Republic of Serbia
Ministry of Environmental Protection

Land Degradation Neutrality Target Setting Programme

REPORT ON THE APPLIED METHODOLOGY AND IDENTIFICATION OF TARGETS TO ACHIEVE LAND DEGRADATION NEUTRALITY IN THE REPUBLIC OF SERBIA

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LIST OF ABBREVIATIONS

UNCCD – United Nations Convention to Combat Desertification

LDN – Land Degradation Neutrality

SDG – Sustainable Development Goal

FAO – Food and Agriculture Organization

COP – Conference of Parties

GM – Global Mechanism

ESA – European Space Agency

EEA – European Environment Agency

CLC – CORINE Land Cover

CORINE– Coordination on Information on the Environment

LDNW – Land-degradation neutral world

SWQI – Serbian Water Quality Index

JRC – Joint Research Centre

SPOT – Satellite Pour l'Observation de la Terre

NDVI – Normalized Difference Vegetation Index

ISRIC – International Soil Reference and Information Centre

SoilGrids — Global gridded soil information

LCCS – Land Cover Classification Systems

GCS_WGS_1984 – World Geodetic System

NPP – net primary productivity

LPD – Land Productivity Dynamics

SOC – Soil Organic Carbon

IPCC – Intergovernmental Panel on Climate Change

GeoTIFF – Georeferenced Tagged Image File Format

SDG15.3.1 – Sustainable Development Goals indicator 15.3.1

GIS – Geographic Information System

SUMMARY

Land is a principal natural resource and a medium for the survival and development of living beings on the planet. Given that land formation processes can take from several tens to several thousand years, protection and responsible management should constitute priority activities. Rational management over land resources, in addition to the increase in quantity and quality of food and establishment of the Sustainable Development Goals (SDGs), may contribute with numerous activities focusing on mitigation and adaptation to the climate change effects, as well as on conservation and enhancement of biodiversity.

With the aim of resolving the land degradation problem and establishing sustainable mechanisms to manage land resources, t*he United Nations Convention to Combat Desertification - UNCCD* promotes the view that it is necessary to apply the modern concept of land degradation neutrality (LDN) to fight desertification and land degradation as a part of SDG Target 15.3.

Since the Republic of Serbia does not have publicly available collection of national data, containing spatial and temporal attributes indispensable to determine LDN parameters, global data provided by the UNCCD was used to determine baseline for the trend of land use change. The global data used is of a temporary nature, pending the formation of a representative national database relevant to degradation analytics according to the LDN concept. A representative national database should be established based on detailed monitoring, in accordance with a consistent methodology adopted by competent national research institutions.

The time span for baseline analysis (according to the determined methodology) covers the period from 2000 to 2015. From the point of view of land use and land cover, being the first indicator in the assessment of land degradation, according to the global data a total of 899.99km2, i.e., 1.03% of the total land area, is degraded. The category "stable" covers 96.44%, whereas the category of "improved" condition accounts for 2.53% of the total territory of the Republic of Serbia. Compared to the indicator of land productivity dynamics, 5.42% of the territory of the Republic of Serbia is degraded, whereas the "improved" condition accounts for 73.42%. The increased content of soil organic carbon is found in 229km^2, i.e., 0.26% of the national territory, whereas the "stable" condition is observed in 98.94%. Areas identified as degraded, i.e., where the soil organic carbon content has decreased, cover 602km^2, i.e., 0.69% of the national territory.

Applying these three indicators, hot spots have been identified (areas of degraded conditions), at the level of administrative districts of the Republic of Serbia, for each indicator respectively. A general overview of the changes according to degradation categorizes a total of 72.86% of the territory of the Republic of Serbia into the "improved" soil condition, the total area of degraded land is 6.47% of the total territory of the RS and share of stable soil condition amounts to 20.54%.

Processing the global databases, provided by the UNCCD secretariat, results facilitating defining LDN targets to attain land neutrality degradation in the Republic of Serbia by 2030 have been obtained. Nationwide LDN target of reaching land degradation neutrality in the territory of the Republic of Serbia by 2030 is articulated through the number of associated technical measures and priorities on enabling environment.

1. LAND DEGRADATION AND LDN CONCEPT

Land degradation represents the loss of real or potential productivity, i.e., of the value of the land area. Degradation may be conditioned by numerous natural and anthropogenically-induced processes, such as climate change (long periods without precipitation, extreme temperatures, intensive rainy and windy periods), uncontrolled urbanisation, deforestation, wind and water-induced erosion, floods, mass movements of slopes, inadequate treatment of arable land (wrong selection of crops, invasive cultivation techniques), excessive spraying, dry and moist deposition of pollutants from the air, disposal of municipal and industrial waste, groundwater level fluctuations, salinization, etc. One of the main factors of land degradation in the territory of the Republic of Serbia, which causes a series of negative physical and physical-chemical changes, is the phenomenon and development of different forms of land erosion processes.

At present, one of the major ecological and civilisation challenges is desert expansions or desertification coupled with land degradation. Desertification represents a problem present not only in those parts of the planet located in the closer or wider zone of the equatorial belt, but also in those territories farther from this belt, in the northern and southern hemispheres. According to research, desertification may put in danger and force the migration of nearly 50 million people over the next 10 years. The increasing anthropogenic pressure has significantly accelerated the process of desertification and land degradation on primary natural resources (land, forests, and waters).

The UN's Food and Agriculture Organization (FAO) assesses that land degradation already affects over 20% of the world's population and impacts 30% of all land in the world: 33% of pastures, 25% of arable land and 27% of forests have been degraded. Globally, approximately 10 to 12 million hectares of fertile land are lost annually due to poor management. The level of land degradation in the EU is also significant, whereby approximately 22% of the land has been affected by pluvial and aeolian erosion, whereas approximately 45% of the fertile land has low level or very low level of soil organic carbon.

One of the essential natural resources and mediums for existence and prosperity of humankind is land being invaluable inclusive capital for all generations, nations, groups and individuals. Depending on local conditions, the process of land creation may last from several tens to several thousand years. In addition, soil is highly sensitive to degradation processes, and thereby the priority activity is its protection and responsible management of it.

The pressure over land resources has been linearly increasing with the increase of the world's population, which results in the degradation of soil physical and chemical characteristics, and thereby its productivity. Globally, agricultural land mostly disappears due to intensive

urbanisation and desertification. There is a risk that the increased demands for land and its spatial control (management) will increase social and political instability, compromise the food security of the population in quantitative and qualitative terms, and lead to poverty, conflict and migration. Efficient solution to the land degradation problem is of critical importance for the survival and progress of civilisation. Rational management over the land resource, along with efficient desertification and degradation control, may, in addition to increasing food quantity and quality and establishing a sustainable lifestyle, bring simultaneous benefits to mitigate and adapt to climate change, as well as conserve biodiversity.

With the aim of resolving the land degradation problem and establishing sustainable mechanisms to manage land resources, the United Nations Convention to Combat Desertification (UNCCD) promotes the view, (LDN) to fight desertification. The concept of LDN has been introduced in the global dialogue to create a more efficient approach within the framework of activities directed to combat land degradation. LDN has been accepted as part of SDG 15, and capacity building to achieve LDN is a primary goal of the UNCCD.

In the course of the 12th UNCCD Conference of the Parties, COP 12, which was held in Ankara in Turkey, land degradation neutrality was 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." In the course of this conference, UNCCD adopted SDG Target 15.3 and the concept of LDN, as one of the key activities of the Conference. This concept has the aim of restoring the productivity of significant areas of degraded land and soil, improving living conditions for more than 1.3 billion people and mitigating the adverse effects on sensitive social groups.

Target 15.3 is dedicated 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." In accordance with the aforementioned, all country Parties are invited to formulate targets to achieve LDN on a voluntary basis and to incorporate them into their UNCCD action programmes. In line with the mentioned decisions, the Global Mechanism (GM) established the LDN Target Setting Programme. The essence of this Programme is to enable countries to set their LDN targets and identify necessary steps and measures to achieve land degradation neutrality by 2030.

In the course of the last assembly of country Parties to the UNCCD (COP 13), the Strategic Framework to the Convention was adopted for the period 2018 to 2030, along with the appropriate decisions and activities. One of these goals is to achieve the status of land degradation neutrality by 2030 and improve reporting systems on progress made, through sub-indicator 15.3.1 ("Percentage of degraded land and soil of the total area of land resources").

The concept of land degradation neutrality constitutes the core of the new strategic framework and supports the achievement of SDG Target 15.3. The Convention also emphasizes the importance of mitigating the effects of drought, including long-term strategies dedicated to rehabilitation, conservation and sustainable land and water resources management, which should result in improved living conditions, in particular at the level of local communities. Three key activities have been identified as indispensable parts of the fight against drought: design of a drought early warning system, prevention and adaptation through the reduction of exposure and vulnerability, hence increased resilience to drought risks, through the preparation and implementation of adequate activities (ICCD/COP13/19).

This document has been elaborated by an expert team from the National Centre for Climate Change and Desertification of the University of Belgrade, Faculty of Forestry (national expert professor, PhD Ratko Ristić, Assistant Professor, PhD Boris Radić and MSC in Engineering Siniša Polovina), with an active participation of the Special Working Group for the Implementation of Activities pertaining to the "Land Degradation Neutrality" of the United Nation Convention to Combat Desertification, with the support of the Global Environment Facility (GEF), United Nations Environment Programme (UNEP) and the Food and Agriculture Organization of the United Nations (FAO).

1.1. General Data on the Republic of Serbia

The Republic of Serbia is a continental country located in South-Eastern Europe, in the central part of the Balkan Peninsula, between 41°53′ and 46°11′ north latitude, and 18°9′ and 23°01′ east longitude. In the north, the Republic of Serbia borders with Hungary, in the southeast with Romania, in the east with Bulgaria, and in the south with the Republic of North Macedonia, in the southwest with Albania and Montenegro, and in the west with Croatia and Bosnia and Herzegovina (entity of Republika Srpska) (Image 1). Due to one part of its territory belonging to the Pannonia Plane (north of the Republic), Serbia is also part of the region of Central Europe. The territory of Serbia is dominated by a temperate continental climate, with more or less pronounced local characteristics. The spatial distribution of climatic parameters is conditioned by different combined effects of relief, large-scale air pressure distribution, terrain exposure, presence of river systems, vegetation, degree of urbanization, etc. Most of the territory of the Republic of Serbia has a continental precipitation regime, with larger amounts in the warmer half of the year (April-September), except for the south-western regions where the highest rainfall occurs in the colder part of the year (October-March). Ground air currents are largely conditioned by orography. In the warmer part of the year, north-west and west winds are predominant. In the course of the colder part of the year, east and south-east winds are predominant.

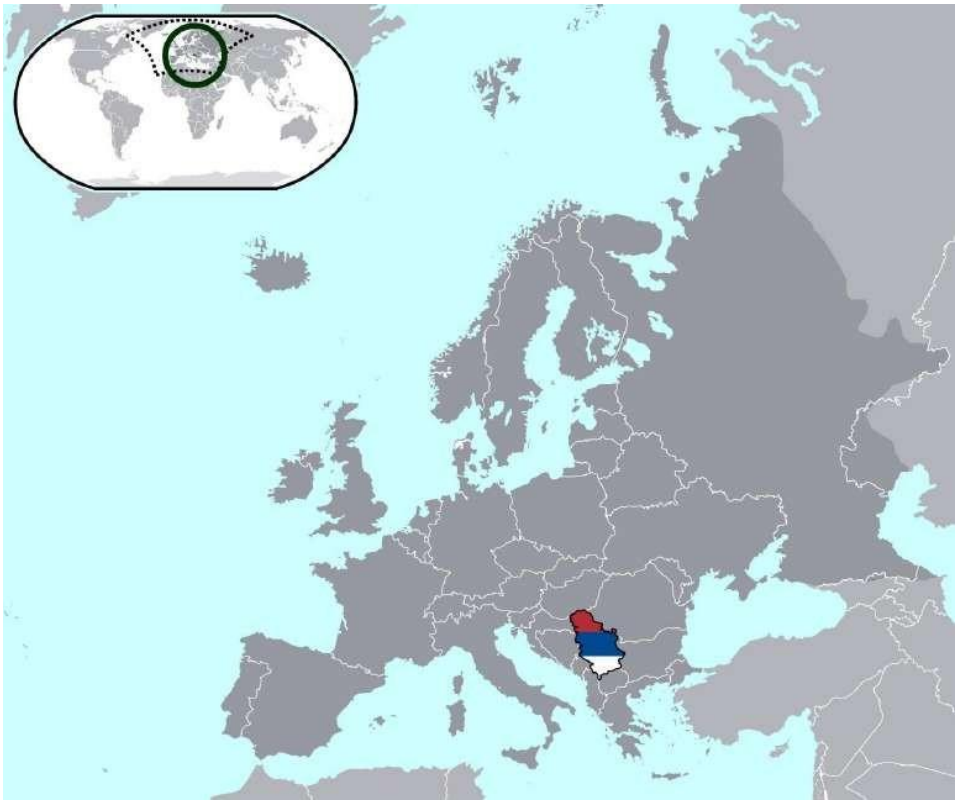

Image 1. Geographical position of the Republic of Serbia

The total area of the Republic of Serbia[1] amounts to 88,499km^2 and more than nine million inhabitants live in this territory (2011 census). The administrative and economic centre of the state is its capital Belgrade, with 1,659,444 inhabitants, including the wider surrounding (2011 census). The official language is Serbian, and the official currency is the Serbian Dinar. The territory of the Republic of Serbia is divided into 29 administrative districts, the territory of the City of Belgrade and 193 municipalities.

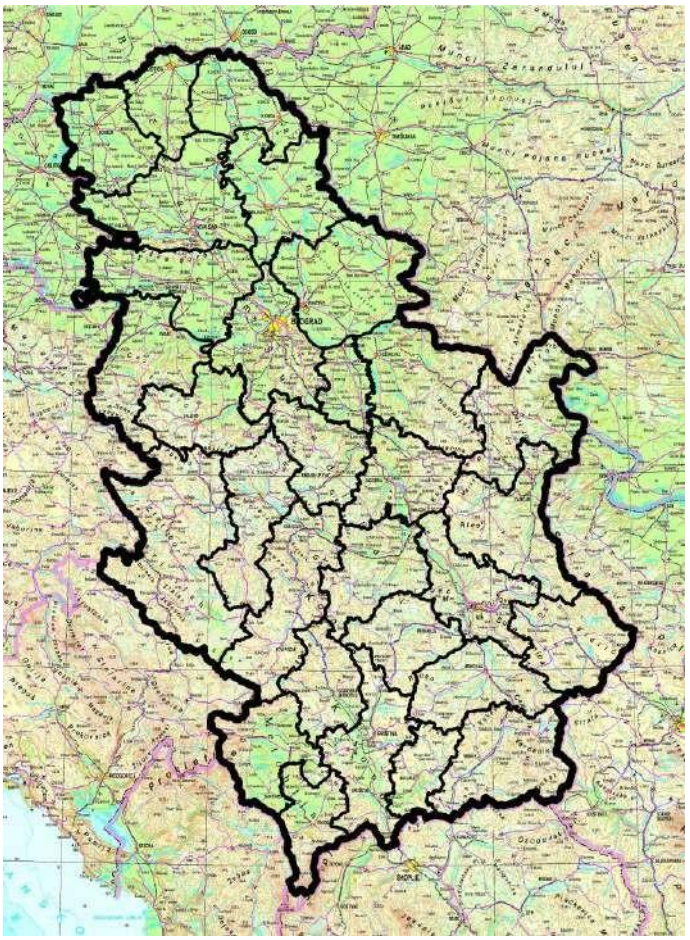

Image 2. Geographic map of the Republic of Serbia with regional division

1.1.1. Landscape of the Republic of Serbia

In the territory of the Republic of Serbia, different types of reliefs alternate from north to south. In the north, there are vast plains that continue to hilly terrain intersected by shallow river valleys, to the high mountains to the south and east. The highest peak of Serbia is Đeravica on the Prokletije Mountain, with an altitude of 2,656 m, while the lowest point is the

[1] The total area data is taken from the Statistical Yearbook of the Republic of Serbia of 2018. For the calculation of land degradation, the area of the Republic of Serbia is reported as 88,488.44 km^2 (0.01% difference) due to (1) the spatial resolution of the used global databases and (2) the conversion of geographic projection from local to global.

mouth of the Timok River into the Danube, at 28 m.

1.1.2. Pedological characteristics of the Republic of Serbia

From the aspect of pedological cover, three large groups of land can be distinguished in the territory of the Republic of Serbia, namely:

1. automorphic soils, which receive moisture exclusively from precipitation and the waters freely flow through the soil;
2. hydromorphic soils, which are under the temporary or permanent influence of ground and surface non-mineralized waters as well as flood waters. They appear at lower terrains, in depressions and valleys of large rivers;
3. halomorphic soils (salt water springs) are formed under the strong influence of mineralized water; that is, water enriched with easily soluble salts. There are few in the territory of Serbia and they appear most often in Vojvodina.

