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# GUIDE FOR SUSTAINABLE LAND MANAGEMENT AT THE LOCAL LEVEL IN THE REPUBLIC OF SERBIA

Belgrade, 2019

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# FOREWORD BY UN ENVIRONMENT

As a valuable and non-renewable natural resource that takes a moment to destroy and a lifetime to replenish, soil is nowadays facing unprecedented stress caused by serious degradation, deforestation, urbanization and climate change. These and other factors compromise the multiple roles that soil has, from the functioning of ecosystems to conserving biodiversity, providing a range of biophysical and socioeconomic goods and services, to ensuring food security.

Nevertheless, soil degradation does occur and often goes unnoticed. Drawing attention of individuals and societies to responsible and sustainable land management practices is therefore of central importance. With the aim to address this global environmental challenge and as an urgent call for action by all countries, the UN's 2030 Agenda for Sustainable Development has set a specific goal to protect, restore and promote sustainable use or terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss.

This Guide comes as one of the numerous results of the project "*Enhanced Cross-Sectoral Land Management through Land Use Pressure Reduction and Planning*" in the Republic of Serbia, which is implemented by UN Environment in cooperation with the Ministry of Environmental Protection and the Serbian Environmental Protection Agency (SEPA) and funded by the Global Environment Facility with the expert and financial support of the Italian Ministry of the Environment, Land and Sea. In addition to national capacities, the Project has enabled the strengthening of local capacities through targeted training sessions aimed at the use and submission of data to the Cadaster of Contaminated Sites managed by SEPA. Furthermore, I expect that local self-governments will benefit from the results of preliminary investigation at 32 contaminated sites, as well as two Site Characterisation Plans that provide instructions for detailed investigation prior to remediation efforts.

Following the collaborative effort of numerous expert institutions in achieving mentioned project results, this Guide aims to further inform and support local authorities, decision-makers and other stakeholders involved in agriculture, environmental management and sustainable development at the local level in producing a systematic and integrated response to an effective and sustainable land management.

I strongly encourage the use of this Guide, hoping that it will make a difference and help produce beneficial, far-reaching and long-term changes in applying sound land management practices.

*Bruno Pozzi*
***Director***
***UN Environment Europe Office***

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# FOREWORD

The global community is nowadays facing considerable challenges: climate change, accelerated human population growth, expansion of urban areas and environmental degradation. In many parts of Europe, land resources have been overexploited and irreversibly depleted due to inadequate management, industrial activity and intensive farming practices, which leads to further pollution of the soil, erosion and loss of organic matter.

Sustainable Development Goals (SDGs) identify the need to restore degraded land and improve overall state of soil. Sustainable land management contributes to the increase in food production and nutritional value of food, as well as climate change adaptation and mitigation. In a rapidly changing world, when urgent measures are required to eliminate hunger, erosion, ensure food security and soil protection, raising awareness on the significance of these issues and achieving sustainable land management have never been more important.

Sustainable land management at the local level is achieved by applying scientific knowledge, rules of the profession, fulfillment of legal competencies and responsibilities, as well as the objectives and recommendations set out in strategic documents. The goals are achieved through joint initiatives, cross-sectoral cooperation and, above all, responsible behavior of the community and individuals.

I expect that the *Guide for Sustainable Land Management at the Local Level in the Republic of Serbia* will provide guidelines to the competent authorities and relevant institutions in municipalities and cities with the aim of establishing a land management system and thus make a significant contribution to the sustainability of local communities and our country and society as a whole.

*Goran Trivan*
***Minister of Environmental Protection***

Republic of Serbia
MINISTRY OF
ENVIRONMENTAL PROTECTION

# ABOUT THE GUIDE

*The Guide for sustainable land management at the local level in the Republic of Serbia* was prepared within the project titled "*Enhanced Cross-Sectoral Land Management through Land Use Pressure Reduction and Planning*" (hereinafter: the Project) as an initiative to undertake urgent and comprehensive measures to conserve land in the territory of the Republic of Serbia, by encouraging the transfer of science and technology, strengthening institutional capacities, developing partnership for joint actions and raising awareness on integral and sustainable land management.

The purpose of the Project is the development of instruments and mechanisms for integrated land use management and remediation, while developing capacities and providing support in reducing pressures on land as a natural resource and prevent its further degradation. The Project has been funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UN Environment) via Programme Office in Vienna, in cooperation with the Ministry of Environmental Protection of the Republic of Serbia.

