favor involvement of national, regional and international actors in restoration actions and provide opportunities to easily find financial sources from international organizations.

Possible threats to LDN TSP are related to lack of regulations combating land degradation, and to delays in the elaboration of draft legal acts, discussions and approval procedures. Furthermore, a multi-sector approach can affect management efficiency and land degradation issues can become of secondary importance in respect to other environmental hazards for funding. Threats are also related to impact of potential changes in the global and national economies, stakeholder indifference in project organization, elaboration and implementation, increased urbanization, soil sealing, a high incidence of floods and droughts, the impact of climate change and natural disasters.

3.3 LDN baseline

The establishment of the LDN baseline in Montenegro has faced similar problems as elsewhere in the region. Up to this moment, the national working group has decided to use global data on sub-indicators although there was no possibility to validate the data accurately, and to characterize these as very confident. This decision could be explained by the lack of national data and our willingness to collect national data on sub-indicators in the forthcoming period, and therefore, to readjust the LDN baseline. The following decisions have been made regarding the establishment of the LDN baseline in Montenegro:
1. Land use/cover and land use change data to be used from the ESA dataset with possible option to include CORINE land cover in future analysis.
2. Land productivity dynamics data to be used from the JRC dataset since there are no national data on this sub-indicator. Future efforts at the country level should be made to strengthen capacities related to this sub-indicator.
3. Soil organic carbon stock data to be used from the ISRIC dataset until the end of the official compilation of all existing, good quality, SOC data in the country, and the collection of new data from new SOC campaigns.

Table 4 - Table 6 in the Annex presents the results on sub-indicators from global datasets. In Table 2 are presented some of the measures that should be carried out in order to improve the LDN baseline, with their costs.
4 Setting LDN targets

4.1 LDN voluntary targets

The decisions of the national working group on national and specific voluntary targets and associated measures were taken following the assessment of trends in land degradation derived from global data, potential hotspots visits, determination of land degradation types and indirect and direct drivers of land degradation, and after the elaboration of various official national documents, programs and actions in the environmental field. The result is an agreement that the target at the national scale is **LDN achieved by 2030 as compared to 2015 baseline (no net loss)**. Four specific voluntary targets and 25 associated measures are proposed to achieve these targets. Specific voluntary targets up to 2030 are: (a) to avoid and minimize land degradation and redirect land use changes, (b) to increase land productivity (c) to strive to protect natural ecosystems from wildfires, and (d) to improve soil monitoring system. These specific four targets can be achieved through implementation of programs, measures and actions by different Ministries and scientific institutions. Montenegro’s LDN voluntary targets are presented in Table 1.

<table>
<thead>
<tr>
<th>Target number</th>
<th>Achieving LDN to 2030 compared to 2015 baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Avoiding, minimizing land degradation and redirecting land use changes</td>
</tr>
<tr>
<td>2</td>
<td>Increase of land productivity</td>
</tr>
<tr>
<td>3</td>
<td>Protection of natural ecosystems from wildfires</td>
</tr>
<tr>
<td>4</td>
<td>Improvement of soil monitoring system</td>
</tr>
</tbody>
</table>

In this report we used global data which refer to the period until 2010. We share the opinion that it is necessary to get new data sets which are released in the meanwhile in the context of **UNCCD reporting. This would help the country fine-tune the parameters and then to quantify sub-targets.**

4.2 Associated measures to achieve LDN

Programs, actions and measures (in further text measures) to achieve LDN in Montenegro up to 2030 are presented in Table 2. The same table also presents responsible institutions for conducting specified programs, actions and measures, as well as the amount of money for specific measures, either planned by governmental authorities or decided by the national working group during the LDN TSP in Montenegro. Some of the measures are related to enhancement of the LDN baseline in Montenegro. Measures No 1 and 2 are related to environmental legislation, through the creation and adoption of the Law on Soil Protection and the adoption of the Law on Agricultural Soil, which is an ongoing process. The responsible Ministry for the first Law is the Ministry of Sustainable Development and Tourism, whereas the second law is under the Ministry of Agriculture and Rural Development.

The responsible institution for execution of the Soil Monitoring Program and the Biodiversity Research and Monitoring Program is the Environmental Protection Agency of Montenegro, which is an entity of the Ministry of Sustainable Development.
Those two environmental monitoring programs are going to be conducted following **recommendations of the European Environmental Agency**. The Soil Monitoring Program includes monitoring of dangerous and harmful substances in soils. This is actually a **soil pollution monitoring program**, which tends to investigate the level of pollutants near landfills and dump fills, highways and roads, industrial zones, airports, and settlements, with special attention to city parks and children playgrounds. The following substances are part of this monitoring program: cadmium (Cd), lead (Pb), mercury (Hg), arsenic (As), chrome (Cr), nickel (Ni), fluorine (F), copper (Cu), zinc (Zn), boron (B), cobalt (Co) and molybdenum (Mo). The monitoring program also includes PAH’s, PCB’s, PTC’s, POP’s, TBT, TMT, organotin compounds and pesticides.