1.1.3. Land use in the Republic of Serbia

Land use refers to the land structure and use. According to the data obtained from the European Space Agency (ESA) in cooperation with the European Environment Agency (EEA), a map of the land cover called "CORINE Land Cover" (CLC) was produced within the frame of the Copernicus Programme. Based on the “CORINE Land Cover” from 2012, the largest area in Serbia is covered by deciduous forests with over 24,000 km^2, followed by non-irrigated arable land with over 22,000 km^2, followed by complex agricultural land with over 11,000 km2. Water bodies cover an area of about 800 km^2, which makes 1.03% of the total area of the territory of Serbia.

1.1.4. Population of the Republic of Serbia

According to the 2002 census, which was not carried out in the entire territory of the Republic of Serbia (not carried out in the territory of the Autonomous Province of Kosovo and Metohija), the territory where the census was organized had a population of 7,498,001. Out of the total number of the population covered by census, 52% live in urban areas. According to the 2011 census, which was not carried out in the territory of the Autonomous Province of Kosovo and Metohija, the total population amounted to 7,186,862, which represents a decrease of 311,139 inhabitants compared to the 2002 census.

2. METHODOLOGY FOR CALCULATION AND ACHIEVEMENT OF LAND DEGRADATION NEUTRALITY

Forming the necessary operational basis for the practical implementation of LDN activities requires the implementation of a ten-step process, grouped into five types of activities as shown in the Table 1. The implementation of these steps may be put in the adequate context and adapted to national needs and conditions.

Table 1. Ten steps to achieve land degradation neutrality targets

Group 1: Coordination	
Steps	Main activities
Step 1: Government management and engagement of stakeholders	Government leadership and coordination among the line ministries to harness the potential for the LDN target setting process.
	Identification of the main actors to be involved in the LDN target setting process.
	Engagement and coordination among stakeholders, including establishment of the national LDN working groups.
Group 2: Assessment	
Step 2: Determining the LDN "baseline"	Define the LDN "baseline"
	Calculate the baseline by using the LDN indicators land cover, land productivity and soil organic carbon (above and below land surface).
	Supplement the above-mentioned indicators, if necessary, with the additional national indicators.
	Use global sources in the absence of national databases, supplement and improve the quality of national databases.
Step 3: Assessment of land degradation trends	Assess historical land degradation trends to understand the current state of affairs, to determine anomalies and identify degraded areas.
	Identify significant trends in land degradation, i.e., when: • negative land cover changes occur; and / or • land productivity shows a significant decline; and / or • soil organic carbon shows a significant decline; and / or • negative change occurs in another nationally relevant indicator.

Step 4: Identification of land degradation causes	Identify types of land degradation for certain land cover categories.
	Identify direct degraded land and indirect causes.
	Analyse the legal and institutional framework pertaining to LDN.
	Identify advantages, weaknesses, possibilities and threats to the legal and institutional frameworks, including the UNCCD National Action Programme.
Group 3: Planning	
Step 5: Defining national voluntary LDN targets	Define measurable targets regarding what the country wants to achieve in terms of LDN.
	Define the scope and ambitions related to LDN.
	Define the time frame for the achievement of the LDN targets.
Step 6: Involvement of LDN in land use planning	Integrate LDN into the national land use planning models to predict “gains” and “losses”.
Step 7: Identifying measures to achieve LDN goals	Identify measures referring to initiators/drivers of the land degradation process.
	Promote implementation of the LDN response hierarchy: avoid, reduce, and reverse the causes of land degradation.
	Plan to strike a balance between inevitable land degradation and restoration activities.
Group 4: Activity	
Step 8: Enabling actions in line with the LDN concept	Communication on multiple LDN benefits.
	Implementation of the LDN concept into national policies and plans.
	Increase investment to reach LDN targets.
	Establish / strengthen the partnership to implement the LDN concept.
Group 5: Monitoring and reporting	
Step 9: Monitoring progress towards LDN	Monitoring changes in the values of LDN indicators to quantify “gains” and “profits”.
	The assessment of possibilities to achieve LDN goals.
Step 10: Reporting on LDN	Communication on the progress made towards LDN, at all levels.

3. LEGAL FRAMEWORK TO APLLY LAND DEGRADATION NEUTRALITY CONCEPT

Legal and institutional frameworks for land protection has its basis in the Constitution of the Republic of Serbia, which establishes the right of citizens of the Republic to a healthy environment, but also emphasizes their obligation to protect and promote all elements of the environment in accordance with the law. Monitoring, protection and adequate management over land resources are observed in numerous legal and development documents of the Republic of Serbia (Table 2). *The Law on Agricultural Land* ("Official Gazette of the RS", 62/2006-22, 65/2008-3, 41/2009- 206, 112/2015-55, 80/2017-3, 95/2018-267) observes the term "land" from the standpoint of agricultural production and determines it as different areas (orchards, grasslands, pastures, fields, and the similar), which in the current conditions may have certain benefits for agricultural production or with application of certain measures be converted to be used for this purpose. *The Law on Forests* ("Official Gazette of the RS", 30/2010-61, 93/2012-28, 89/2015-12, 95/2018-267) observes the land as a medium which is critical for the preservation, protection, planning, growing and utilisation of forests. *The Law on Waters* ("Official Gazette of the RS", 30/2010, 93/2012, 101/2016, 95/2018 and 95/2018) observes water management as a spatial category which is conditioned by water land conditions and perspectives. *The Law on Planning and Construction* ("Official Gazette of the RS", 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013, 132/2014, 145/2014, 83/2018 and 31/2019) is the umbrella law regulating the conditions and means for space development, development and use of construction land and other land. *The Law on Impact Assessment* ("Official Gazette of the RS", no. 135/2004 and 36/2009) also observes land as one of the critical environmental factors, necessary to be analysed within the context of the exposure to adverse effects of different project solutions.

Table 2. The laws of the Republic of Serbia observing land differently

The Law on Plant Nutrition Products and Soil Enhancers	"Official Gazette of the RS": 41/2009-116, 17/2019-6
Law on the Amendments to the Law on Food Security	"Official Gazette of the RS": 41/2009-77, 17/2019-10.
Law on the Amendments to the Law on Plant Protection Products	"Official Gazette of the RS": 41/2009-124, 17/2019-18
Law on the Amendments to the Law on Waters	"Official Gazette of the RS": 30/2010-81, 93/2012-27, 101/2016-9, 95/2018-388, 95/2018-267.
Law on the Amendments to the Law on Fire Protection	"Official Gazette of the RS": 111/2009-25, 20/2015-13, 87/2018-3 (other law), 87/2018-41, 87/2018-50.

Law on the Amendments to the Law on Planning and Construction	” Official Gazette of the RS”: 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013,
Law on the Amendments to the Law on Environmental Protection	“Official Gazette of the RS”: 135/2004-29, 36/2009-144, 36/2009-115, 72/2009-164, 43/2011-88, 14/2016-3,
Law on the Amendments to the Law on Local Self-Government	“Official Gazette of the RS”: 129/2007-41, 83/2014-22, 101/2016-9, 47/2018-3.
Law on Public Roads	“Official Gazette of the RS”: 41/2018-32, 95/2018-267.
Law on Railways	“Official Gazette of the RS”: 41/2018-54.
Law on National Spatial Data Infrastructure	“Official Gazette of the RS”: 27/2018-32.
Law on Agricultural Land	“Official Gazette of the RS”: 62/2006-22, 65/2008-3, 41/2009-206, 112/2015-55, 80/2017-3, 95/2018-267.
Law on the Amendments to the Law on Agriculture and Rural Development	“Official Gazette of the RS”: 41/2009, 10/2013, 101/2016.
Law on the Amendments to the Law on Incentives in Agriculture and Rural Development	“Official Gazette of the RS”: 10/2013-3, 142/2014-195, 103/2015-155, 101/2016-6.
Law on the Amendments to the Law on Nature Protection	”Official Gazette of the RS”: 36/2009, 88/2010, 91/2010,14/2016,95/2018.
Law on the Amendments to the Law on Waste Management	”Official Gazette of the RS”: 36/2009-115, 88/2010-170, 14/2016-17, 95/2018-267.
Law on Land Protection	“Official Gazette of the RS”: 112/2015-59.
Law on Mining and Geological Researches	“Official Gazette of the RS”: 101/2015, 95/2018.
Law on the Amendments to the Law on Forests	“Official Gazette of the RS”: 30/2010-61, 93/2012-28, 89/2015-12, 95/2018-267.
Law on National Parks	“Official Gazette of the RS”: 84/2015-15, 95/2018-267.
Law on Amendments to the Law on Integrated Prevention and Control of the Environment Pollution	”Official Gazette of the RS”: 135/2004-23, 25/2015-6.
Law on the Amendments to the Law on Chemicals	”Official Gazette of the RS”: 36/2009-33, 88/2010-158, 92/2011-26, 93/2012-26, 25/2015-3
Law on Amendments to the Law on Strategic Environment Impact Assessment	”Official Gazette of the RS”: 135/2004-18, 88/2010-160
Law on Agricultural Counselling and Technical Activities	“Official Gazette of the RS”: 30/2010-136

Special importance to and the status of land are also underlined in the *National Environmental Protection Programme*, which has recognized within the short-term (2010-2014) and continuous goals (2010-2019) the importance of land protection as a special sectoral activity through:

- harmonization of national environmental protection laws and regulations with acquis communautaire;
- establishment of a systemic programme to monitor land quality and establishment of databases on land conditions;
- making a list of sites with the status of particularly vulnerable environmental segments and setting priorities for rehabilitation and remediation in 20% of the territory;
- developing a long-term strategy and action plans and programmes for drought, degradation and desertification management;
- reducing the total area of land affected by erosion by 40% through anti-erosion works,
- establishing and updating the cadastre of landslides and unstable slopes, and the like.

In addition, the National Environmental Protection Programme also observes land protection as an activity, which is priority activity in other sectors: mining (land pollution prevention measures), agriculture, forestry and hunting (identify areas at risk of soil pollution, conducting soil monitoring, preventing aeolian erosion).

The National Sustainable Development Strategy ("Official Gazette of the RS", no. 55/05, 71/05 and 101/07) recognizes land as one of the most important natural resources, and emphasizes the following strategic sustainable use goals:

- harmonization of legal enactments, related to land use and protection, with the acquis communautaire;
- prevention of further land losses, preservation and improvement of its quality, particularly in the context of industrial, mining, energy, transport and other activities;
- protection against degradation due to land use changes, as well as conservation of agricultural land.

Compared to the mentioned guidelines, the *Law on Environmental Protection* ("Official Gazette of the RS", no. 135/2004, 36/2009, 72/2009, 43/2011, 14/2016, 76/2018, 95/2018) provides for the establishment of the systematic monitoring of land in the Republic of Serbia. Different institutional levels of the spatial and administrative organisation of the territory of the Republic (autonomous province and local self-government units) provide for continuous environmental control and monitoring. Land protection is attained through the activities of systematic monitoring of land resource quality, by monitoring relevant indicators for land degradation risk assessments, as well as remediation programmes to eliminate the effects of

degradation, whether it is due to natural or anthropogenically-induced processes. Accordingly, *the Decree on the Systematic Monitoring of Land Quality Programme* was adopted, using indicators for assessing land degradation risks and the methodology for the preparation of remediation programmes ("Official Gazette of the RS", no. 88/2010, 30/2018). The subject Decree defines terminology relevant for the land protection process (land degradation, land degradation processes, areas under risks, etc.).

Based on the provisions of *the Law on Environmental Protection*, *the Decree on the content and way of maintaining environmental protection information system, methodology, structure, common basis, categories and data collection levels, and information content for regularly and compulsorily information of the public* ("Official Gazette of the RS", number 112/2009) was passed. Based on this Decree, the *Rulebook on National list of environmental protection indicators* ("Official Gazette of the RS", number/2011) was adopted. The National list of indicators contains methodology for data collection, ways and deadlines for submission of data, information, indicators and reports generated by the Information System. The National list of indicators includes the set of indicators for land, which systematizes information on land conditions, land use changes and land degradation factors.

The Law on Land Protection ("Official Gazette of the RS", number 112/2015) is particularly important, and it defines land as a comprehensive medium and provides for principles of protection of all types of land and soil irrelevant of their use. This Law underlines the application of the "integrity of land protection" principle, i.e., the necessity to integrate land protection through all sectorial policies and harmonize all plans and programmes. Land protection represents a set of measures and actions applied in the course of planning, development, land use, and protection from pollution and degradation, with the aim of preserving and securing all of its functions. The novelty introduced by the Law on Land Protection is a set of documents in the function of land protection: land protection plan; annual land protection programme and land monitoring programme.

The new global concept, represented by "land degradation neutrality", is the result of the 2012 UNCCD Conference, which articulated global aspirations and efforts to achieve a "stable" condition of land resources, that is, to reach a world with "zero" land degradation (land degradation-neutral world – LDNW). This initiative is based on the need to preserve healthy and productive land for the needs of humankind while ensuring its ecosystem-related services. Land degradation neutrality is defined as a "condition in which land resources quality and quantity, indispensable for ecosystem maintenance and provision of food production, should remain unchanged or improved within specific space and temporal scales." The land degradation neutrality concept is an integral part of the Goal 15 of the 2030 Agenda for Sustainable Development that was adopted in 2016. This goal (Target 15.3) reads as follows: "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." LDN may be defined as a flexible goal integrated into sectoral policies implemented at national, regional and local level. Activities pertaining to the attainment of this goal and its achievement can be seen as an accelerator for achieving all Sustainable Development Goals (SDGs), such as eradicating poverty in all its forms across the globe, achieving food security, promoting sustainable agriculture, creating sustainable consumption and production patterns, accessibility and sustainable management of water and sanitation, sustainable forest management, combating desertification, stopping degradation of land and biodiversity, degraded land and biodiversity restoration, achieving inclusivity, security, resilience and sustainability of cities and settlements. Most of the SDGs rely on the land and soil as a medium, so LDN is a starting point and unavoidable platform for their achievement.

With the new UNCCD strategic framework, country Parties are committed to include nation LDN targets into their strategic and development programmes, as well as the ways to attain these targets. What sets LDN apart from earlier approaches is a two-way approach - (i) prevention of land degradation with (ii) activities for the restoration of degraded areas. Such a constellation enhances the achievement of a condition of zero tolerance for the loss of healthy and productive land and soil. The general LDN targets are:

- to improve the quality of land and soil ecosystem services;
- to improve productivity to ensure uncompromised food production;
- to increase resilience of landscape and its soil features, but also of the population that is dependent on it;
- to attain synergy-wise relations of LDN with the other environmental protection goals;
- to achieve land-resource responsible management.

Despite the fact that the concept of land degradation neutrality has not yet been explicitly defined under the current legislation of the Republic of Serbia, there is a clear tendency and effort to identify this approach in various development documents. In that regards, the publications "Sustainable Land Management at the Local Level in the Republic of Serbia" (2018) and "Guide for Sustainable Land Management at the Local Level in the Republic of Serbia" (2018) are very important. The aforementioned publications represent in a meaningful way the LDN approach, as a spatial and organizational principle that can be applied at different levels (from national to local level), applying traditional and contemporary land management modalities.

Incorporation of LDN into the legislation is one of the essential steps in its implementation, and it will enable practical implementation through the process of spatial planning and realisation of the envisaged goals at all organisational levels in the Republic of Serbia. "Visibility" of the

LDN concept in the *Law on Environmental Protection* and *Law on Land Protection* would have major significance, for the fact that these laws are explicitly related to the issue of land as a living medium, which requires specific legislative, planning and management solutions. Of course, the LDN concept has the potential to be identified in other laws, such as the L*aw on Agriculture and Rural Development, the Law on Forests, the Law on Planning and Construction, the Law on Nature Protection, the Law on Waters, the Law on Mining and Geological Researches*. As the LDN concept has not been explicitly observed in the planning documents so far, the opportunity for its implementation might be recognized through the development of a new Spatial Plan of the Republic of Serbia and identification of strategic priorities for the attainment of the SDGs.

4. APPLICATION OF LDN INDICATORS

Within the conceptual LDN framework, the minimum goal is to stabilize the baseline numerical value of specific indicators (used as indicators of the state of land-based natural capital), to eliminate negative trends and to achieve a dynamic balance of their changes with respect to the basic (baseline) values.