*The Guide for sustainable land management at the local level in the Republic of Serbia* was prepared by regional non-governmental network **fea**, established in 2007, aiming at the enhancement of the environment and forests in the Republic of Serbia and the region. The basis for the Guide was the extensive *Analysis of Sustainable Land Management in the Republic of Serbia* (hereinafter: the Analysis) produced in 2016. The Analysis included overview of literature, legal and institutional framework, public policies in the European Union and the Republic of Serbia, recognising stakeholders, similar projects and locations of great importance for the nature, analysis of current land use in the Republic of Serbia, while applying DPSIR model (*Driving Forces – Pressures – State – Impact – Responses*) and information collected in consultation with stakeholders throughout the Republic of Serbia. Consultations with stakeholders were carried out between August and December 2016. Three methods of data collection were used: semi-structured interviews, pilot focus groups and bilateral meetings. Semi-structured interviews were used with the following stakeholders: representatives of local self-governments, experts and representatives of science and research institutions and civil society organisations. There were the total of 65 persons interviewed (36 representatives of local self-governments, 15 experts, 7 representatives of civil society organisations and 7 key individuals). Research was carried out in the following local self-governments: Apatin, Bač, Beočin, Novi Sad, Srbobran, Sremski Karlovci, Žabalj, Kikinda, Zrenjanin, Ruma, Sremska Mitrovica, Bor, Kladovo, Majdanpek, Boljevac, Velika Plana, Veliko Gradište, Ljubovija, Mali Zvornik, Šabac, Paraćin, Rača, Gornji Milanovac, Ivanjica, Prijepolje, Kruševac, Trstenik, Kraljevo, Novi Pazar, Leskovac, Vladičin Han, Čačak, Kostolac, Kragujevac, Negotin and Svilajnac. Pilot focus groups were organised in the following local self-governments: Bor, Kruševac, Trstenik, Kraljevo, Zrenjanin, Kikinda, Novi Sad and Obrenovac.

Special thanks goes for comments and suggestions which considerably contributed to the improvement of the *Guide for sustainable land management at the local level in the Republic of Serbia* to the following members of inter-disciplinary expert group: (a) Hristina Radovanović–Jovin, MSc, on behalf of Provincial Secretariat for Urban Planning and Environmental Protection, (b) Dragana Vidojević, PhD, on behalf of the Environmental Protection Agency, (c) Božidar Đokić, PhD, on behalf of the Geological Institute of Serbia, (d) Radmila Pivić, PhD, on behalf of the Soil Institute, Belgrade, (e) Jordana Ninkov, PhD, and Milorad Živanov on behalf of the Institute of Field and Vegetable Crops, Novi Sad, as well as (f) Ana Repac on behalf of the Ministry of Environmental Protection.

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# LIST OF ABBREVIATIONS/ACRONYMS:

| | |
|---|---|
| **ASAP** | Anomaly hot Spots of Agricultural Production |
| **CA** | Conservation Agriculture |
| **CLC** | Corine Land Cover |
| **COP** | Conference of Parties - COP |
| **DDT** | Dichloro Diphenyl Trichloroethane |
| **DPSIR** | Driving forces – Pressures – State – Impacts – Responses |
| **Eionet** | European Environment Information and Observation Network |
| **EEA** | European Environment Agency |
| **EU** | European Union |
| **FAO** | Food and Agriculture Organization of the United Nations |
| **GAP** | Good Agriculture Practice |
| **GEF** | Global Environment Facility |
| **GIS** | Geographic Information System |
| **GIZ** | German Organisation for International Cooperation |
| **IARC** | International Agency for Research on Cancer |
| **IFOAM** | International Federation of Organic Agriculture Movements |
| **ISFM** | Integrated Soil Fertility Management |
| **IUCN** | International Union for Conservation of Nature |
| **JRC** | Joint Research Centre |
| **LDN** | Land Degradation Neutrality |

| | |
|---|---|
| **LPIS** | Land Parcel Identification System |
| **LSG** | Local self-government |
| **MASIS** | Macedonian Information System on Soil |
| **MDGs** | Millennium Development Goals |
| **PCB** | Polychlorinated Biphenyls |
| **RGAP** | Rules of Good Agriculture Practice |
| **RS** | Republic of Serbia |
| **RSD** | Serbian Dinar |
| **SDGs** | Sustainable Development Goals |
| **SEPA** | Serbian Environmental Protection Agency |
| **SLM** | Sustainable Land Management |
| **SMEs** | Small and Medium Enterprises |
| **SWOT** | Strengths, Weaknesses, Opportunities, Threats |
| **TPP** | Thermal Power Plant |
| **UN** | United Nations |
| **UNCCD** | United Nations Convention to Combat Desertification |
| **UNDP** | United Nations Development Programme |
| **UN Environment** | United Nations Environment Programme |
| **USD** | United States Dollar |