These four groups of measures, including Measure No 16 on preservation of autochthonous genetic resources in agriculture, are directly related to Target 1. The responsible institution for this set of measures is the Ministry of Sustainable Development and Tourism.

There are a group of measures related to Target 1 and Target 2, such as:
- No 21 Afforestation, arrangement and protection of forests and seedling production, and
- No 22 Raising economic forests on private land (land use change).

A sum of 4.3 M USD is planned for these measures. Measure No 18, sustainable use of mountain pasture is related to Targets 1, 2 and 3. These three measures are going to be conducted by the Ministry of Agriculture and Rural Development and a sum of 5.9 M USD is planned for these activities.

The measures related to Target 2, Increase of land productivity - reduction of soil degradation – are:
- No 6, Production and use of biochar in sustainable land management and study of its effect on soil,
- No 7, Raising awareness about soil and land degradation and promotion of sustainable land management through educational programs,
- No 17, Support to organic production,
- No 19, Support to manure management, and
- No 24, Raising perennial plantations.

Measures No 6 and 7 are going to be initiated and conducted jointly by the two abovementioned Ministries and the University of Montenegro (Biotechnical Faculty), and an amount of 1.65 M USD is planned. Measures 17, 19 and 24 are going to be carried out by the Ministry of Agriculture and Rural Development, and almost 4.4 M USD is planned for these measures.

The main ideas for defining programs, actions and measures are found in multiple sources. The working group was guided by the defined activities of the Ministry of Agriculture and Rural Development (defined through the agrobudget), the Ministry of Tourism and Sustainable Development, the Environmental Protection Agency, and the Forest Administration. The working group had an important role in defining programs, actions and measures, especially during workshops and terrain visits.
Table 2: Programs, actions and measures to achieve Montenegro LDN voluntary targets up to 2030

<table>
<thead>
<tr>
<th>No</th>
<th>Programs, actions and measures</th>
<th>USD</th>
<th>Target</th>
<th>Responsible Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Creation and adoption of the Law on Soil Protection (Law on Soil as natural resource)</td>
<td>20,000</td>
<td>1</td>
<td>MORT¹</td>
</tr>
<tr>
<td>2</td>
<td>Adoption of the Law on Agricultural Soil (in progress)</td>
<td>10,000</td>
<td>1</td>
<td>MPRR²</td>
</tr>
<tr>
<td>3</td>
<td>Soil monitoring program</td>
<td>350,000</td>
<td>1</td>
<td>MORT</td>
</tr>
<tr>
<td>4</td>
<td>Biodiversity research and monitoring program</td>
<td>700,000</td>
<td>1</td>
<td>MORT</td>
</tr>
<tr>
<td>5</td>
<td>Design of micro-accumulations in order to cope with fires and water scarcity in cattle breeding and perennial plants</td>
<td>1,500,000</td>
<td>2, 3</td>
<td>MPRR</td>
</tr>
<tr>
<td>6</td>
<td>Production and use of biochar in sustainable land management and study of its effect on soil</td>
<td>1,200,000</td>
<td>2</td>
<td>MORT, MPRR, UCG-BTF</td>
</tr>
<tr>
<td>7</td>
<td>Raising awareness about soil and land degradation and promotion of sustainable land management through educational programs</td>
<td>450,000</td>
<td>2</td>
<td>MORT, MPRR, UCG-BTF</td>
</tr>
<tr>
<td>8</td>
<td>Support to the improvement of the livestock fund (small ruminants - sheep and goats)</td>
<td>7,500,000</td>
<td>3</td>
<td>MPRR</td>
</tr>
<tr>
<td>9</td>
<td>Improvement of agro-forestry sector through raising new orchards of hazel, pomegranate or other perennial species in the areas subjected to fires</td>
<td>1,200,000</td>
<td>3</td>
<td>MPRR</td>
</tr>
<tr>
<td>10</td>
<td>Collection of all existing data related to soil organic carbon and other parameters of soil fertility into one integrated database</td>
<td>650,000</td>
<td>4</td>
<td>UCG-BTF</td>
</tr>
<tr>
<td>11</td>
<td>Strengthening national capacities (human and technical resources) in remote sensing</td>
<td>450,000</td>
<td>4</td>
<td>MORT, MPRR, UCG-BTF</td>
</tr>
<tr>
<td>12</td>
<td>Registration of users of arable agricultural soil</td>
<td>300,000</td>
<td>4</td>
<td>MPRR</td>
</tr>
<tr>
<td>13</td>
<td>Support for development of olive growing</td>
<td>1,000,000</td>
<td>2, 3</td>
<td>MPRR</td>
</tr>
<tr>
<td>14</td>
<td>Support for growing medical and aromatic plants</td>
<td>650,000</td>
<td>2, 3</td>
<td>MPRR</td>
</tr>
<tr>
<td>15</td>
<td>Support to investments in water supply (wells, reservoirs)</td>
<td>2,000,000</td>
<td>3</td>
<td>MPRR</td>
</tr>
<tr>
<td>16</td>
<td>Preserving autochthonous genetic resources in agriculture</td>
<td>125,000</td>
<td>1</td>
<td>MPRR</td>
</tr>
<tr>
<td>17</td>
<td>Support to organic production</td>
<td>2,200,000</td>
<td>2</td>
<td>MPRR</td>
</tr>
<tr>
<td>18</td>
<td>Sustainable use of mountain pasture</td>
<td>1,375,000</td>
<td>1, 2, 3</td>
<td>MPRR</td>
</tr>
<tr>
<td>19</td>
<td>Support to manure management</td>
<td>650,000</td>
<td>2</td>
<td>MPRR</td>
</tr>
<tr>
<td>20</td>
<td>Education, investigations, development and analyses</td>
<td>550,000</td>
<td>4</td>
<td>MPRR</td>
</tr>
<tr>
<td>21</td>
<td>Afforestation, arrangement and protection of forests and seedling production</td>
<td>4,100,000</td>
<td>1, 2</td>
<td>MPRR</td>
</tr>
<tr>
<td>22</td>
<td>Raising economic forests on private land (land use change)</td>
<td>200,000</td>
<td>1, 2</td>
<td>MPRR</td>
</tr>
<tr>
<td>23</td>
<td>Determination of Fire Weather index FWI</td>
<td>80,000</td>
<td>3</td>
<td>IHMS⁴, MORT</td>
</tr>
</tbody>
</table>
Four measures are related to Target 3, Protection of natural ecosystems from wildfires. Wildfires have become a serious threat to the environment in Montenegro, both inland and in coastal zones. Wildfires affected State forests in 2017 on almost 14000 ha, of which 55% of the area includes the coastal zone. A total of 115 wildfires were identified in 2017, and assumed damage was around 2 million US dollars. The protection measures against wildfires are:

- No 8, Support to the improvement of the livestock fund (small ruminants - sheep and goats),
- No 9, Improvement of the agro-forestry sector through raising new orchards of hazel, pomegranate or other perennial species in the areas subjected to fires,
- No 15, Support to investments in water supply (well, reservoir) and
- No 23, Determination of fire weather index (FWI).

A total sum of 10.8 M USD is planned for wildfire protection measures, and responsible institutions are the Ministry of Agriculture and Rural Development for first the three measures and the Institute for Hydrometeorology and Seismology and the Ministry of Sustainable Development and Tourism for No 23.

Target 4, Improvement of soil monitoring system, can be achieved by implementing the following measures:

- No 10, Collection of all existing data related to soil organic carbon and other parameters of soil fertility into one integrated database,
- No 11 Strengthening national capacities (human and technical resources) in remote sensing,
- No 12 Registration of users of arable agricultural soil,
- No 20 Education, investigations, development and analysis, and
- No 25, Soil erosion map creation.

The responsible institution for measures No 10 and No 25 is the University of Montenegro, Biotechnical Faculty. For measure 11 the responsible institutions are the two abovementioned Ministries and the University of Montenegro’s Biotechnical Faculty, and for measures No 12 and 20, the Ministry of Agriculture and Rural Development. Almost 2.0 M USD is planned to carry out these activities.

Measures related to Target 2 and Target 3 are:

- No 5, Design of micro-accumulations in order to cope with fires and water scarcity in cattle breeding and perennial plants (species),
- No 13, Support for development of olive growing, and
- No 14, Support for growing of medical and aromatic plants.

The Ministry of Agriculture and Rural Development is the main responsible Ministry for these activities. A total sum of 3.2 M USD is planned to perform these activities.
5 Achieving LDN

5.1 Leverage achieved

Montenegro agreed to become part of the LDN TSP in May 2016. Since that time, many strengths and efforts were put into the target setting process. The Ministry of Sustainable Development and Tourism is a leading institution for this process. LDN is recognized by the NWG members as an opportunity to create multiple benefits, as a vehicle to foster coherence among policies, and a tool to push climate action and expand financing opportunities.

During the working period, Montenegro assessed the conditions of national resources and potential datasets on environmental indicators. Land degradation was observed from a different point of view, and off-site effects of degradation were recognized by the NWG. The NWG was a real platform for discussions related to land and soil resources and their links with biodiversity, and especially the climate change sector. Social aspects of land degradation were recognized through evidence of wildfires, soil sealing and human migration; whereas space to increase knowledge on land degradation problems and awareness was broadened. The easiest way to monitor and calculate the economics of land degradation was through biological degradation, i.e. wildfires. This evident land degradation problem could be used to foster financial support to other land degradation types, whose extent is not so visible, but the long-term impact could be even more severe to the environment and society.