Monitoring progress towards LDNs can be observed in terms of increasing soil productivity, areas under vegetation cover, restoration of biodiversity and ecosystem services, as well as through resulting socio-economic gains. The baseline set of indicators, recommended for monitoring the progress towards LDN, is comprised of:

1. Trends in Land cover change,
2. Trends in Land productivity,
3. Trends in Soil organic carbon.

These three indicators together give a valid assessment of land's natural capital condition and ecosystem services over the total land area of one country (UNCCD, 2017). Land cover, as the first indicator, shows changes in the structure of areas, inter alia, vegetation cover to a certain extent and basic land use, as well as conversion of land and soil and habitat fragmentation. Data on productivity provides information on the functioning and vitality of land. Carbon stock, particularly soil organic carbon, is a significant indicator of total land and soil quality. However, the three mentioned indicators represent a baseline set which might be further improved and supplemented with additional national (or sub-national) indicators in order to attain a more precise assessment of land degradation, in-line with the Rulebook on the national list of environmental protection indicators ("Official Gazette of the RS", no. 37/2011).

4.1. Default sets of available data

Calculation of LDN indicators is based on the complex analytical approach, which implies three levels of detail:

- Level 1: Global/regional database on planet, geospatial information and modelling;
- Level 2: National statistics is based on the data collected from administrative or natural reference units (for instance, watercourses) at the national spatial level
- Level 3: Field surveys, assessment and measures on the land area.

Such approach enables the state authorities to use methods in line with their capacities, resources and level of data availability, and facilitates comparability at the global level. Detailed description of indicators and review of methods to obtain indicators at the level 1 will

be described in the following chapters.

Globally determined databases were used for the assessment of land degradation in the Republic of Serbia. Reasons to use these data lays in the fact that currently the data of the Republic of Serbia is not aligned in the spatial and temporal intervals with the LDN Methodology which refers to the principle of selection of zero and existing conditions of certain factors. UNCCD Default data currently represents the unique solution for the application of the LDN methodology and calculation of land degradation level due to following reasons:

- UNCCD Default data have an adequate spatial and temporal interval for all three LDN indicators on the basis of which the conditions of land resources can be assessed (land use, soil productivity dynamics, soil organic carbon);
- Categories related to land use are aligned with the IPCC categories;
- Digital format of global databases is adapted to the LDN calculation methodology;

The global datasets used to assess baseline condition are from different databases and are shown in the Table 3.

Table 3. Default LDN indicators and data sources at the global level

Indicator	Data sources at the global level
Land cover	ESA Climate Change Initiative Land Cover – 300m resolution data set;
Land productivity	JRC Land Productivity Dynamics – data set obtained via 15-year time series, SPOT Vegetation NDVI; 1km spatial resolution.
Soil organic carbon	ISRIC SoilGrids – 250m resolution data set

5. GLOBAL DATA BASES WHICH REFER TO SERBIA

5.1. Indicator: Land cover

The term "land cover" refers to the observed physical cover of a particular part of the Earth. Changes to the land cover indicate to reduction or increase of the areas under vegetation, changed habitat conditions and modification of land uses. Although the Republic of Serbia implements the methodological procedure defined by national enactments and regulations (see Chapter 10 for more information: Differences in the perception of LDN indicators in the context of global and national databases) related to the monitoring of land cover changes using the Corine Land Cover methodology, for the implementation of the LDN approach in the territory of the Republic of Serbia, national databases are not adequate, and the database on land cover changes created by the European Space Agency (ESA) was used. Its hierarchy categorization is based on the FAO Land Cover Classification Systems - LCCS, with 22 categories at the “level 1” for the whole world, and 14 additional categories at the “level 2”. In order to improve the implementation, 22 original categorises cover six main land cover categories (Table 4).

Table 4 Land cover category

Number of class	Category	Description of ESA CCI-LC category
1	Forest	Geographic areas dominated by autochthonous forest vegetation, with the share of 15% or more. This class also involves: mosaic of trees and shrubs (> 50%) / grassy (herbaceous) layer; seasonal or permanently flooded trees in the riparian areas
2	Shrubs, grasslands and sparsely vegetated	Geographic areas dominated by: natural bushes, or natural herbaceous plants; or rare natural vegetation with the cover of 15% or less; this class also includes: mosaic of natural vegetation (> 50%) / crops, and mosaic of herbaceous cover (> 50%) / trees and shrubs.
3	Cropland	Geographic areas dominated by: herbaceous plants; or other woody crops; or mixed herbaceous and woody crops. This class also involves: mosaic of crops (50%) / natural vegetation.
4	Wetlands	Geographic areas dominated by: bush and herbaceous vegetation, water or regularly flooded areas; or mangrove forests
5	Artificial areas	Geographic areas dominated by artificial (anthropogenic) land areas, including urban and suburban areas (for instance, parks),

		transport infrastructure, industrial areas, landfills, mine pits.
6	Bare land and other	Bare areas, snow or glaciers
7	Water bodies	Water surfaces (natural / artificial, stagnant /running, land / sea).

Datasets on land cover, for a certain number of years, obtained from ESA database, in the raster and vector database forms, may be read by all commercial or free-of-charge GIS software package.

General parameters of land cover database are:

- Coordinate system: GCS_WGS_1984;
- Pixel resolution (X; Y): 0.0027777777; 0.0027777777 [in decimal degrees], which roughly corresponds to a 300-meter resolution;
- Source: Data obtained from ESA CCL-LC database recategorized with 22 categories into 6 main categories;
- Values of digital categories ranging from 1 to 6 and are presented in the Table 4.

Land cover and land use changes, for the Republic of Serbia, are analysed for the period from 2000 to 2015. The table 5 contains basic categories of land cover and observed changes, starting from "zero" period (the year of 2000) until the end period (2015), whereas the spatial distribution is presented in images 3 and 4. The image 5 presents spatial distribution of changes for each category of land cover.

Table 5. Changes in spatial distribution of land cover for the period from 2000 to 2015. (Data Sources: ESA-European Space Agency)

Category	Area (km^2)		Change	
	2000	2015	(km^2)	(%)
Forest	30,664.61	32,615.72	1,951.11	6.36
Grasslands	5,864.74	4,099.85	-1,764.88	-30.09
Croplands	50,131.14	49,282.76	-848.38	-1.69
Wetlands	117.94	119.18	1.24	1.05
Artificial areas	892.62	1,539.48	646.86	72.47
Bare land and other	60.68	72.82	12.14	20.00
Water bodies	756.70	758.62	1.92	0.25
Total	88,488.44	88,488.44		

According to the table 5, for the observed period, there are following changes for each category of land use:

- the areas under forests increased by 1,951.11 km^2, i.e., by 6.36%.
- Negative trend was observed with the areas under grasslands, which decreased by 1,764.88 km^2, i.e., by 30.09%.
- the biggest increase is observed in the artificial areas, which increased by 1,539.48km^2, i.e., by 72.47%.
- Wetlands and water bodies have slightly increased their areas (by 1.30%),
- the areas under bare rocky grounds and other areas (which include glaciers and snow) increased by 20%, i.e., or 12.14 km^2.

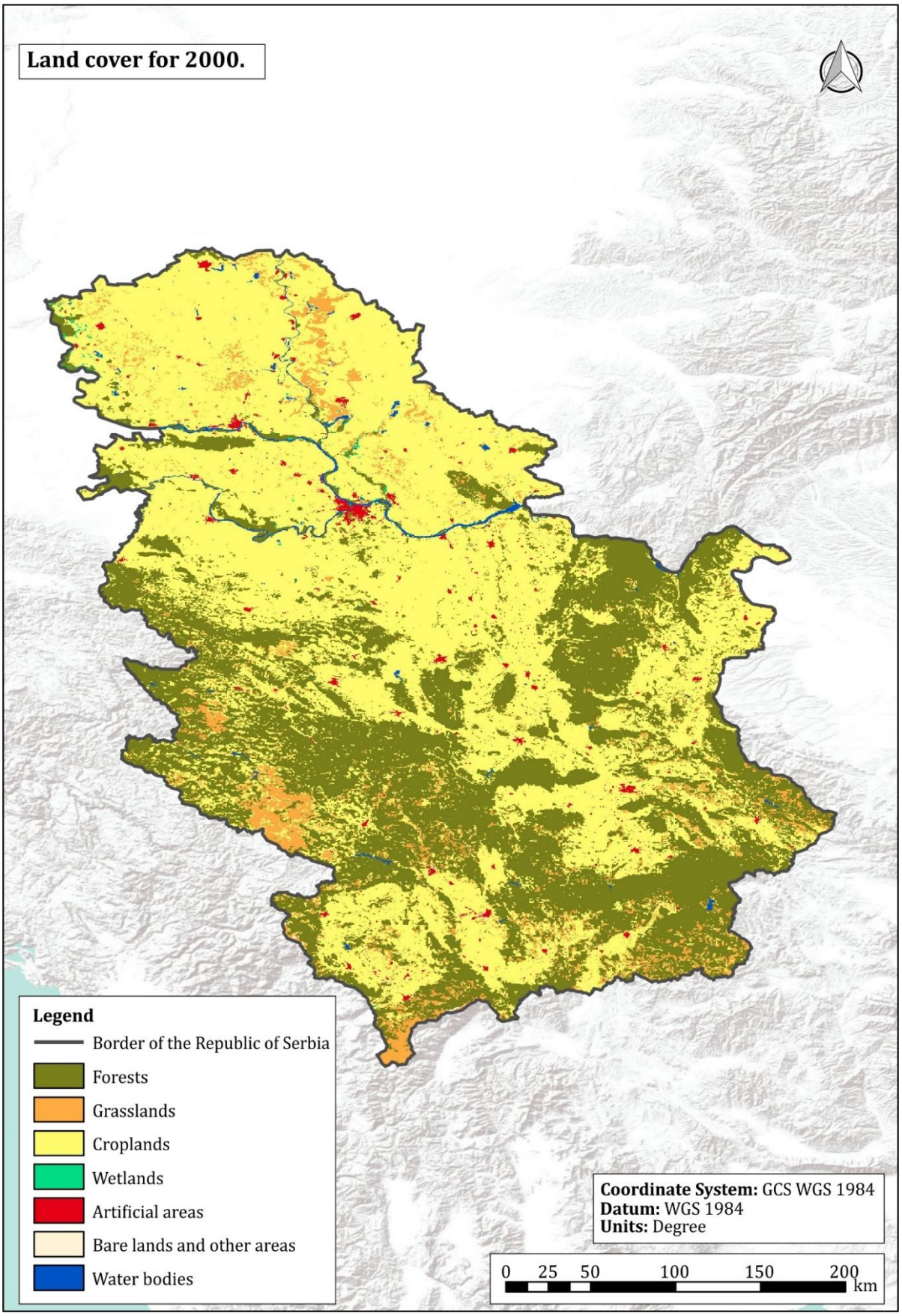

Image 3. Map of land cover in the territory of the Republic of Serbia for the year of 2000 (Data Sources: ESA -European Space Agency)

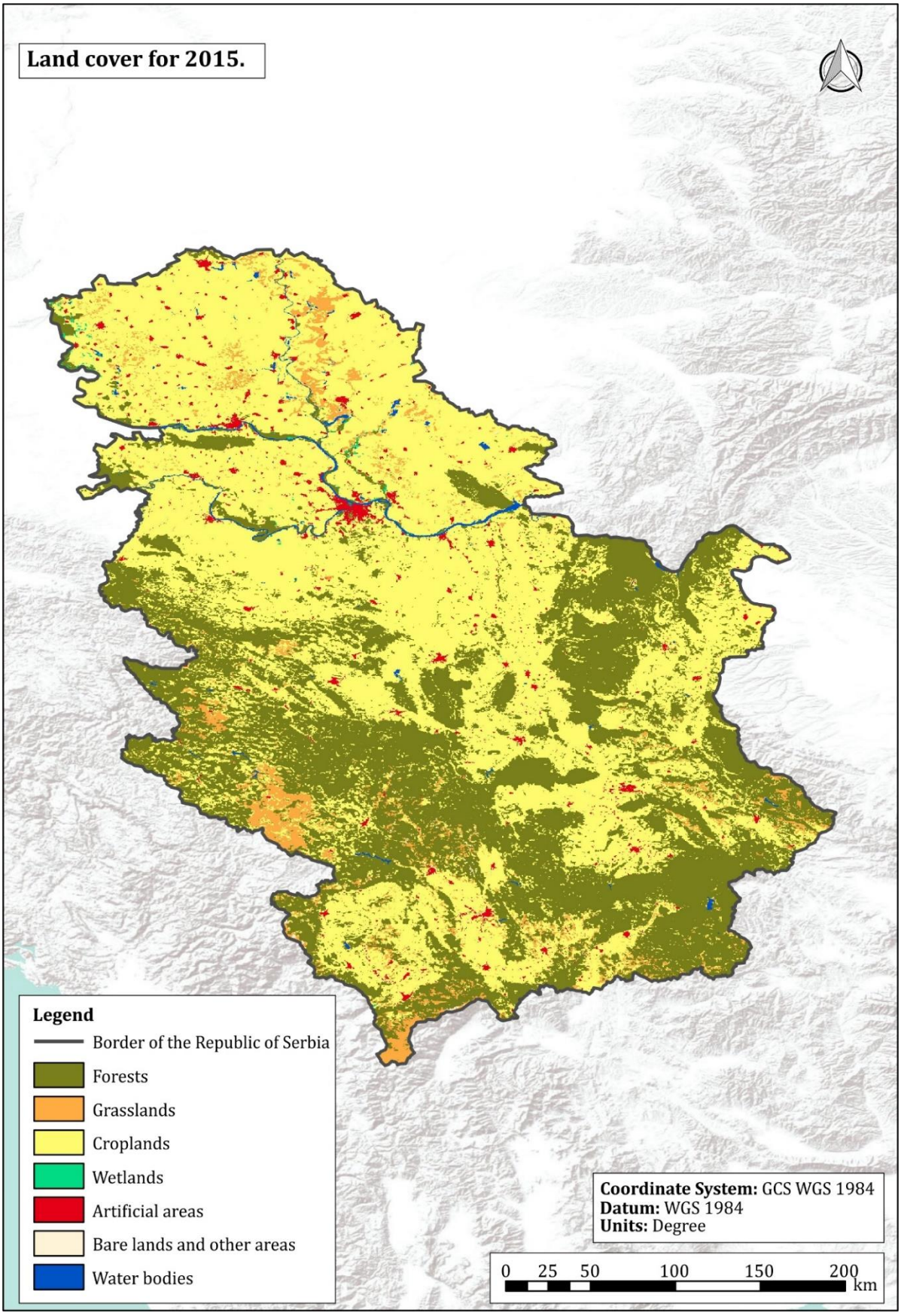

Image 4. Map of land cover in the territory of the Republic of Serbia for the year of 2015 (Data Sources: ESA -European Space Agency)

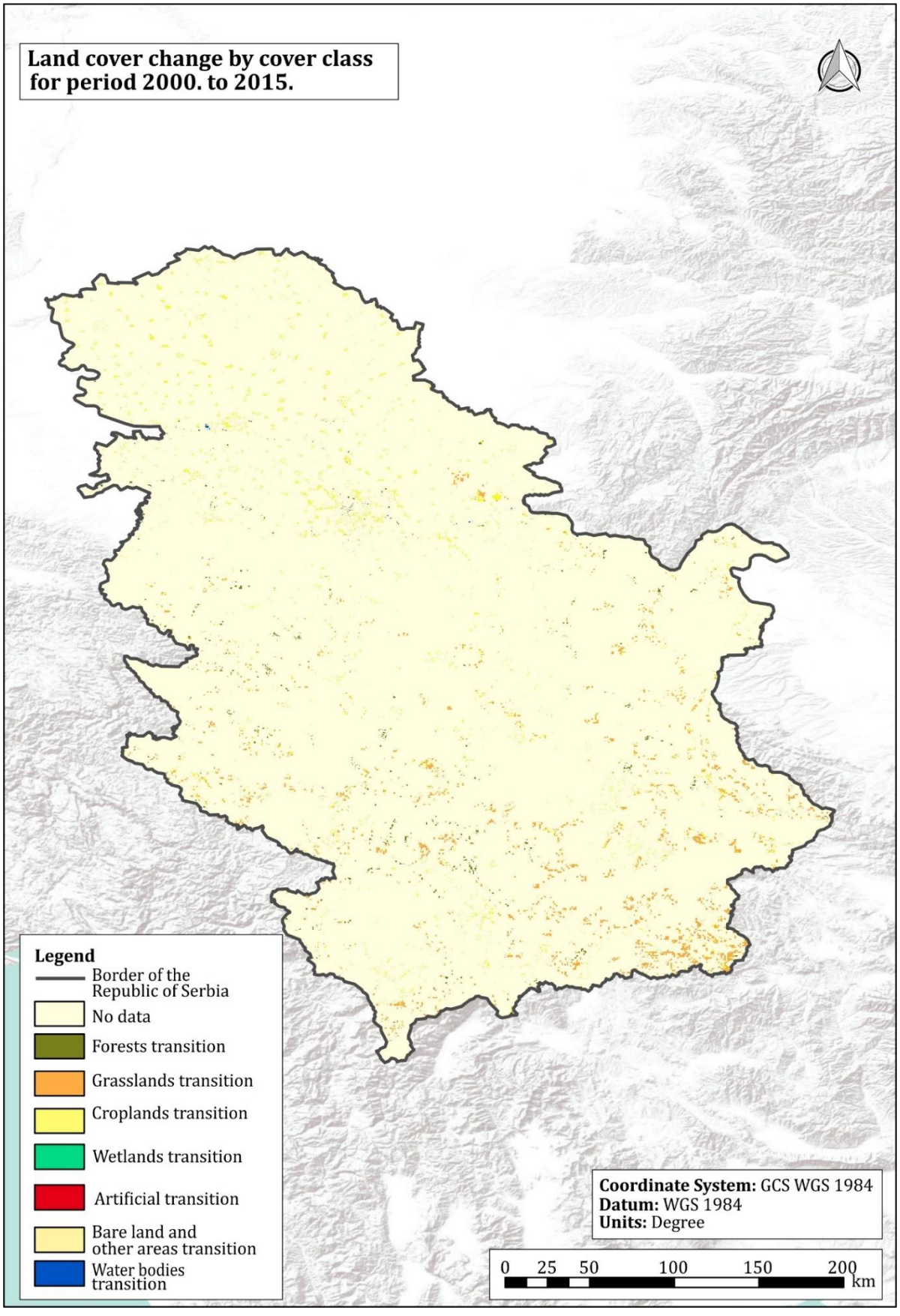

Image 5. Map of land cover changes in the territory of the Republic of Serbia
(Data Sources: ESA -European Space Agency)

5.2. Indicator: Land productivity dynamics

Land productivity refers to the total net primary productivity - NPP, which is expressed in the tonnes of dry mass per hectare per year. This indicator refers to biological productive capacity of land indispensable for survival of humankind. Given that the Republic of Serbia does not have any national data on land productivity dynamics, databases provided by the Joint Research Centre's Land Productivity Dynamics dataset (LPD) were used for the development of this document. The given data set was obtained over 15-year temporal series, SPOT Vegetation NDVI observations with 10-day intervals and a spatial resolution of 1 km. Productivity is shown in five basic categories (productivity reduction, different sign of reduction, stable but affected productivity, stable and increased productivity), presented under the Table 6.