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# DEFINITIONS OF KEY TERMS

**Agroforestry[1]:** a collective name for land use systems and practices in which woody perennials are deliberately integrated with agricultural crops and/or livestock for a variety of benefits and services.

**Biodiversity[2]:** the totality of genes, species and ecosystems on Earth or another clearly defined area.

**Descendent (downward) movement[3]:** gravity water movement downward, primarily through wide non-capillary pores.

**Eutrophication[4]:** the process of enriching an environment with nutrients; in ecology: form of polluting water ecosystems by deposition of nutrients, originating mainly from agricultural activities.

**Indicators of soil quality[5]:** indicators of state and degree of change in soil caused by natural and anthropogenic interference.

**Cadastre of contaminated sites[3]:** a set of relevant data on threatened, polluted and degraded land areas.

**Contaminated sites[6]:** sites where the presence of hazardous and noxious substances is confirmed, caused by human activity, in concentrations that may cause significant risk to human health and environment.

**Conservation agriculture[7]:** approach to managing agro-ecosystems for enhanced and sustainable productivity, increased profit and ensuring food safety, while maintaining and improving resource base and the state of environment.

**Local network[8]:** spatially positioned soil sampling measurement points for the purpose of monitoring of autonomous province and local self-governments.

[1]Liniger, H.P., R. Mekdaschi Studer, C. Hauert and M. Gurtner. 2011. Sustainable Land Management in Practice – Guidelines and Best Practices for Sub-Saharan Africa. TerrAfrica, World Overview of Conservation Approaches and Technologies (WOCAT) and Food and Agriculture Organization of the United Nations (FAO)
[2]Law on the Protection of Nature (*Official Gazette of the RS*, no. 36/2009, 88/2010, 31/2010 – correction, and 14/2016)
[3]Source: https://documents.tips/documents/voda-u-tlu.html (accessed: 20.5.2017)
[4]Source: http://baltazar.izor.hr/azopub/indikatori_podaci_sel_detalji2?p_ind_br=4K03&p_godina=2010 (accessed: 20.5.2017)
[5]Law on Soil Protection (*Official Gazette of the RS, no.* 112/2015)
[6]Regulation on Programme of systemic monitoring of soil quality, indicators for assessment of risk from land degradation and methodology for developing remediation programmes (*Official Gazette of the RS, no. 88/2010)*
[7]FAO, 2015
[8]Law on Soil Protection (*Official Gazette of the RS, no.* 112/2015)

**Land degradation neutrality[9]:** a term indicating that soil quantity degraded annually may not exceed soil quantity recovering from degradation.

**Land management[10]:** a set of measures and activities accomplished by planning the preservation of quality and environmental functions of land in line with requirements, purpose, use and measures of soil protection and environment.

**Sustainable land management[11]:** system of land management combining technologies, public policies and activities aimed at integrating socio-economic principles with environmental concern.

**Organic production[12]:** production of agricultural and other products based on applying the method of organic production at all production stages, which excludes the use of genetically modified organisms and products composed thereof, or obtained therefrom, as well as the use of ionising radiation.

**Waste[13]:** any substance or object which the holder discards or intends or is required to discard.

**Pastoralism[14]:** extensive livestock production with grazing, mainly applied in dry and semi-dry areas.

**Natural disasters[15]:** an event of hydro-meteorological, geological or biological origin caused by force of nature, such as: earthquake, flood, torrent, storm, heavy rain, atmospheric discharge, hail, drought, landslides or land subsidence, avalanches and snow drifts, extremes of temperature, accumulation of ice on the watercourse, epidemics, outbreaks of animal diseases and pest occurrence and other natural occurrences of large scale which may endanger health and life of people or cause large damage; processes in atmosphere, soil or water that may harm people, property or other parts of environment.