LDN TSP is a platform for the promotion of sustainable land management. Good management practice of Green Room S.r.l, a company in construction works and restoration of barren lands, has demonstrated the LDN concept application in practice prior to its implementation at the country level. This was recognized by the Biotechnical Faculty before the initiation of the LDN TSP at the country level. Green Room S.r.l Company is a construction company working mainly in and around the capital, Podgorica. This Karst area faces severe drought periods, dry spells and lacks land resources. The dominating soil types in this area are Lithosols and Kalkomelanosols, according to the national soil classification, which could roughly correspond to Nudilithic and Lithic Leptosols, or sometimes Leptic Phaeozems, according to WRB. The terrain is characterized with the presence of rock outcrops (hard limestones) and mostly shallow soil cover. Moreover, soil depth is not homogenous, and it has non-uniform depth. From one side, the exposures of bedrock limit the use of modern mechanized agricultural equipment, whereas on the other side, where fine soil material covers the ground, effective soil depth for root penetration is unknown. Therefore, the early experience of Green Room and its current activities has resulted in measures to combat land degradation by increasing effective soil depth in the Karst area. Green Room is using its facilities, trucks and other construction and agricultural equipment, to transport often neglected earthy material from construction works to locations where this material is lacking. Moreover, the activities did not stop at a simple increment of soil depth. A new pomegranate nursery was created in the village of Kokoti, with an idea to enhance and enlarge the production. This is the example of conducted reclamation measures resting on planning principles endorsed by the LDN TSP.
This measure has huge long-term environmental, social and economic benefits. These kinds of measures should become more familiar to the broader community and decision makers and mainstreamed into national policies. LDN TSP has created an environment for information exchange between different ministries, governmental bodies, institutions, CSO and academics. In the country, a very important link for LDN TSP is the one between the Ministry of Sustainable Development and Tourism, as a leading institution for this process, and the Ministry of Agriculture and Rural Development, which occupies main land use sectors. These links should be looked at, not only from a legal and policy coherence point of view, but also from the point of view of developing a mechanism to financially support degraded areas. Land degradation neutrality concept opens new financial opportunities and possibilities to work with partners, such as United Nations Environment Programme (UNEP).

The National Action Plan (NAP) to combat desertification is already created and therefore an Annex to the NAP should be developed in order to include LDN into the NAP. The NAP is well structured and four of its strategic goals match with LDN. The National Working Group should further discuss LDN insertion into NAP. This way, the LDN concept can be embedded into national development policy. Strong cross sectorial collaboration and high-level political commitment are the keys for success of LDN target setting and implementation in Montenegro.

5.2 LDN transformative projects and programs opportunities identified

The National working group has specified 25 programs, actions and measures to achieve LDN in Montenegro up to 2030. Among them, three are recognized as potential LDN transformative projects and programs. Those measures are:

- No 5, Design of micro-accumulations in order to cope with wildfires and water scarcity in cattle breeding and perennial plants. This measure is related to Target 2 - Increase of land productivity - reduction of soil degradation, and Target 3 - Protection of natural ecosystems from wildfires. The responsible institution is the Ministry of Agriculture and Rural Development.
- No 6, Production and use of biochar in sustainable land management and study of its effect on soil. This measure is related to Target 2 - Increase of land productivity - reduction of soil degradation. The responsible institutions are the Ministry of Agriculture and Rural Development, the Ministry of Sustainable Development and Tourism and the Biotechnical Faculty.
- No 9, Improvement of the agro-forestry sector through raising new orchards of hazel, pomegranate or other perennial species in the areas subjected to fires. This measure is related to Target 3 - Protection of natural ecosystems from wildfires. The responsible institution is the Ministry of Agriculture and Rural Development.

Specified amount of 3.9 million USD for these measures include:
- support for experimental works in restoration activities,
- cattle breeding and perennial plants growth, and
- experimental work on the establishment of new orchards on areas previously degraded by wildfires.
Therefore, a set of pilot projects concerning land degradation in Montenegro could be initiated during this process. Such projects should allow gaining knowledge on the problems of land restoration after wildfires. The three abovementioned measures are overlapping and synergetic and the outcomes of pilot projects could further result in international projects or programmes of broader significance. Montenegro also plans to support Measure No 8, Support to improve the livestock fund, breeding of sheep and goats, but to a lesser extent for experimental work. This transformative LDN project/programme could really put into practice the LDN conceptual framework, contribute to Target 2 and Target 3, Increase of land productivity, and Protection of natural ecosystems from wildfires, and consider land degradation hotspots and baseline. This Project/Programme could contribute to SDGs, be synergetic with three Rio Conventions and contribute to climate-resilient development. Pilot projects can cover smaller areas and be organized by national institutions. Their results could be scaled up, using scientifically based and proven good practices, and create social impacts to small farmers, rural communities and indigenous people. This project/programme could strengthen national capacities in the fruit growing sector, protection against wildfires, as well as in academic institutions. Nevertheless, this type of project/programme could easily include private sector investments in land restoration and tap into climate finance, or blended financing.
6 Conclusions