Table 6. Land productivity categories
(Data Sources: Joint Research Centre of the European Commission)

Value	Description of category
1	Declining
2	Moderate decline
3	Stressed
4	Stable
5	Increased productivity

Datasets on land productivity dynamics, obtained from Joint Research Centre (JCR), in the raster and vector database forms, may be read by all commercial or free-of-charge GIS software package.

General parameters of global land productivity database are:

- Coordinate system: GCS_WGS_1984
- Pixel resolution (X, Y): 0.0089285714; 0.0089285714 [in decimal degrees], which roughly corresponds to a 1km resolution;
- Digital value has a category from 1 to 5.

General parameters of land productivity database are:

- Coordinate system: GCS_WGS_1984
- Pixel resolution (X; Y): 0.0027777777; 0.0027777777 [in decimal degrees]; which roughly corresponds to a 300-meter resolution; In this case, the global set of soil productivity databases has a spatial resolution of 1 km, which has been converted to a resolution of 300 meters by the integration method;
- Digital value has a numerical expression from 1 to 5.

The obtained databases from Joint Research Centre of the European Commission were converted to a spatial resolution of 300 meters applying integration method. The table 7 presents the total land area of each productivity category. The total land area distribution is shown in the table 6. Calculation of land productivity has been analysed only for the mainland of the Republic of Serbia. The above set of data is presented in five basic categories, among which the first three categories are observed as an indicator of a potential decline in land productivity, i.e., as an indicator of land degradation. In the Republic of Serbia, 73.26% of the total area is under increased productivity, while the percentage of the stable and undeveloped areas is represented with 21.23%. The area of the first three categories cover 5.4% of the total area. Category no data occupies 0.09%.

Table 7. The total land area of productivity category in the Republic of Serbia
(Data Sources: Joint Research Centre of the European Commission)

Value	Description of category	km^2	%
1	Declining	243.95	0.27
2	Moderate decline	1,455.83	1.64
3	Stressed	3,091.28	3.49
4	Stable	18,787.24	21.23
5	Increased productivity	64,828.84	73.26
	No data	81.3	0.09
	Total	88,488.44	100

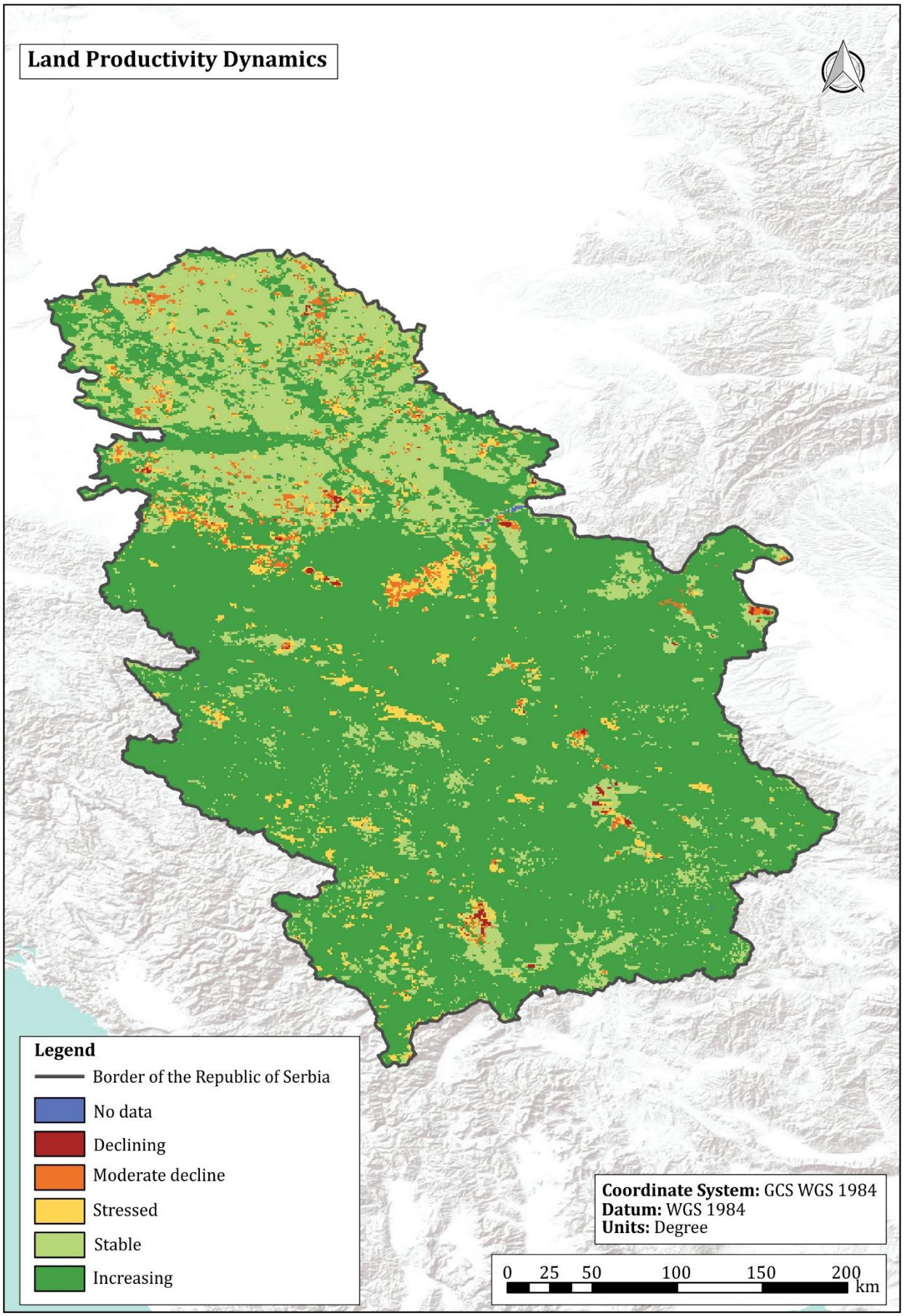

Image 6. Land productivity dynamics of the Republic of Serbia
(Data Sources: Joint Research Centre of the European Commission)

5.3. Indicator: Soil organic carbon

Stocks of terrestrial carbon represent the total quantity of carbon in the system, which has capacities to accumulate or release carbon. Terrestrial carbon sinks are biomass, death organic matters and soil (IPCC 2003). It is expressed in tons of carbon per ha. This indicator has both local and global relevance due to its role in the global carbon circulation cycle. The Republic of Serbia is investing huge efforts to develop national database that will show soil organic carbon and so far, the Environmental Protection Agency of the Republic of Serbia has developed a significant database. However, the national database has some spatial and temporal deficiencies (for more information see Chapter 10: Differences in the perception of LDN indicators in the context of global and national databases) disabling their use for the application of the LDN methodology. Data regarding this parameter, used for the elaboration of this report, were provided by the International Soil Reference and Information Centre (ISRIC). Assessment of trends is based on the IPCC reference values, i.e., carbon stocks under different climate and soil conditions up to the reference depth of30Cm, so the carbon content change factor varies for different uses and land management regimes.

The general parameters of a soil organic carbon database for one country are:

- Coordinate system: GCS_WGS_1984 and projected MODIS sinusoidal (SR- RG:6842)
- Pixel resolution (X; Y): 0.0027777777; 0.0027777777 [in decimal degrees]; which roughly corresponds to a 300 meter resolution;
- Soil Organic Carbon - SOC values are presented in the metric tons per hectare.
- The factor change values are stored in integer format (the factor is multiplied by 10).

The basic database on soil organic carbon is obtained based on the Global Database obtained from International Soil Reference and Information Centre (ISRIC). All these sub-indicators are provided to the user in the form of georeferenced spatial layers, both in raster format (GeoTIFF) and in vector format (shape file).

The average value of soil organic carbon is 99.56 t / ha, while the values of carbon by categories of space utilization are shown in the Table 8 for the observed period from 2000to 2015. Quantity of carbon in the forests amounts to 116.17 t/ha, while the highest recorded value amounted to 120.96 t/ha. The lowest value was recorded in artificial areas, while the value of soil organic carbon on arable land is lower (83.80 t / ha) than in grasslands (108.66 t / ha). Spatial distribution is shown in the table 7.

Table 8 Average value of soil organic carbon according to the land use categories
(Data Source: ISRIC- International Soil Reference and Information Centre)

Land use per categories	Area (2000) km^2	Area (2015) km^2	Change km^2	Soil organic carbon (t/ha)
Forest	30,657.97	32,610.30	1,952.33	116.17
Grasslands	5,861.72	4,099.85	-1,761.87	108.66
Croplands	50,128.24	49,279.66	-848.58	83.80
Wetlands	117.18	117.80	0.62	98.19
Artificial areas	892.62	1,537.97	645.35	69.53
Bare land and other areas areas	60.68	72.82	12.14	120.96
Average SOC (t/ha)				99.56

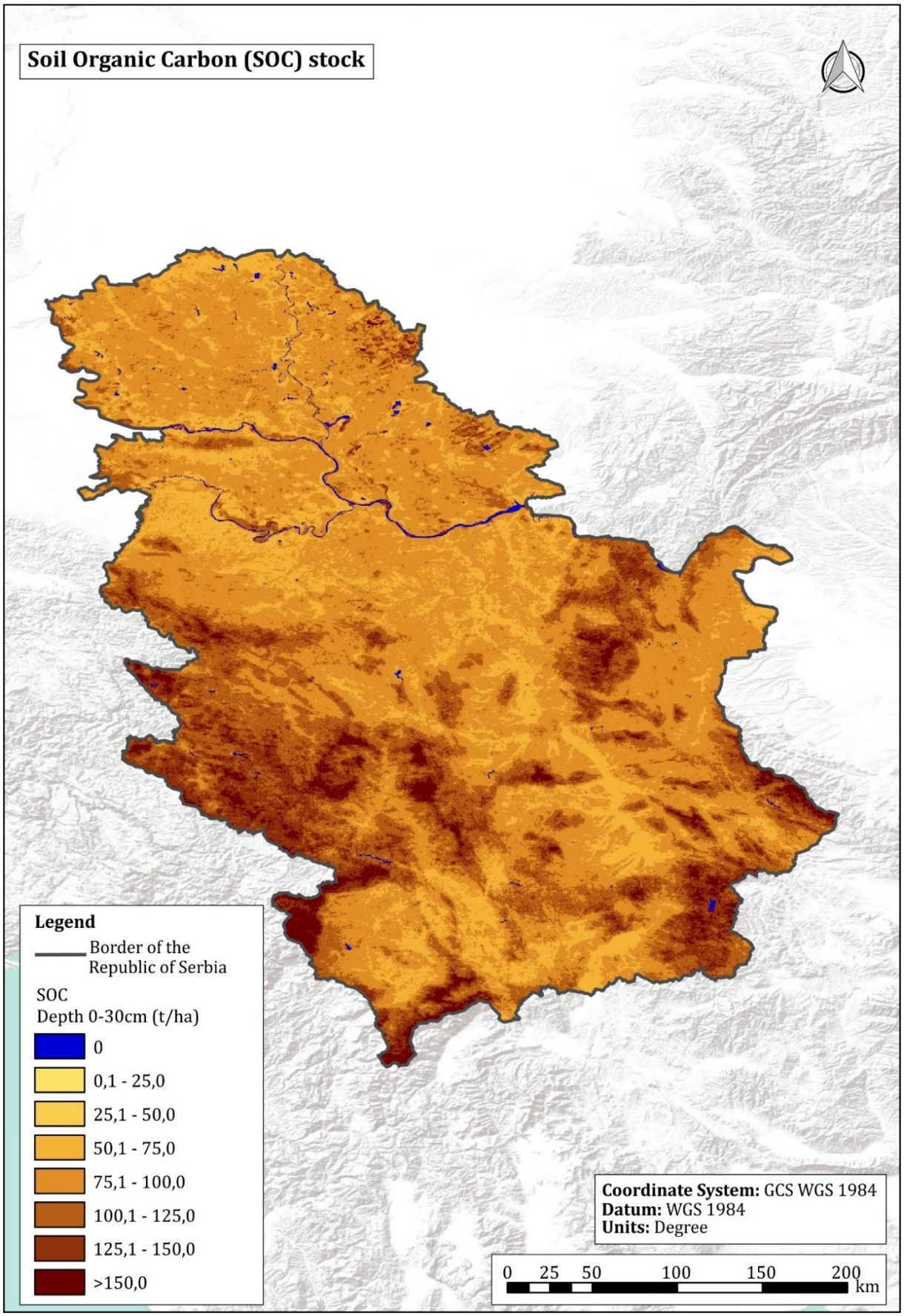

Image 7. Map of soil organic carbon in the territory of the Republic of Serbia

(Data Source: ISRIC- International Soil Reference and Information Centre)

6. LDN BASELINE

Three indicators (land cover, soil productivity, and soil organic carbon) were used to determine the baseline. In determining the baseline, it is necessary to estimate, for each indicator, the average value over the five-year baseline period, however, a retrospective trend analysis requires observing changes in the indicator values over the period 10-15 years prior to the current condition (in our case, the period from 2000 to 2015 was used).

Land cover, land productivity and soil organic carbon indicators are mutually conditioned and complementary.

It is generally believed that degradation occurs when:

- land productivity shows a significant negative trend; or
- soil organic carbon shows a significant negative trend; or
- a negative change in land cover appears; or
- a negative change occurs in the second relevant national indicator.

However, trends in indicators must be interpreted within the local condition context.

6.1. Land cover / changes in land use

The table 10 gives an overview of land cover changes form one category into the other for the observed period. According to global data from ESA - European Space Agency, there have been changes in land use, where according to the areas affected by the changes, the appropriate categories can be separated. The first category includes the conversion of forests into arable land, where the area of change from the forest to the cropland category is 184.73 km^2. Global data (ESA -European Space Agency) shows that in the observed period there was a reduction of arable land by 848.38 km^2. The total of 184.73km^2 of forest areas were converted into arable land, while 417.65km^2 of croplands s were converted in forests, i.e., 622.62 km^2 or croplands were converted into artificial areas.

Besides the changes shown under the table 10, LDN methodology also provides general overview on land use changes according to global data (ESA -European Space Agency), as shown in the table 9. According to degradation level, land cover may be classified into the following categories: degraded, stable and improved. According to the Table 9, it is observed that 96.44% of land cover is stable, while 2.53% of the total land area is improved. Only 1.03% of the total land areas falls under the category of degraded land. All of these categories are also territorially presented in the generated map (Image 8).

The total area of land cover, according to degradation categories, is given only for the mainland part of the territory of the Republic of Serbia, excluding water areas.

Table 9. General overview of the land cover per degradation category

Categories of degradation	Area km^2	Area %
Improved	2,219.48	2.53
Stable	84,610.34	96.44
Degraded	899.99	1.03
No data	0	0
Total	87,729.82	100.00

Table 10. Land cover changes for the observed period (2000-2015) expressed in km^2 (Data source: ESA -European Space Agency)

	Category	2015							
		Forest	Grasslands	Croplands	Wetlands	Artificial areas	Bare land and other	Water areas	Total
2000	Forest	30,397.89	47.17	184.73	1.55	7.73	18.90	6.65	30,664.61
	Grasslands	1,793.65	4,051.64	8.00	0.00	8.11	0.32	3.02	5,864.74
	Croplands	417.65	1.04	49,086.93	0.00	622.62	0.00	2.91	50,131.14
	Wetlands	0.93	0.00	0.00	116.26	0.00	0.00	0.75	117.94
	Artificial areas	0.00	0.00	0.00	0.00	892.62	0.00	0.00	892.62
	Bare land and other areas	0.19	0.00	0.00	0.00	6.90	53.60	0.00	60.68
	Water areas	5.42	0.00	3.11	1.38	1.51	0.00	745.30	756.70
	Total	32,615.72	4,099.85	49,282.76	119.18	1,539.48	72.82	758.62	88,488.44

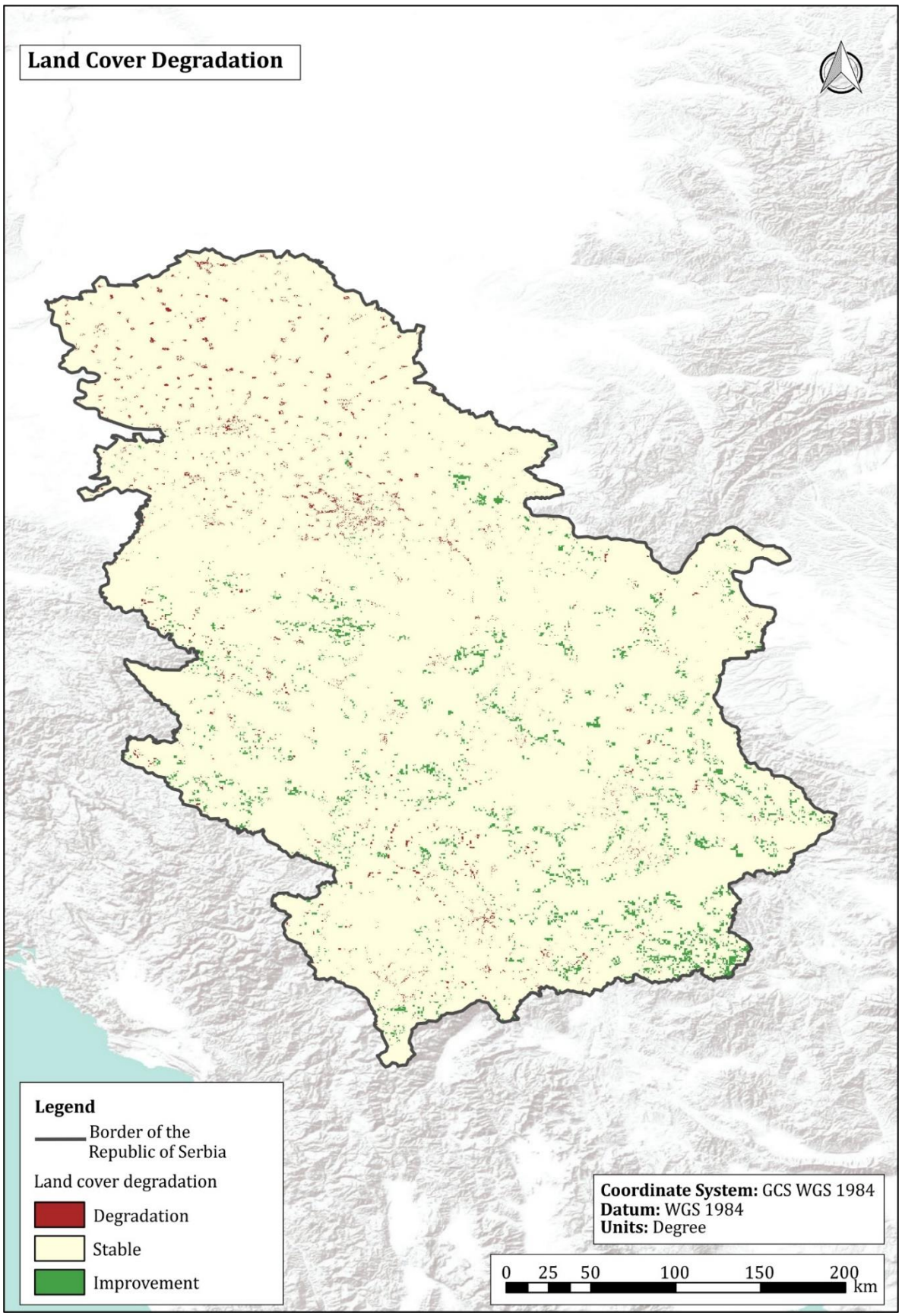

Image 8. Geospatial summary information on land use changes

(Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

6.2. Land productivity dynamics

General overview of the changes and dynamics of land productivity is given in the Table 11, which is obtained from global data. The total of 73.42% of the mainland territory falls under the category of improved land productivity, while 21.13% out of the total areas falls under the category of stable productivity. **Degraded land productivity is spread out in the area of 4,758.90 km^2, i.e., 5.42% out of the total land area.**

Table 11. General overview of the land productivity per degradation category
(Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Categories of degradation	Area km^2	Area %
Improved	64,410.09	73.42
Stable	18,535.33	21.13
Degraded	4,758.90	5.42
No data	25.50	0.03
Total	87,729.82	100.00

Analysing productivity per land use categories, the table 13 shows the total land area of each category. Reduction in productivity is the mostly identified in the croplands (179.71 km^2), then in grasslands (25.29 km^2). On the other hand, observing the increased productivity category, the most of these areas is under croplands and forests. When the calculation involves the assessment of land productivity dynamics for those areas affected by land use changes, results presented in the table 12 are obtained. The table shows only the most significant changes, i.e., the transformation of grasslands into forests, whereby no reduction in productivity was observed, on the contrary, the productivity increased in an area of 1,723.46 km^2.Negative trend in decreasing productivity was identified in the transition of croplands into artificial areas.

Table 12. Land productivity dynamics per land use change (2000-2015)
(Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Land use change		Area of change	Land productivity dynamics (km^2)				
Conversion from	Conversion into	km$_2$	Declining	Moderate decline	Stressed	Stable	Increased
Forest	Artificial areas	7.73	0.22	0	0.44	3.09	3.98
Grasslands	Forest	1,793.65	0	1.03	3.94	65.22	1,723.46
Grasslands	Artificial areas	8.11	0.81	0.61	0.76	2.55	4.19
Croplands	Artificial areas	622.62	10.93	21.79	50.93	307.94	231.03

Table 13. Net land productivity in the territory of the Republic of Serbia for the period from 2000 to 2015
(Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Land use per categorize	Net land productivity dynamics (km^2)					
	Declining	Moderate decline	Stressed	Stable	Increased productivity	No data
Forest	3.27	45.49	219.60	2,319.99	27,802.96	6.57
Grasslands	25.29	157.42	313.55	791.98	2,761.70	1.70
Croplands	179.71	1,206.23	2,385.26	14,410.10	30,889.77	15.85
Wetlands	0.04	0.44	2.87	22.45	90.28	0.18
Artificial areas	14.42	13.59	74.33	545.70	243.91	0.66
Bare land and other areas	3.41	0.72	2.89	17.76	28.82	0.00

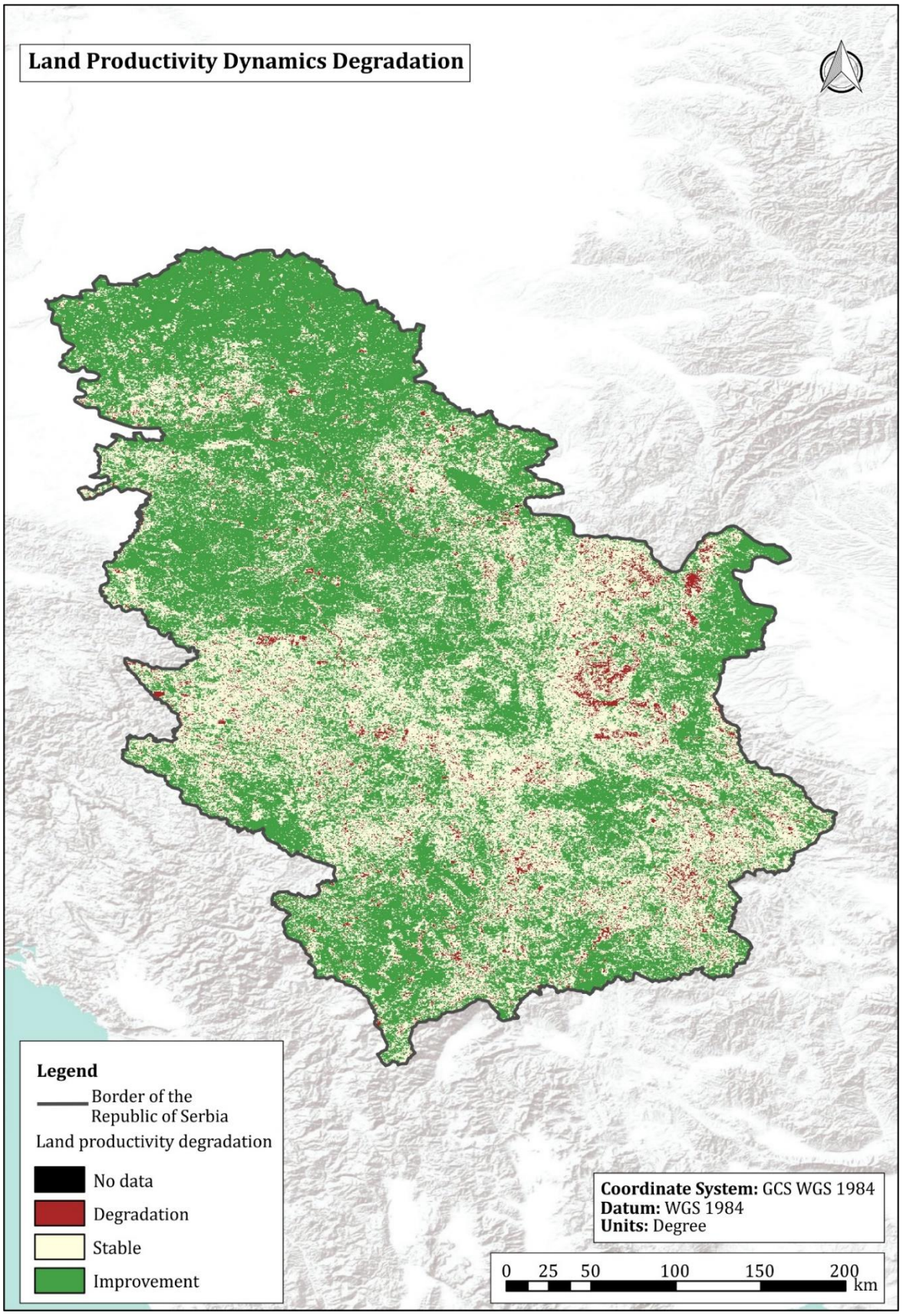

Image 9. Geospatial summary information on the application of land productivity (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

6.3. Soil organic carbon

General overview of the soil organic carbon changes is given in the Table 14, which is obtained from global data. The total of 229 km^2 is under the category of improved (increased) soil organic carbon, i.e., 0.26% of the total territory of the Republic of Serbia. The stable category has the highest share with 98.94% of the total area. Areas identified as degraded, i.e., where the soil organic carbon has decreased, are present in 602 km^2, i.e., 0.11% of the territory.

Table 14. A general overview of changes in soil organic carbon by degradation categories (2000-2015) (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Categories of degradation	Area km^2	Area %
Improved	229.0	0.26
Stable	86,803.1	98.94
Degraded	602.0	0.69
No data	95.7	0.11
Total	87,729.82	100.00

Changes in soil organic carbon content are determined on the basis of the land use change. The table 15 shows only significant changes, observed by global data processing. According to the results obtained, it can be seen that through the conversion of croplands into artificial areas (622.62 km^2), for the period 2000-2015, the reduction of soil organic carbon of 7,039.8t was identified. The increase in soil organic carbon by 5,214.7t is identified due to conversion of grasslands into forests (1,793.65 km^2).

Table 15. Changes in soil organic carbon content due to the land use change (2000-2015) (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Land use change		Area of change	Soil organic carbon (SOC)				
Conversion from	Conversion into	km^2	2000 (t/ha)	2015 (t/ha)	2000 (t)	2015 (t)	Change SOC(t)
Forest	Grasslands	47.17	114.1	114.0	538,129.3	537,727.8	-401.5
Forest	Croplands	184.73	107.6	107.5	1,987,666.4	1,986,183.5	-1,482.9
Grasslands	Forest	1,793.65	80.4	80.4	14,420,509.9	14,425,724.6	5,214.7
Croplands	Artificial areas	622.62	66.2	66.1	4,124,213.1	4,117,173.3	-7,039.8
Croplands	Forest	417.65	77.0	76.8	3,214,391.7	3,208,904.9	-5,486.8

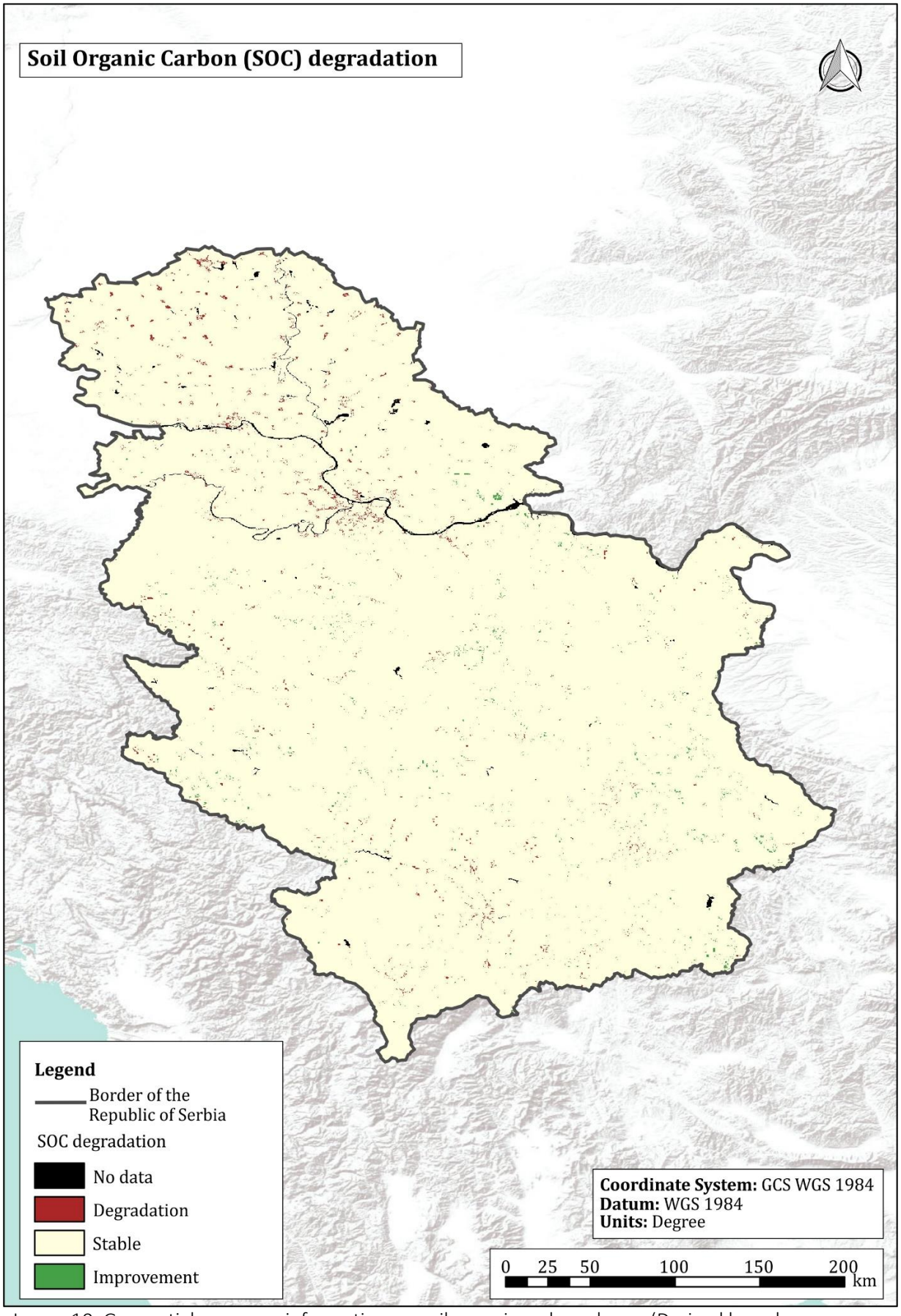

Image 10. Geospatial summary information on soil organic carbon change(Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

7. LAND DEGRADATION HOT SPOTS AND BRIGHT SPOTS

The analysis of global data was also carried out at the district level in order to obtain the identification of land degradation areas in the Republic of Serbia. Hot spots were identified (degraded areas against the baseline 2000, ESA, JRC, ISRIC), and bright spots (areas of the improved condition, against the baseline 2000, according to ESA, JRC, ISRIC). This analysis was applied for each indicator individually, in order to see, at the district level, the state of increased or decreased degradation.