**Overall achievements and lessons learned of the LDN target setting process**

LDN is recognized as a concept that could create environmental, social and economic benefits. LDN TSP is a planning principle for achieving balance between anticipated and on-going land degradation, and future efforts to improve degraded land. Integrated landscape i.e., land and water management, sustainable land management and restoration and reclamation of degraded land are the key activities leading to LDN achievement. These activities require the involvement of various stakeholders. The Ministry of Sustainable Development, as a leading institution, organized the National Working Group, which covers all groups of stakeholders; i.e. Ministries, governmental agencies, universities, land users, civil society organizations, development partners and regional extension services. The National working group took several decisions related to LDN TSP. The LDN target setting process helped to mobilize various stakeholders. Experience has been gained and the country is currently in the process of building up LDN TSP at a decision-making level.

After review of global default data and nationally available data sets, the national working group decided to use global datasets on sub-indicators received from UNCCD as the LDN baseline in Montenegro. There was no possibility to validate the data well, and to characterize them as very confident. The decision to use global datasets is related to the lack of national data. There is willingness to collect national data on sub-indicators in the forthcoming period. Therefore, the idea is to improve the LDN baseline in forthcoming period. Future efforts at the country level should be made to strengthen capacities related to this sub-indicator.

The decisions on national and specific voluntary targets and associated measures were made following the analysis of types, trends and drivers of land degradation, visits to potential hotspots, and after reviewing various official national documents, programs and actions in the area of the environment. The national voluntary target is to achieve LDN as compared to baseline up to 2030 with four specific voluntary targets and twenty-five associated measures. Specific voluntary targets are: (a) to avoid and minimize land degradation and redirect land use changes, (b) to increase land productivity, (c) to strive to protect natural ecosystems from wildfires, and (d) to improve soil monitoring system.

The amount of investments for specified measures is either planned by governmental authorities, or by the national working group during the LDN TSP. Measures are related to enhancement of the LDN baseline in Montenegro, the legal framework and environmental legislation, and to sustainable land management in agriculture and forestry, or to preventing, minimizing land degradation and restoring degraded land. Responsible institutions for the measures are the Ministry of Sustainable Development and Tourism, the Ministry of Agriculture and Rural Development, the Biotechnical Faculty - University of Montenegro and the Institute for Hydrometeorology and Seismology. Targets and measures overlap among themselves since land degradation has its own spatial, temporal, and socio-economic context.
Three defined measures are recognized as drivers of potential transformative projects/programs such as:

- No 5 - Design of micro-accumulations in order to cope with wildfires and water scarcity in cattle breeding and perennial plants;
- No 6 - Production and use of biochar in sustainable land management and study of its effect on soil; and
- No 9 - Improvement of the agro-forestry sector through raising new orchards of hazel, pomegranate or other perennial species in the areas subjected to fires.

The success of LDN TSP dependents largely on mainstreaming LDN into land use planning. The NAP to combat desertification was developed recently. UNCCD MNAP is the basic national planning document toward UNCCD implementation. LDN should be embedded into MNAP by adding an Annex to the document and then proposing actions to improve policy, legislative, institutional and coordination frameworks, which could underpin LDN achievement. It can be a trigger to increase investments in land degradation or to establish land degradation neutrality related partnerships.

LDN target setting is not a stand-alone process but should be embedded in national development policy processes. Strong and active involvement of all stakeholders impacting the land-based natural capital is required to achieve LDN.
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The report was prepared by Prof. Dr. M. Knezevic, LDN country consultant, with the participation of Ms. Biljana Kilibarda, UNCCD Focal point in Montenegro and working group members.
8 ANNEX

8.1 List of LDN working group members

Members of national land degradation neutrality working group

1. Ministry of Sustainable Development and Tourism: Ivana Vojinović, Biljana Kilibarda, Srđan Mugoša, Marija Mijušković, Ivana Stojanović
3. Biotechnical Faculty: Mirko Knežević, Ana Topalović, Daliborka Lekić
4. Real estate administration: Marina Kilibarda
5. Environmental Protection Agency: Vesna Novaković
6. NGO “ProES”: Katarina Pavičević
7. JP National Parks of Montenegro: Mojaš Đurović
8. Institute for Hydrometeorology and Seismology: Sanja Pavićević, Miraš Drljević
9. Green Room d.o.o.: Petar Đurišić
11. Municipality of Nikšić - Service of Agricultural Development: Zdravko Ašanin
12. Statistical Office of Montenegro: Dragan Peković, Nataša Vojinović
13. Monteorganica: Jovan Nikolić

8.2 Dates of working group meetings and workshops

National working group had two meetings during 2017 and one meeting in 2018:

1. The inception workshop was organized at 25–26 April 2017
2. Validation workshop was organized at 26–28 July 2017.
3. The last workshop was organized at 8–9 February 2018.
Figure 5: National map of selected hotspots
Figure 6: The first national working group meeting in Podgorica

Figure 7: Discussion during the first national working group meeting in Podgorica
Figure 8: Field visit during the first national working group meeting - Kokoti

Figure 9: The second national working group meeting in Kolašin
Figure 10: Discussion during the second national working group meeting in Kolašin

Figure 11: Field visit during the second national working group meeting - hotspot Sinjajevina
Figure 12: The third national working group meeting in Petrovac

Figure 13: Discussion during the third national working group meeting in Petrovac
### 8.3 LDN baseline tables

Table 3 IPCC (Level 1) and FAO LCML (Level 2) land use categories used in LDN TSP

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest Land</strong></td>
<td><strong>Forest tree cover</strong></td>
</tr>
<tr>
<td>Grassland</td>
<td>Pasture and natural grassland</td>
</tr>
<tr>
<td></td>
<td>Shrubland, bushland, heathland</td>
</tr>
<tr>
<td></td>
<td>Sparsely vegetated areas</td>
</tr>
<tr>
<td></td>
<td>Natural vegetation associations and mosaics</td>
</tr>
<tr>
<td><strong>Cropland</strong></td>
<td>Medium to large fields of rain-fed herbaceous cropland</td>
</tr>
<tr>
<td></td>
<td>Medium to large fields of irrigated herbaceous cropland</td>
</tr>
<tr>
<td></td>
<td>Permanent crops, agriculture plantations</td>
</tr>
<tr>
<td></td>
<td>Agriculture associations and mosaics</td>
</tr>
<tr>
<td><strong>Wetlands</strong></td>
<td>Open wetlands</td>
</tr>
<tr>
<td><strong>Settlements</strong></td>
<td>Urban and associated developed areas</td>
</tr>
<tr>
<td><strong>Other Land</strong></td>
<td>Barren land</td>
</tr>
<tr>
<td></td>
<td>Permanent snow and glaciers</td>
</tr>
<tr>
<td>Water bodies (inland water bodies, coastal water bodies, sea)</td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Summary table of sub-indicators framework obtained via global datasets for Montenegro (LDN baseline)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>km$^2$</td>
<td>km$^2$</td>
<td>km$^2$</td>
<td>Declining</td>
<td>Early signs of decline</td>
</tr>
<tr>
<td>Forest</td>
<td>6900.6</td>
<td>6876.0</td>
<td>-24.6</td>
<td>3.6</td>
<td>20.9</td>
</tr>
<tr>
<td>Shrubs, grasslands and sparsely vegetated areas</td>
<td>1589.3</td>
<td>1596.9</td>
<td>7.6</td>
<td>38.9</td>
<td>15.2</td>
</tr>
<tr>
<td>Croplands</td>
<td>4515.3</td>
<td>4532.3</td>
<td>17.0</td>
<td>45.0</td>
<td>60.9</td>
</tr>
<tr>
<td>Wetlands and water bodies</td>
<td>427.8</td>
<td>427.8</td>
<td>0.0</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Artificial areas</td>
<td>220.5</td>
<td>220.5</td>
<td>0.0</td>
<td>12.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Bare land and other areas</td>
<td>14.0</td>
<td>14.0</td>
<td>0.0</td>
<td>1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>SOC average (t/ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of total land area</td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Total (km$^2$)</td>
<td>13667.5</td>
<td>13667.5</td>
<td>102.2</td>
<td>101.7</td>
<td>539.4</td>
</tr>
</tbody>
</table>

(**) Values for NetLPD and SOC are only for areas where Land Use/Cover is unchanged from 2000-2010

(*** 'No Data' includes snow, ice, desert areas, water bodies and missing pixels)
Table 5: Trends in net land productivity dynamics in the areas facing land cover conversions

<table>
<thead>
<tr>
<th>Changing Land Use/Cover Category</th>
<th>Net land productivity dynamics trend 2000-2010 (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Declining</td>
</tr>
<tr>
<td>Forests to Cropland</td>
<td>0.27</td>
</tr>
<tr>
<td>Forests to Shrubs, grasslands and sparsely vegetated areas</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Table 6: Change in SOC stocks according to conversions between land use categories for the period 2000/2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>km²</td>
<td>2000 ton/ha</td>
</tr>
<tr>
<td>Forest to Cropland</td>
<td>17.01</td>
<td>141.5</td>
</tr>
<tr>
<td>Forest to Shrubs, grasslands and sparsely vegetated areas</td>
<td>7.56</td>
<td>136.8</td>
</tr>
<tr>
<td>Total</td>
<td>24.57</td>
<td>344025</td>
</tr>
<tr>
<td>Percent loss total SOC stock (country)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(****) Change in SOC due to changing Land Use/Cover derived from IPCC Good Practice Guidance for LULUCF (2006)
Figure 14: Trends in net land productivity dynamics according to the land use/land cover category from 2000 to 2010
Table 7: Watersheds in Montenegro obtained from the GAUL network; watershed area (km$^2$), area of watershed in respect to the country area (%), degrading area in watershed (km$^2$), total degraded area at the country level (%), total degraded area in watershed (%) and cumulative sum of national area (%)