The Table 16 shows administrative units in the Republic of Serbia (districts), with areas related to the land cover indicator. The generated map (Image 11) also shows potential spots per districts. According to the Table no. 16, bright spots are prevalent in the Pčinja District, with the total land area of 419.23km^2. Based on the hot spot spatial disposition, the major prevalence of the degraded land is observed in the districts in the South Bačka (90.15km^2) and the North Bačka (47.35km^2).

Table 16. Area of hot spots, and bright spots per districts obtained based on land cover changes

Potential spots	District	Area (km^2)
bright spot	Pčinja	419.23
hot spot	North Bačka	47.35
hot spot	South Bačka	90.15

Using the same approach, based on land productivity indicators, hot spot and bright spot were determined by districts, with the total areas (Table 17), while the spatial distribution is shown on the generated map. According to this indicator, hot spots were observed in the North Bačka with the total area of 99.8 km^2. At the same time, bright spots with increased land productivity are observed in the Zajecar District, in an area of 3,596.64 km^2.

Table 17. Potential hot spots and bright spots per districts based on land productivity

Potential spots	District	Area (km^2)
bright spot	Zaječar	3,596.64
hot spot	North Bačka	99.8

Areas of hot spots and bright spots obtained based on the soil organic content indicator, are presented in the table 18 with the spatial disposition on the generated map. The districts where increased soil organic content was observed are Pirot, in the total land area of 25.03km^2 and Zaječar, in the total land area of 18.71km^2. The areas where decreased soil carbon content and increased degradation were observed are the area of Belgrade, in the total land area of 0.49km^2 and the North Bačka District, in the total land area of 44.73km^2.

Table 18. Potential hot spots and bright spots per districts based on soil organic carbon

Potential spots	District	Area (km^2)
bright spot	Pirot	25.03
bright spot	Zaječar	18.71
hot spot	Belgrade	0.49
hot spot	North Bačka	44.73

Based on the analysis of all three indicators (Tables 16, 17 and 18), the hot spots were observed by global datasets processing.

Areas with hot spots are mostly prevalent in the South and North Bačka Districts. Both districts form part of Vojvodina, being the agricultural region of extreme importance, with the land and soil that by their characteristics belong to the more fertile land and soil in Europe. However, due to increasing use of fertilizers and plant protection products, the content of hazardous and harmful substances, particularly of heavy metals (copper, nickel, chromium, cadmium, lead, zinc, mercury and arsenic) and pesticides in the soil has increased, which reduces its production quality and increases the risk in healthy food production. The application of mineral (nitrogen) fertilizers initiates the processes that lead to acidification of the soil, i.e., to a decrease in the pH value in the surface layers. Land and soil in the territory of the Central Serbia belong to the group of highly acidic soils. The salinization process (salinization of soil in the surface layer) is one of the main problems in AP Vojvodina. There is a clear decrease in the content of organic matter (humus) observed in agricultural land, which is not only a consequence of climatic conditions, but also of the intake of nitrogen fertilizers and cultivation of crops with reduced biological potential. Climate change (greenhouse effect), erosion processes (pluvial, fluvial and eolian erosion) and soil degradation (caused by surface coal exploitation) are also causing soil pollution.

The AP Vojvodina is considered to be one of the least forested regions in Europe. This province is a part of Pannonian biogeographical region which was covered in large tracts of oak-dominated thermophilous forests and forest steppes. However, during centuries these forests were cut down to make way for extensive grasslands. Areas that might impact on the increase level of forestation and spatial corridors favourable for the formation of windbreaks. Aeolian erosion is a significant factor of soil degradation in the territory of AP Vojvodina, as it leads to the movement of finest particles from the surface layer of soil and the reduction of nutrient content. The declining productivity of agricultural land can occur due to several factors. Loss of organic matter, uncontrolled application of pesticides and mineral fertilizers, inadequate management and cultivation, lack of application of modern agro-technical measures, affect the general degradation of land area. On the other hand, natural factors such as droughts and floods also reduce

productivity and soil stability. Due to the increased risk of climate change, the territory of the Republic of Serbia is one of the areas where reclamation measures are necessary due to the frequent occurrence of excess water in the non-vegetation period and its deficit in the vegetation period. Inadequate management and poor maintenance of reclamation system can cause multiple damages. Better understanding of the temporal and spatial dynamics of the occurrence of moisture surpluses and deficits, as well as the relevant risk assessment, contribute to a more rational planning of land reclamation measures, optimal selection and making rational decisions regarding the management and investment in land area.

The emergence of hot sports is also a consequence of intensive urbanization, industrialization and overexploitation of area in the Belgrade District. In addition to the increase in urbanized areas, there was also a high prevalence of abandoned agricultural land in the territory of the Republic of Serbia. The least abandoned land is in Vojvodina, about 4%, while the worst situation is in southern and south-eastern Serbia, where about 22% of agricultural land is not cultivated. Several factors mutually affect the consequence of abandonment of agricultural land, the two most important being the lack of working age population and unfavourable economic conditions.

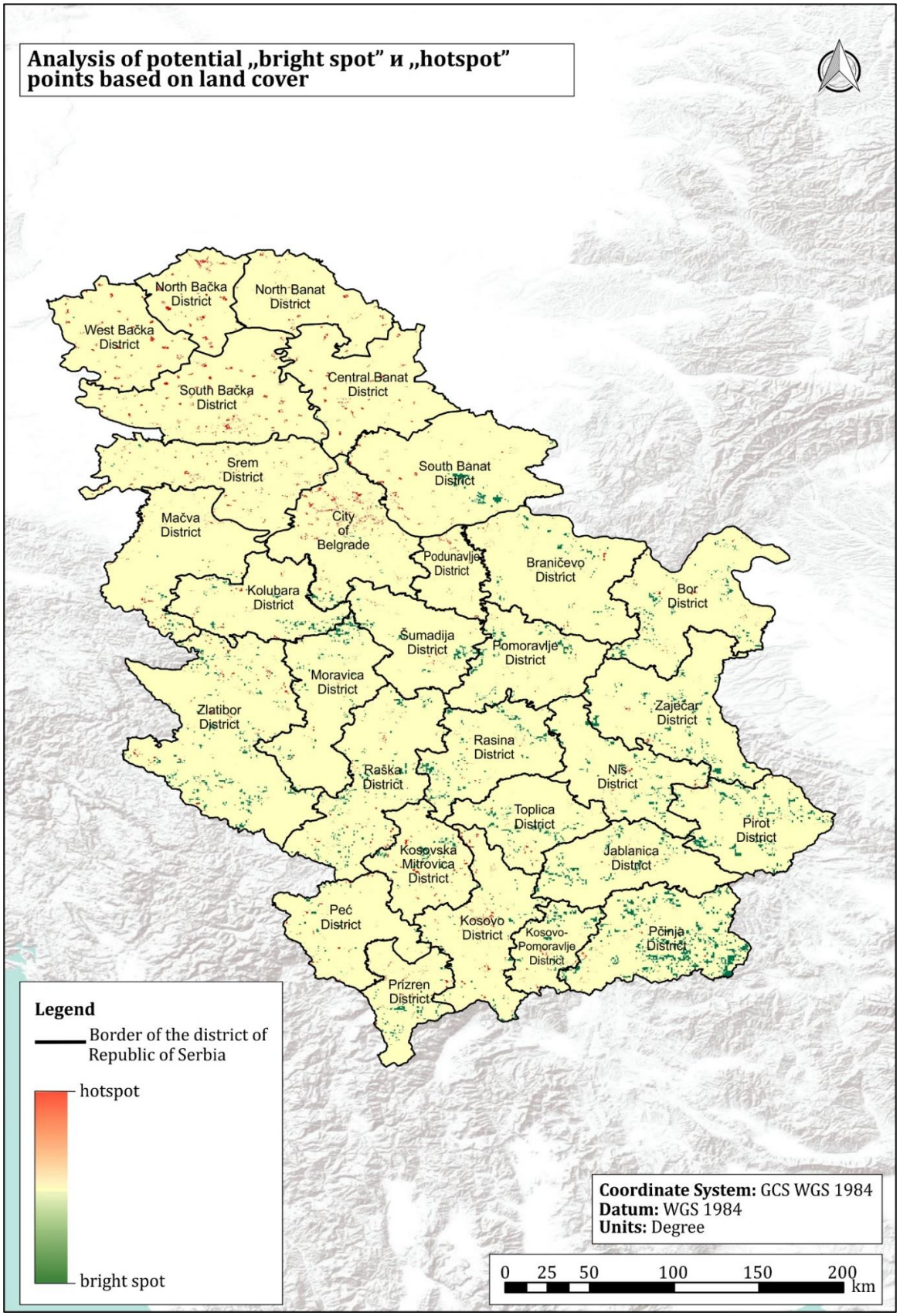

Image 11. Map of potential bright spots and hot spots based on land cover in the territory of the Republic of Serbia (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

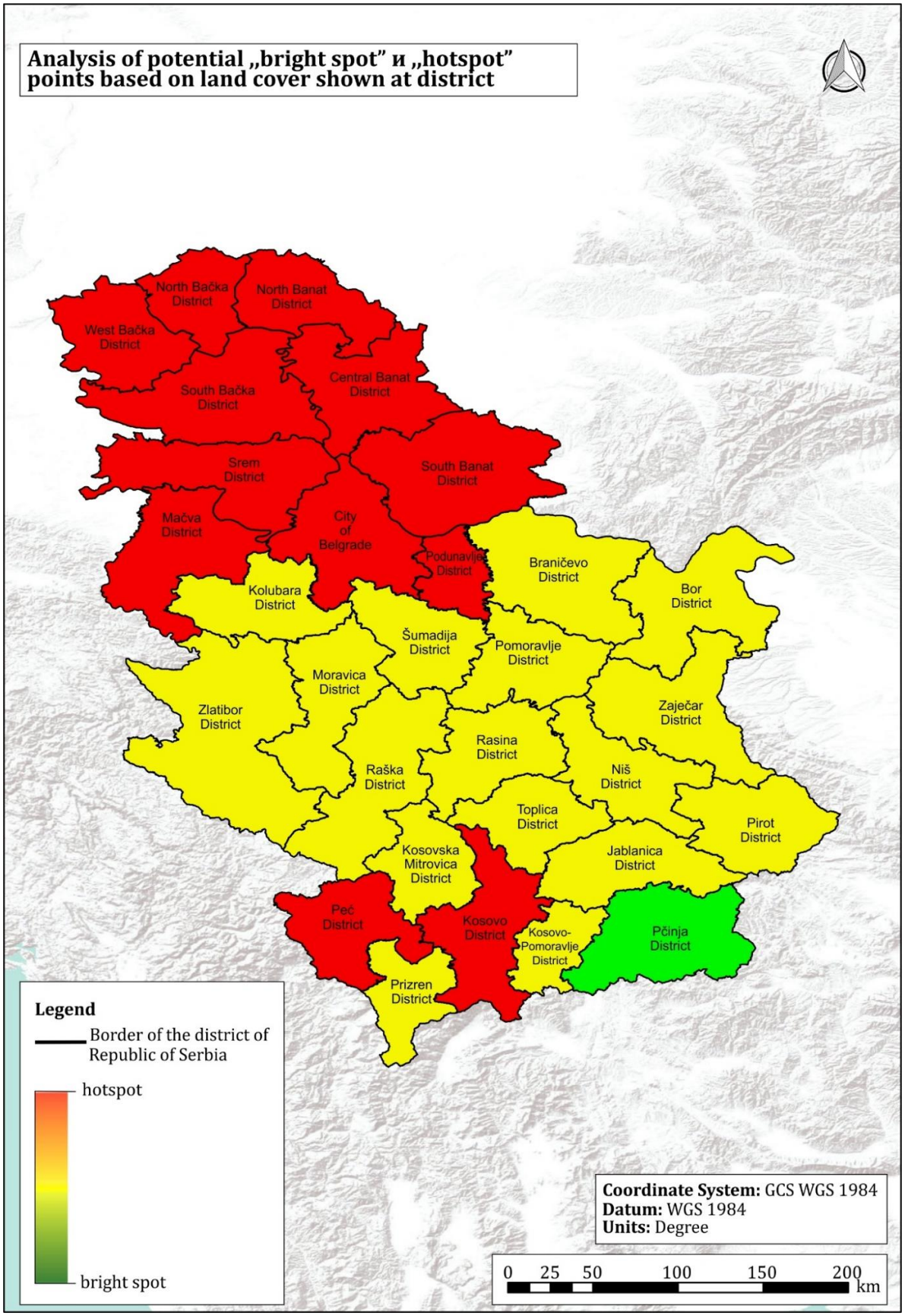

Image 12. Map of potential bright spots and hot spots based on land cover at the level of districts (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

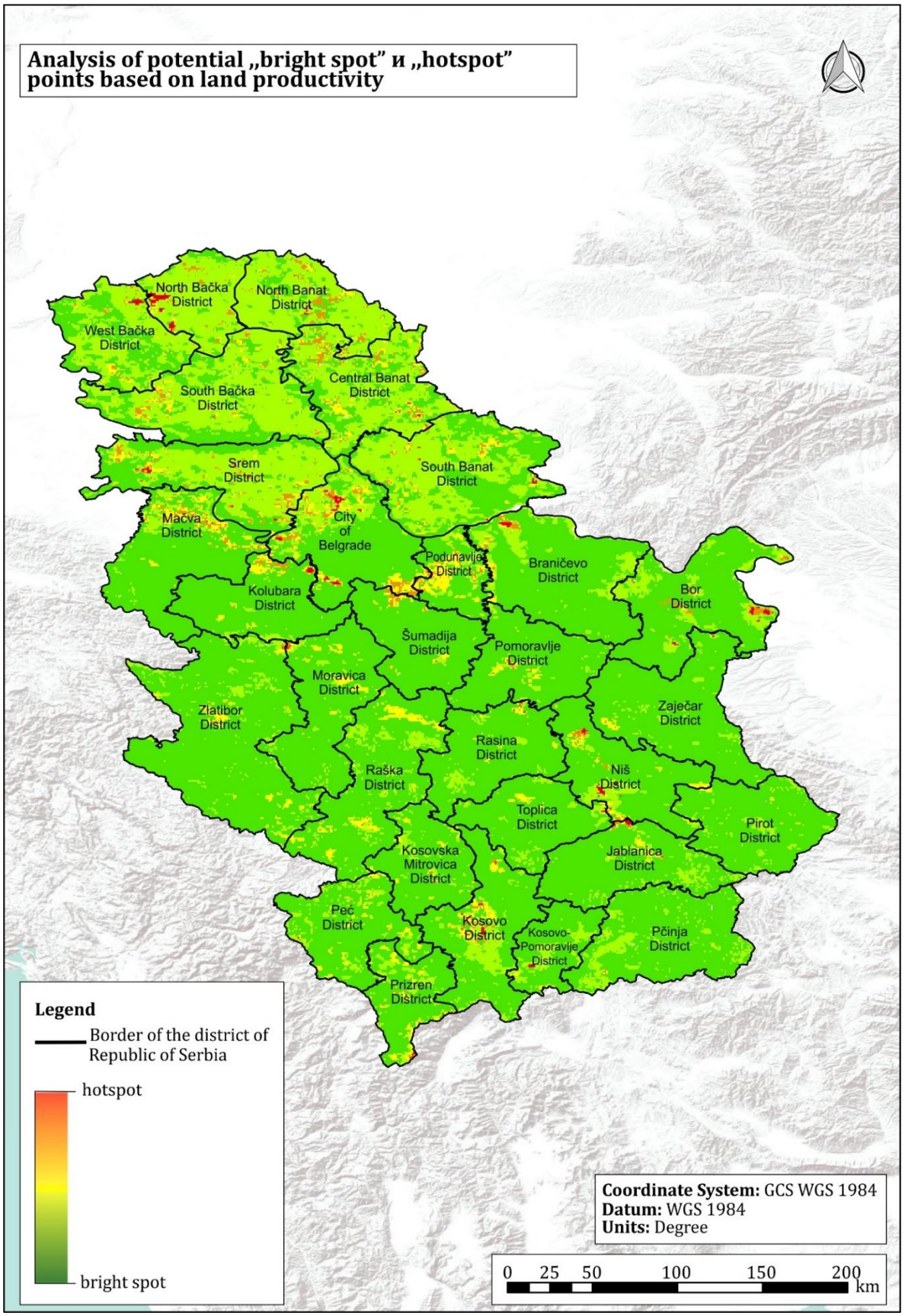

Image 13. Map of potential bright spots and hot spots based on land productivity dynamics in the territory of the Republic of Serbia (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

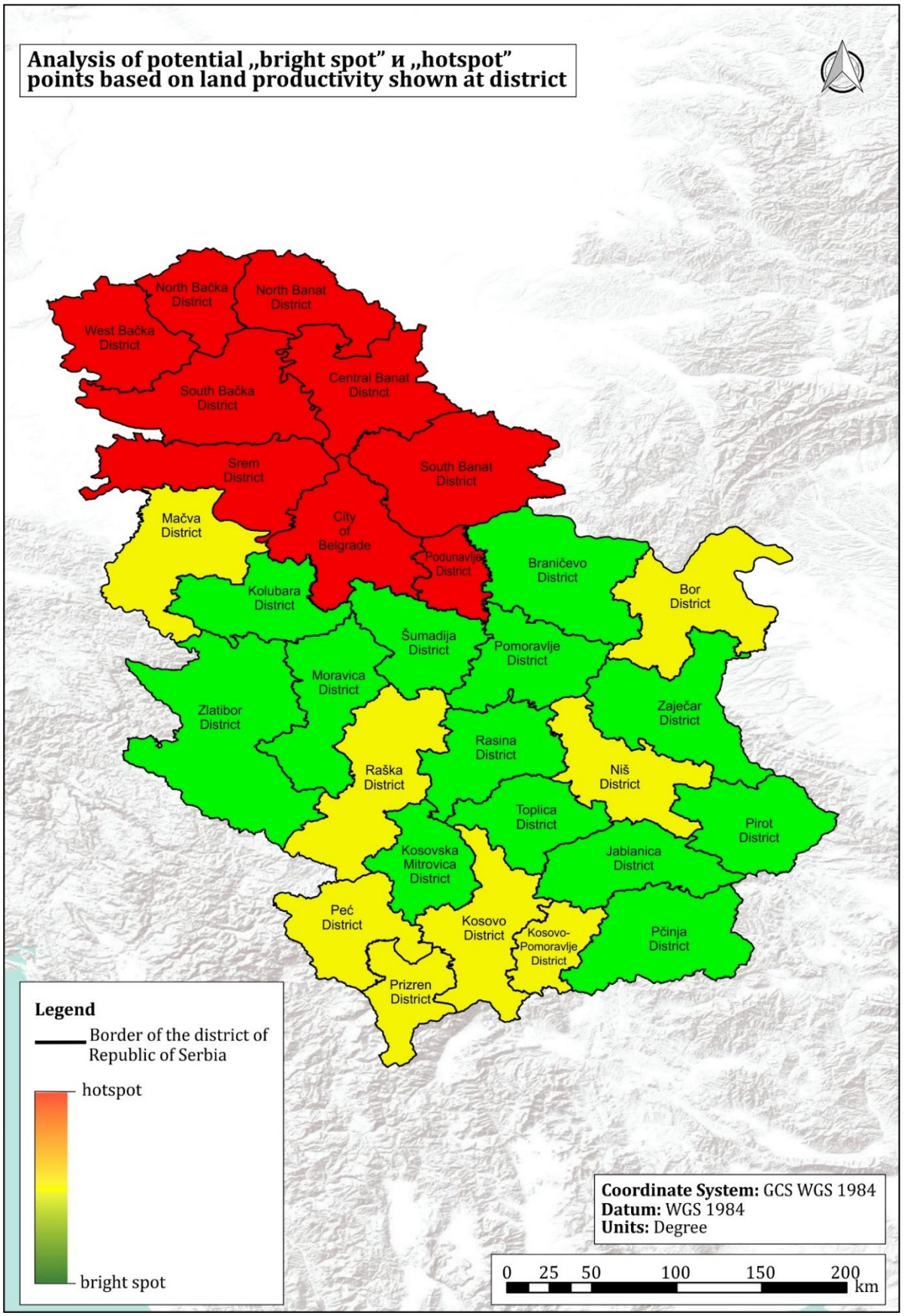

Image 14. Map of potential bright spots and hot spots based on land productivity dynamics at the level of districts (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

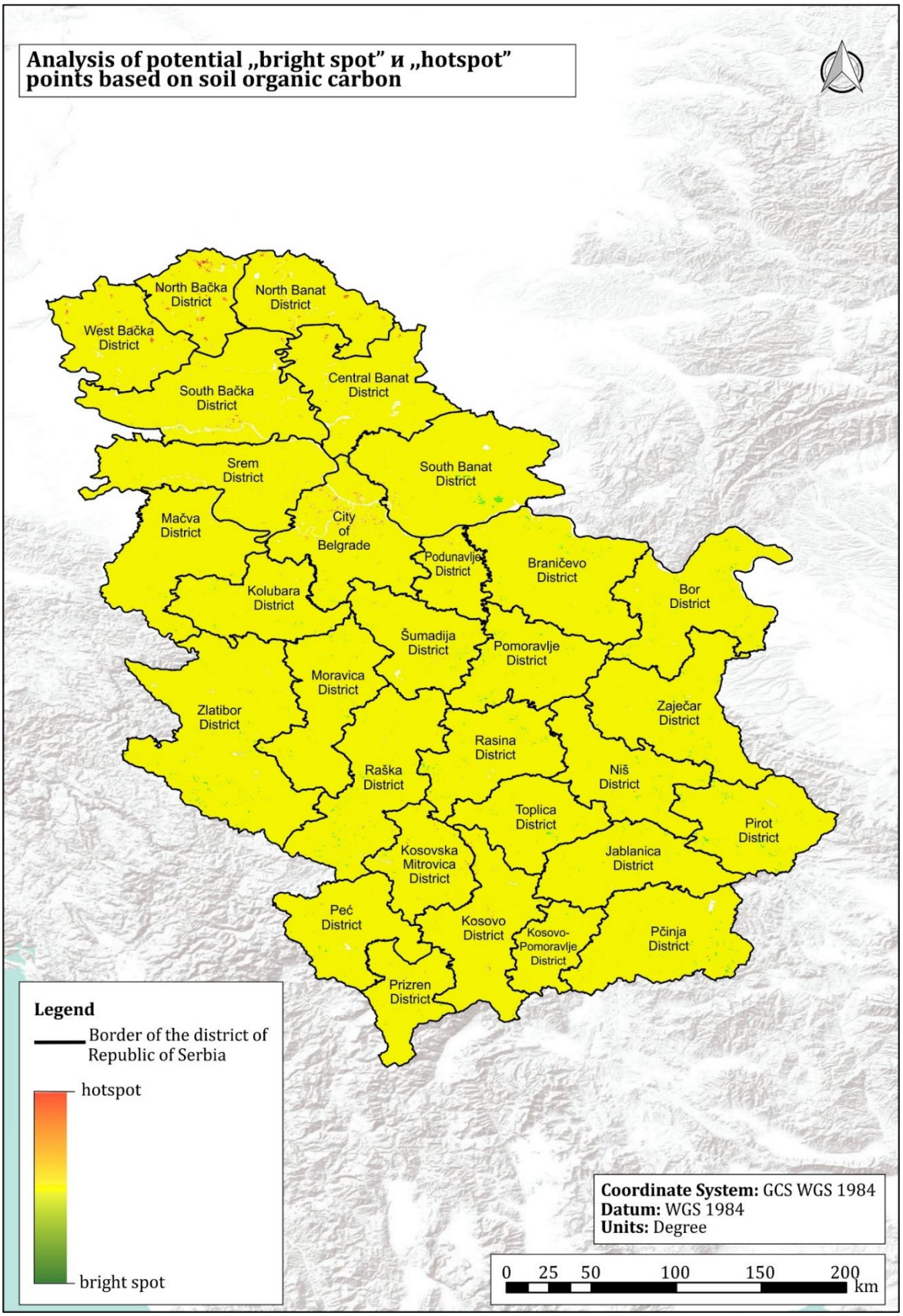

Image 15. Map of potential bright spots and hot spots based on soil organic carbon in the territory of the Republic of Serbia (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

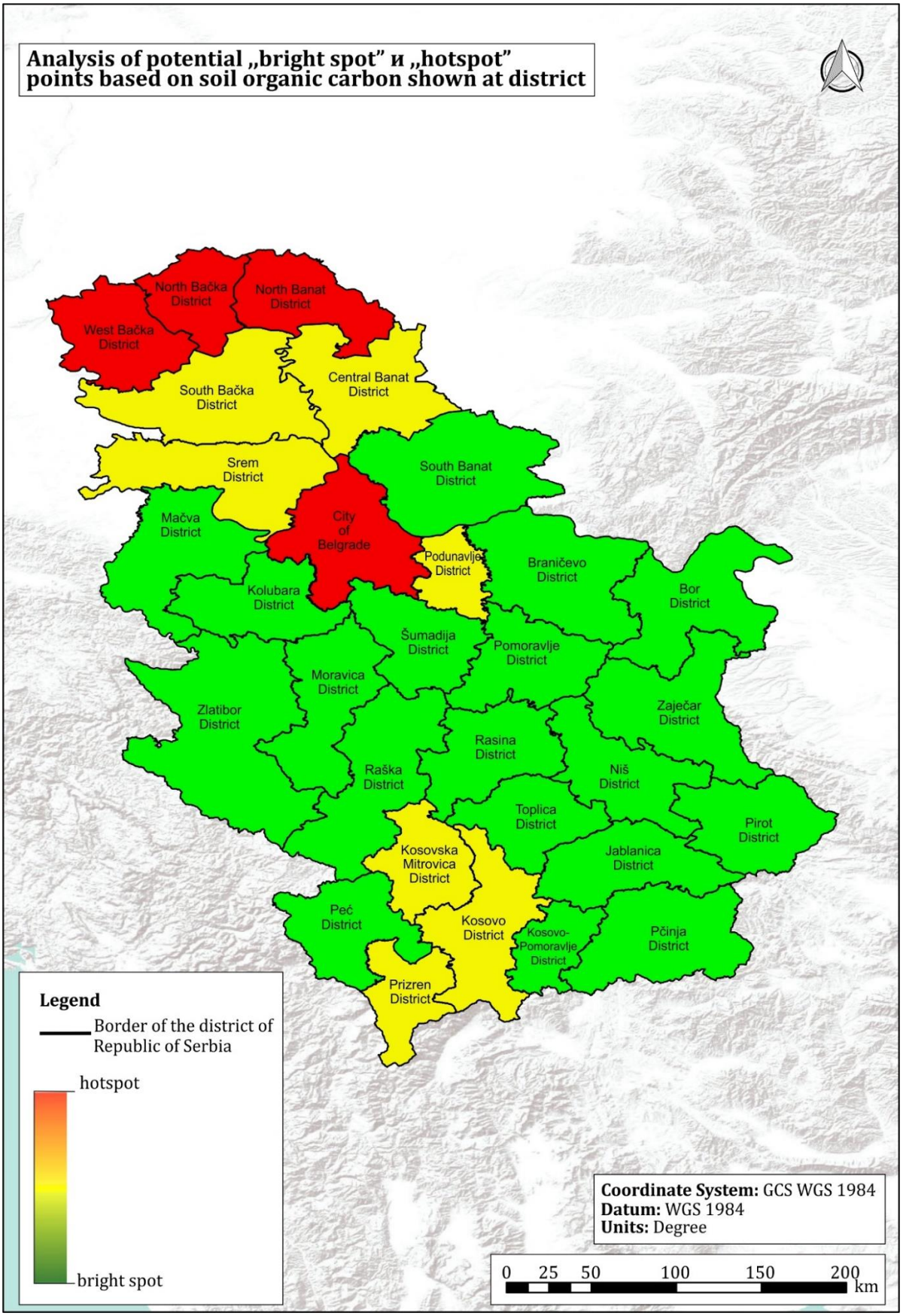

Image 16. Map of potential hot spots based on soil organic carbon stocks in soil at the level of districts (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

8. ASSESSMENT OF THE LAND THAT IS DEGRADED OVER TOTAL LAND AREA AGAINST THE SDG SUBINDICATOR

15.3.1. (Percentage of land that is degraded over total land resources)

At the 13th session of the UNCCD Conference of the Parties, the Strategic Framework to the Convention was adopted for the period from 2018 to 2030, and adequate decisions were made underlying the priority activities of the Convention in the coming period. One of them is to achieve the status of land degradation neutrality by 2030 and improve reporting system about the progress made through the sub-indicator 15.3.1. "Percentage of degraded land and soil of the total area of land resources."

Land degradation neutrality constitutes the core of new strategic framework and Sustainable Development Goal 15.3. SDG Target 15.3.1. is represented by the report in the form of a binary classification (whether an area is degraded or not), based primarily to the greatest extent possible on comparable and standardized national official data sources (UNCCD, 2017b). SDG Indicator 15.3.1 relays on geospatial information and digital data from national, regional and global data sources. Based on this data, it provides information on the identification, scope, spatial reference, display, distribution, and other characteristics of digital geographic data and services.

The results of this indicator are obtained based on calculations and estimates of changes in the three main sub-indicators (land cover, soil productivity and organic carbon stocks). The methodology is designed to be universal, enabling the countries to select the most appropriate datasets and supplement the land degradation calculation with other sub-indicators, data and information. Quantitative assessment and appropriate mapping at the national level, as required by indicator 15.3.1., will help countries to prioritize land management and planning policies, and in particular, to identify hot spots and prepare activities aimed at reducing degradation. In addition to reducing degradation, this indicator also includes conservation, restoration and sustainable management of land resources, as well as addressing future pressures to avoid land degradation.

Calculation of 15.3.1. indicator for the territory of the Republic of Serbia was performed on the basis of three sub-indicators, which were obtained by global data processing. The total land area by degradation categories is presented in the Table 19, while the spatial distribution is shown in Figure 17. According to the Table 19, the total area of degraded land is 5,673 km^2, or 6.47% of the total territory of the RS. Share of stable soil condition amounts to 20.54%, whereas 72.86% pertains the category of the improved soil condition.

Table 19. Degradation category by indicator 15.3.1. (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

Categories of degradation	Area (km^2)	Area (%)
Improved	63,919.33	72.86
Stable	18,017.4	20.54
Degraded	5,673.0	6.47
No data	120	0.14
Total	87,729.82	100.00

Data produced for Target 15.3 („Report on the applied methodology and identification of targets to achieve land degradation neutrality in the Republic of Serbia", 2019.) will be incorporated in the process of national SDG reporting.

The Republic of Serbia is firmly committed to promoting an accelerated implementation of the 2030 Agenda. Within the scope of the *National Sustainable Development Strategy* (2009-2017) and pursuant to the EU accession negotiation process started in 2014, Serbia participated actively on Sustainable Development Goals (SDGs) and the Intergovernmental Committee of Experts on Sustainable Development Financing.

The Inter-Ministerial Working Group for the Implementation of the 2030 Agenda (IMWG) coordinates the work of all Ministries and State institutions. The partnering endeavor of the Secretariat for Public Policy in mapping the National Strategic Framework against the SDGs resulted in the *Serbia and the 2030 Agenda* document. The Statistical Office of the Republic of Serbia diligently maps, produces or collects ***appropriate data*** to credibly measure progress on the SDGs.

The Focus Group of the National Assembly of Serbia for the Development of Control Mechanisms for the Process of Implementation of the SDGs, formed in 2017, initiated the first public hearing on SDGs implementation. The Assembly creates a legal framework and ensures budgeting for the SDGs. Through liaising with local, cross-border, regional and international stakeholders and through inter-parliamentary cooperation, it is becoming the centre stage for public advocacy of the SDGs.

Serbia is striving to end depopulation, reduce inequalities, improve social inclusion and solidarity and empower women and girls to achieve gender equality. Undertaking resolute measures to combat corruption, eradicate poverty and make the transition to a carbon-neutral circular economy to meet the nationally determined contributions under the Paris Agreement, Serbia has gone a long way to enhance the living conditions of everyone, of its youth and future generations first.

Through the broad coordinated network of partners, the mainstreaming of the 2030 Agenda implementation in Serbia evolves through monitoring, reviewing, reporting and following up by the State institutions, local authorities and communities, human rights mechanisms, civil society, social partners, business communities, academia and research community, bilateral

and multilateral development partners within, across, and beyond borders. Sustainable possibilities are thus being created by the whole-of-Government and whole-of-society for everyone everywhere. European integrations are closely linked with the fulfillment of Sustainable development goals of the United Nations through Agenda 2030 which is in the center of the Serbian government's planning politics.