<table>
<thead>
<tr>
<th>No</th>
<th>Watersheds</th>
<th>Watershed area (km$^2$)</th>
<th>Country area (%)</th>
<th>Degrading area: LPD + SOC (sq. km)*</th>
<th>Total degraded area of the country (%)</th>
<th>Total degraded area in watershed (%)</th>
<th>Cumulative sum national area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moraca</td>
<td>2584.35</td>
<td>19.4</td>
<td>310.41</td>
<td>41.0</td>
<td>12.0</td>
<td>19.4</td>
</tr>
<tr>
<td>2</td>
<td>Neretva-Trebisnjica</td>
<td>3891.96</td>
<td>29.1</td>
<td>266.13</td>
<td>35.1</td>
<td>6.8</td>
<td>48.5</td>
</tr>
<tr>
<td>3</td>
<td>Drina</td>
<td>6240.15</td>
<td>46.7</td>
<td>153.36</td>
<td>20.2</td>
<td>2.5</td>
<td>95.2</td>
</tr>
<tr>
<td>4</td>
<td>Bojana</td>
<td>175.86</td>
<td>1.3</td>
<td>21.06</td>
<td>2.8</td>
<td>12.0</td>
<td>96.6</td>
</tr>
<tr>
<td>5</td>
<td>Sitnica-Drenica-Lab</td>
<td>422.37</td>
<td>3.2</td>
<td>4.95</td>
<td>0.7</td>
<td>1.2</td>
<td>99.7</td>
</tr>
<tr>
<td>6</td>
<td>Beli Drim</td>
<td>34.38</td>
<td>0.3</td>
<td>1.44</td>
<td>0.2</td>
<td>4.2</td>
<td>100.0</td>
</tr>
<tr>
<td>7</td>
<td>Drim</td>
<td>3.60</td>
<td>0.0</td>
<td>0.00</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>13352.67</td>
<td>100</td>
<td>757.35</td>
<td>100</td>
<td>5.67*</td>
<td></td>
</tr>
</tbody>
</table>

* Portion of the total country area affected with land degradation
8.4 Reports on National Map of Selected LDN Hotspots

In period from August 17th to August 30th 2017, the members of the working group from the Ministry of Sustainable Development and Tourism and the Biotechnical Faculty visited potential hotspots, photographed terrain, surveyed the local population, analyzed the situation and produced detailed reports and recommendations in order to achieve land degradation neutrality. In five routes with 2360 km in total length, 15 hotspots were visited. The first route covered hotspots: Podgorica, Danilovgrad and Zijovo-Kuci; second: Ulcinj, Grbalj - Pastrovici and Lovcen; third: Orjen, Bijela Gora, Vilusi and Golija; fourth: Prekornica-Maganik and Lola and fifth: Treskavac and Pljevlja.

The degraded areas, also called potential hotspots, were identified on a basis of more aggregated pixels with LPD classes 1 to 3 and pixels with negative land conversions. The analysis allowed locating 15 potential hotspots in the country (Table 8 in Annex). Table 8 also presents the name of the site, overall degraded surface, dominant land use in the area and the main cause of land degradation. It is better to group hotspots in Montenegro by means of land degradation cause. Therefore, there are 10 potential hotspots where the reduction in land productivity was caused by fires. These hotspots are named Lovcen, Vilusi, Bijela gora, Orjen, Golija, Lola, Prekornica-Maganik, Sinjajevina, Zijovo-Kuci, and Treskavac-Durmitor (Figure 15 - Figure 20).
In these hotspots, fires were the main cause of land degradation and this type of degradation belongs to biological land degradation. Drivers of degradation were not yet fully identified.
It could be linked to natural causes, like shortage of rainfall in the summer period, or to inactivity in cattle breeding during summer period, due to decrease in livestock. The NWG could not confirm that degradation on all these areas (>22150 ha)
appeared only due to the fires, but fires were recognized as one of the causes/drivers.

The other group of hotspots has multiple drivers of land degradation, such as Ulcinj area (Figure 19) and Podgorica area (Figure 20) and where combined effects of fires, agricultural abandonment and urbanization took place. More than 15800 ha are potentially degraded in these two hotspots. The Podgorica hotspot was found to be potentially the largest one in the country with more than 11700 ha of degraded areas. In the Danilovgrad hotspot (Figure 20), urbanization and agricultural abandonment were found to be the most important cause of land degradation, while in the Pastrovici-Grbalj hotspot (Figure 18) land degradation appeared from the combined effect of urbanization and fires. In the Pljevlja hotspot, mining activity caused degradation, followed by agricultural abandonment.