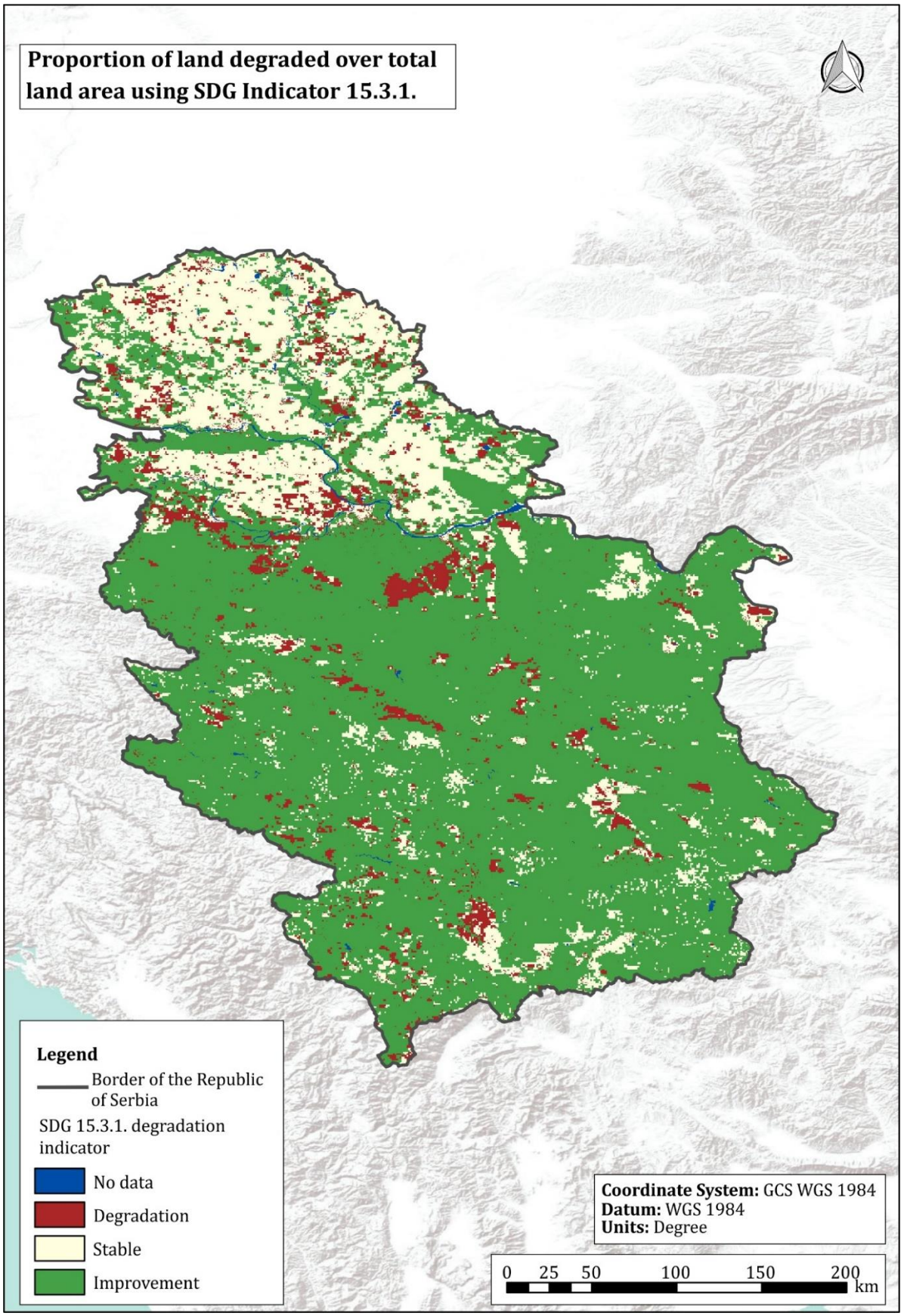

Image 17. Geospatial summary information of soil degradation based on SDG 15.3.1. indicator (Derived based on definitions in the UNCCD Good Practice Guidelines for calculating land degradation neutrality)

9. GOALS TO ACHIEVE LAND DEGRADATION NEUTRALITY BY 2030

Nationwide LDN target:

Reaching land degradation neutrality in the territory of the Republic of Serbia by 2030

Priorities of crate enabling environment to achieve land degradation neutrality by 2030:

1) Recognising elements and targets of land degradation neutrality in legislation, spatial-planning and strategic documents;
2) Improvement, restoration and rehabilitation of degraded areas, implementation of measures of sustainable land management in the Republic of Serbia;
3) Establishment and development of sustainable, systematic land monitoring according to determined national environmental indicators: land use changes; soil organic carbon; land productivity; land erosion;
4) Establishment of appropriate, detailed national databases for the territory of the Republic of Serbia, for the implementation of the LDN methodology;
5) Raising public awareness and the role of education in combating land degradation and droughts.

Associated measures to achieve land degradation neutrality by 2030:

1) To increase the area of national territory under forests to 41.4% by 2050 (Law on the Spatial Plan of the Republic of Serbia);
2) To increase the area under forests in the Autonomous Province of Vojvodina to 14.3% (in relation to the total area of the territory of the AP), primarily by applying the system of forest protection belts[2,3];
3) To increase the level of forest cover in areas under bare and degraded soil, in mountainous areas south of the Sava and Danube Rivers, in the area of 100,000 ha by 2030 so as to control erosion and torrential processes[4];
4) To maintain the determined positive trend of land degradation neutrality, applying appropriate measures and activities, through spatial and planning documentation.

Afforestation measures have a major impact on a range of problems, for which appropriate solutions need to be found: mitigating the effects of climate change in rural and urban areas (increased production in O_2, decrease in $C0_2$ emissions); soil erosion control (more than 70% of the national territory is threatened by erosion processes); protection of watershed areas of water reservoirs that are part of the water supply systems (located in the mountainous area, with a significant share of eroded areas and barren lands, which leads to the filling of the reservoir spaces); prevention of torrential floods, which are associated with erosion processes and represent the most common natural catastrophe in the territory of Serbia; realization of the concept of development of the mountainous region through the agroforestry system; conservation and restoration of biodiversity.

It is of particular importance to increase the forest cover of the Autonomous Province of Vojvodina, which is the lowland granary of Serbia, primarily through the forming of forest belt systems, in order to: protect the soils of eolian erosion in the lowland parts; protect the railway, road and water management infrastructure (water system "Danube-Tisa-Danube"); creating a corridor for biodiversity restoration and ecological network structure. Therefore, afforestation measures are important not only for forestry, but for a whole range of vital activities aimed at restoring ecosystem services, preventing natural hazards and protecting the economic potential of the country, and this is incorporated in Serbia's basic spatial planning and strategic documents.

A common goal is to increase the area of national territory under forests to 41.4% by 2050 (Law on Spatial Plan of the Republic of Serbia from 2010 to 2020, "Official Gazette of the RS", no. 88, 2010). Within that, to increase the level of forest cover in areas under bare and degraded soil, in mountainous areas south of the Sava and Danube Rivers, in the area of 100.000 ha by 2030. so as to control erosion and torrential processes (*Strategy for Water Management in the Territory of the Republic of Serbia*, Institute for Water Management "Jaroslav Černi", Ministry of Agriculture and Environmental Protection, 2015). Also, to increase the area under forests in the Autonomous Province of Vojvodina to 14.3% (in relation to the total area of the territory of the AP), primarily by applying the system of forest protective belts (Regional Spatial Plan of the AP of Vojvodina, Provincial Secretariat for Urbanism, Construction and Environment Protection, 2011).

[2] Regional Spatial Plan of the AP Vojvodina by 2020.

[3] Spatial Plan of the Republic of Serbia from 2010 to 2020

[4] Water Management Strategy of the territory of the Republic of Serbia

10. DIFFERENCES IN THE PERCEPTION OF LDN WITHIN THE CONTEXTS OF BOTH GLOBAL AND NATIONAL DATABASES

Quantitative and spatial expression of individual and synthesis parameters of LDN was performed according to the official UNCCD methodology defined in the document "Default data: methods and interpretation - A guidance document for the 2018 UNCCD reporting", drafted and published by the Secretariat of the Convention in collaboration with their technical partners. The subject document provides the methodology for the preparation of national reports for the reporting needs. In addition, clear guidelines are provided for the use and interpretation of global databases, availability of which is provided to all country Parties to the Convention, in the event that national databases (i) do not exist, (ii) are incomplete or (iii related to the LDN indicators are to be improved.

As noted earlier, **global databases, provided by the ESA, JRC and ISRIC, have been used for the preparation of this report due to the fact that representative national databases relevant to the implementation of the LDN approach have not yet been established.** The results obtained with the use of global databases should be understood as a temporary solution, until the time Serbia forms a representative, publicly accessible collection of national data, with the spatial and temporal attributes necessary to determine LDN parameters. A representative national database should be established on the basis of detailed monitoring, in accordance with a consistent methodology adopted by competent national research institutions.

Despite the use of default global data, it is necessary to emphasize from the aspect of national interests that the **Republic of Serbia is making great efforts to build its own geospatial information databas**e, which can meet the challenges of sustainable management of national resources as well as objective and realistic reporting to global bodies. Using the DPSIR (D - Driving Forces, P - Pressures, S - State, I - Impact, R - Response) theoretical and methodological framework, developed by the European Environmental Agency, the **National List of Environmental Indicators was developed in 2009.** It represents the basic matrix for collecting data on natural and anthropogenic processes that affecting different ways the state of the environment of the Republic of Serbia. Within the thematic unit "land and soil", the Rulebook identifies indicators complementary to the LDN approach:

- (4.27) Land use change;
- (4.28) Soil erosion and
- (4.29) Soil organic carbon.

Land use change shows the result of the change of land cover as a result of planned (changes provided for in the planning documents), unplanned (unplanned activities in space) and natural processes (shifting and succession of vegetation, natural regeneration of forests, etc.) pertaining to the transformation of the territory of the Republic of Serbia. The indicator is calculated by analysing satellite images according to the Corine Land Cover (CLC) methodology and is displayed numerically, tabularly and graphically in hectares or square kilometres, over a period of time. For the territory of the Republic of Serbia, this database is available for the following time sections (years): 1990 (incomplete database due to lack of data for the Autonomous Province of Kosovo and Metohija), 2000, 2006, 2012 and 2018. The primary database, which can be considered as the base condition of the land cover, was determined based on satellite images from 2000 made for the entire territory of the Republic of Serbia. Satellite images that represent the condition of land cover in 1990, but without the territory of the Autonomous Province of Kosovo and Metohija, were retrospectively processed, so that this situation cannot be considered complete and relevant from the point of view of comparing 1990-2000 time sections at national level. In the following decades, land cover bases were developed according to the same (CLC) methodology for 2006, 2012 and 2018, which were based on the identification of structural changes since 2000. Data on the change of land cover based on CLC data is, inter alia, published in the Reports on the Land Conditions issued by the ministry responsible for the environment. This data was prepared by the Environmental Protection Agency, which is the competent institution for the collection of environmental data. Data on this indicator are for the time being published in the reports for the following periods 2006-2008, 2011, 2012, 2013, 2015 and 2016-2017. Although very significant as an environmental indicator, the CLC base does not have the appropriate frequency of time sections necessary to calculate the first LDN indicator. Given that it was decided to analyse the trend of change of indicators in the 2000-2015 interval, the existing three CLC base time sections (2000, 2006 and 2012) are not adequate for the use of the recommended methodology by the Convention. In addition, a clear or generally accepted method of converting the CLC nomenclature, which has 44 types of land use, in the FAO classification system (Land Cover Classification System - LCCS), which with a view of getting the baseline and conclusions, combines 22 original classes via six major categories of land cover has yet not been identified.

The soil erosion indicator shows the intensity of development of erosion processes through the calculation of land losses expressed in t / ha / year of eroded material. The parameter is expressed through the presence of real (current) erosion production and as a potential risk of this form of physical degradation of land area. Empirical erosion models are used for the spatial and quantitative expression of this parameter. The LDN concept does not explicitly recognize land erosion as one of the global indicators of land

degradation. However, the UNCCD Convention and its Technical Guidelines suggest the use of additional national indicators that can indicate land degradation processes. In that sense, the Republic of Serbia is in a significant advantage as land erosion is recognized in its legislations as a national indicator of environmental quality. Unfortunately, in recent decades, there has been no systematic research that would result in a complete information database on erosion processes in the territory of the Republic of Serbia.

An indicator relating to the soil organic carbon (SOC) indicates to the importance of preserving the natural content of organic matters in productive soil. In most cases, declining organic matter content indicates to the processes of reduced soil productivity. Although recognized as a national indicator of the state of the environment, no systematic assessment of the amount of organic matter in different types of land and soils and different types of land cover has been made in the territory of the Republic of Serbia. Despite this fact, as of 2011, the Environmental Protection Agency shows, in its reports on the state of the soil in the Republic of Serbia, the trend of change of organic matter in the soil on the basis of information resulting from scientific or economic researches. The quantitative values of soil organic carbon are mainly the result of fertility control, which is implemented through authorized agricultural expert services. The analyses cover agricultural land and data is available both for the territory of the Autonomous Province of Vojvodina and for the territory of Central Serbia. Unfortunately, existing national data on soil organic carbon is not available for the entire territory of the Republic of Serbia, so a global database was used to calculate the change in SOC. It is important to emphasize that the values of soil organic carbon obtained by national researches made in parts of the territory of the Republic of Serbia deviate from the information on changes obtained by the analysis of global databases. According to the latest report on the condition of soil in the Republic of Serbia (review and assessment of soil condition for 2016 and 2017), the average soils organic carbon is 1.79%, which belongs to the low content category. In addition, the latest results from the analysis of the fertility of agricultural land show that the highest number of samples (more than 60%) have a low soil organic carbon. A list of the realized scientific and professional activities related to the assessment of soil organic carbon is given in the second part of the chapter Literature (11).

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ANNEX I

Members of the National Working Group for the implementation of activities related to the process of "Land Degradation Neutrality (LDN) target setting" of the United Nations Convention to Combat Desertification participated in the process of identifying the goals for the establishment of LDN targets in the Republic of Serbia.

1. Ana Repac, Advisor, Climate Change Department, person responsible for the implementation of the United Nations Convention to Combat Desertification at National Level, Ministry of Environmental Protection - Chairman of the Special Working Group;
2. Slobodan Cvetković, Head of the Land Protection and Renewable Resources Group, Ministry of Environmental Protection, Member;
3. Snežana Kuzmanović, Independent Advisor, Ministry of Environmental Protection, member
4. Anđela Jović Anđelković, Independent Advisor, Division for Sustainable Development and Climate Change, Ministry of Mining and Energy, member
5. Andrej Pavlović, Advisor, Section of Geological Research, Ministry of Mining and Energy, member
6. Olivera Radojičić, Sector for Spatial Planning and Urbanism, Ministry of Construction, Transportation and Infrastructure, member,
7. Zoran Knežević, Head of the Department for the Establishment and Management over the Integrated Management and Control System, Agrarian Paying Agency, Ministry of Agriculture, forestry and water management, member;
8. Svetlana Stankov, Head of the Group for Protection and Development of Agricultural Land, Directorate for Agricultural Land, Ministry of Agriculture, forestry and water management, member;
9. Predrag Jović, Independent Advisor, Forest Directorate, Ministry of Agriculture, forestry and water management, member;
10. Dragana Vidojević, Head of the Section for Indicators and Reporting, Sector for Environment, Environmental Protection Agency, member,
11. Slavica Radovanović, Head of the Section for Operational Agro-meteorology and Drought Monitoring, Republic Hydro-meteorological Institute, member
12. Biljana Milić-Petrović, Chief Analyst for Climate Change and Risk Assessment Methodology, Republic Hydro-meteorological Institute, member
13. Neda Cukavac, Group for Environmental Statistics, Statistical Office of the Republic of Serbia, member
14. Dragica Pajić, position for design and control of content collection of the basic Topographic Model and spatial databases, Republic Geodetic Authority, member
15. Milica Curović, Public Investment Management Office, member
16. Aleksandar Bogunović, Deputy Director of the Sector for Agriculture, Serbian Chamber of Commerce and Industry, member
17. Ljubinka Kaluđerović, Secretary of the Board for Environment and Emergencies, Standing Conference of Towns and Municipalities, member
18. Milivoj Belić, Professor, Faculty of Agriculture, University of Novi Sad, member

19. Aleksandar Đorđević, Professor, Faculty of Agriculture, University of Belgrade, member
20. Ljubomir Životić, Assistant Professor, Faculty of Agriculture, University of Belgrade, member
21. Siniša Polovina, Assistant Professor, University in Belgrade, Faculty of Forestry, member
22. Aleksandra Stanojković-Sebić, Senior Research Associate, Land Institute, member
23. Jovica Vasin, Head of Accredited Laboratory for Soil and Agroecology, Institute of Vegetable and Crop Growing, member,
24. Saša Eremija, Research Associate, Forestry Institute, member
25. Gordana Grujić, Oaza, member
26. Dragana Ranđelović, Association of young researchers Bor, member

ANNEX II

NATIONAL WORKING GROUP WORKSHOPS

Belgrade, Serbia, April 21, 2017

Aranđelovac, Serbia, June 1-2, 2017

Zemun, Serbia, August 30, 2017