The farmers do not identify any change in land quality, but they recognize fire as a visible deterioration of habitat and drought, which are not so unknown in Karstic areas of Montenegro. The visible effect of fires may hide other drivers of land degradation, which potentially could also contribute to overall degradation, like improper soil management, absence of sustainable management practices like
waste burning, soil compaction, use of fertilizers without application of manure, and bad irrigation management. Nevertheless, in some cases the LPD methodology was found to be incorrect, i.e. presence of greenhouses, or the decrease in LPD in urban zones caused by higher extent of construction. Therefore, the NWG needs to better explore the LPD methodology, become familiar with it, carry out analysis and elaborate results in the future with a resolution of 250-300 m. A list of potential hotspots is presented in Table 8, whereas the map of national hotspots is given on Figure 5. Photos from hotspots with visible degradation problems are also given below. In Table 8 sub-basins for each hotspot are also given (FAO Hydrobasin and official country watershed boundaries).
Figure 19: Ulcinj area hotspot
Figure 20: Podgorica area, Danilovgrad area and Zjovo-Kuci hotspots
<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>LPD 1-3 area (ha)</th>
<th>Dominant land use</th>
<th>FAO Hydro-basin</th>
<th>Official country watershed boundaries</th>
<th>Type / driver / factor of degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Podgorica area</td>
<td>&gt;11700</td>
<td>Urban zone, horticulture, field crops</td>
<td>Moraca</td>
<td>Adriatic</td>
<td>Urbanization, abandonment of agric., fires</td>
</tr>
<tr>
<td>2</td>
<td>Danilovgrad area</td>
<td>&gt;4600</td>
<td>Urban zone, horticulture, field crops</td>
<td>Moraca</td>
<td>Adriatic</td>
<td>Urbanization, abandonment of agric.</td>
</tr>
<tr>
<td>3</td>
<td>Zijovo-Kuci</td>
<td>&gt;2350</td>
<td>Forest, pastures</td>
<td>Moraca</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>4</td>
<td>Ulcinj area</td>
<td>&gt;4100</td>
<td>Horticulture, sparsely vegetated areas, extensive pastures</td>
<td>Bojana, Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires, abandonment of agriculture, urbanization</td>
</tr>
<tr>
<td>5</td>
<td>Grbalj-Pastrovici</td>
<td>&gt;2800</td>
<td>Residential area, forests, sparse vegetation</td>
<td>Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires, urbanization</td>
</tr>
<tr>
<td>6</td>
<td>Lovcen</td>
<td>&gt;2000</td>
<td>National park, forest, extensive pastures</td>
<td>Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>7</td>
<td>Vilusi</td>
<td>&gt;2500</td>
<td>Forests, extensive pastures, sparse vegetation</td>
<td>Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>8</td>
<td>Bijela gora</td>
<td>&gt;1900</td>
<td>Forests, extensive pastures, sparse vegetation</td>
<td>Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>9</td>
<td>Golija</td>
<td>&gt;2200</td>
<td>Forests, extensive pastures, bare land</td>
<td>Neretva-Trebisnj., Drina</td>
<td>Adriatic, Black Sea</td>
<td>Fires</td>
</tr>
<tr>
<td>10</td>
<td>Orjen</td>
<td>&gt;1100</td>
<td>Bare land, extensive pastures, forest</td>
<td>Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>11</td>
<td>Lola</td>
<td>&gt;1600</td>
<td>Mount. pastures, forest, bare land, sparse vegetation</td>
<td>Drina, Moraca, Neretva-Trebisnj.</td>
<td>Black Sea, Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>12</td>
<td>Prekornica-Magagnik</td>
<td>&gt;2600</td>
<td>Mount. pastures, forest, bare land, sparse vegetation</td>
<td>Moraca, Neretva-Trebisnj.</td>
<td>Adriatic</td>
<td>Fires</td>
</tr>
<tr>
<td>13</td>
<td>Sinjajevina</td>
<td>&gt;3100</td>
<td>Mountainous pastures, bare land</td>
<td>Drina</td>
<td>Black Sea</td>
<td>Fires</td>
</tr>
<tr>
<td>14</td>
<td>Treskavac-Durmitor</td>
<td>&gt;2800</td>
<td>Mount. pastures, sparsely vegetated areas, bare land</td>
<td>Drina</td>
<td>Black Sea</td>
<td>Fires</td>
</tr>
<tr>
<td>15</td>
<td>Pljevija</td>
<td>&gt;750</td>
<td>Mining, agriculture</td>
<td>Drina</td>
<td>Black Sea</td>
<td>Mining activities, abandonment of agriculture</td>
</tr>
</tbody>
</table>