[9]Source: http://www.un.org/sustainabledevelopment/biodiversity/ (accessed: 20.5.2017)
[10]Law on Soil Protection (*Official Gazette of the RS, no.* 112/2015
[11]Source: http://www.fao.org/docrep/T1079E/t1079e04.htm (accessed: 20.5.2017)
[12]Law on Organic Production (*Official Gazette of the RS, no.* 30/2010)
[13]Law on Waste Management (*Official Gazette of the RS, no.* 36/2009, 88/2010 and 14/2016)
[14]Liniger, H.P., R. Mekdaschi Studer, C. Hauert and M. Gurtner, op.cit, p. 156.
[15]Law on Emergency Situations (*Official Gazette of the RS, no.* 111/2009, 92/2011 and 93/2012)

**Buffering capacity of soil[16]:** the capacity of the soil to resist sudden pH change or pollution during the introduction of various substances in the soil (planned – by agro-technical and reclamation measures, or unplanned – by pollution).

**Contaminated soil[17]:** soil in which concentration of noxious and hazardous substances is above border values.

**Soil contamination[18]:** disposition and introduction of noxious and hazardous substances on the surface soil and into the soil caused by human activity or natural processes.

**Protected areas[19]:** areas with expressed geological, biological, eco-systemic and/or landscape diversity and thus proclaimed as protected areas of general interest under a document on the protection.

[16]Law on Soil Protection (*Official Gazette of the RS, no.* 112/2015)
[17]Idem.
[18]Idem.
[19]Law on Nature Protection (*Official Gazette of the RS, no.* 36/2009, 88/2010, 31/2010 – correction, and 14/2016)

# 1.

# INTRODUCTION

## 1.1 Purpose of the Guide

Soil is defined as the top layer of the Earth's crust (lithosphere) modified to a greater or lesser extent by hydrosphere, atmosphere and biosphere. It is made up of mineral particles, water, air and organic matter, including micro- and macroorganisms. Soil is structurally, chemically and mineralogically heterogeneous. The reason is of geogenic and/or anthropogenic nature. Geological substratum on which the soil is developed considerably affects its structure, mineralogical and chemical composition. Soil consists of fragments of rocks and humus, generated by decay of organic matter. There are three horizons standing out in the vertical profile:

**A:** eluviation, the top part of which contains considerable organic component and where chemical degradation is most pronounced;
**B:** illuvium or zone of accumulation;
**C:** horizon of alteration of mainly physical nature, depositing different fractions as products of rock decomposition.

Soil is the main natural, limited and non-renewable but equally complex, living and changeable resource, performing many functions important for humans, such as production of food and biomass, storing, filtering and transformation of substances, including water, nitrogen and carbon (also known as ecosystem services [20]).[21] Therefore, a soil is a medium with which human beings most directly interact. It represents a dynamic system constantly changing and permanently exchanging substances with surrounding geospheres.

It is evident that, apart from food production, soil has other purposes as well, such as: construction of settlements, industrial plants, roads, exploitation of raw materials, waste disposal, etc. As a consequence of increasingly intensive urbanisation, industrialisation and exploitation, land resources are continuously damaged and destroyed globally, including many parts of Europe. The greatest pressures on soil in the Republic of Serbia are due to: erosion, landslides, organic matter depletion, pollution and changes in type of land use.

*It is estimated that erosion processes of different degrees of intensity are present in over 80% of territory of the Republic of Serbia.*[22]

[20]Types of ecosystem services and soil functions mentioned in the definition may be elaborated as: supporting services including primary production, nutrient cycling and soil forming; provisioning services including production of food and fibres; provisioning of fuel, wood and water; provisioning of raw soil material; provisioning of surface stability; provisioning of habitats and genetic resources; regulating services include regulation of aspects such as water supply and its quality, carbon sequestration, microclimate regulation, flood and erosion control; cultural services include aesthetic and cultural benefits induced from the land use.
[21]Source: http://www.fao.org/soils-2015/news/news-detail/en/c/275770/ (accessed: 20.9.2017)
[22]Ristić R., Kostadinov S., Abolmasov B., Dragićević S., Trivan G., Radić B., Trifunović M., Radosavljević Z. (2012). Torrential floods and town and country planning in Serbia. Nat. Hazards Earth Syst. Sci., 23–35.

Land degradation is the consequence of applying unsustainable practices of land management, and therefore globally, but also specifically in the Republic of Serbia, it represents a threat to environment, human population, and particularly the part of the population whose existence depends on agricultural production. In addition, excessive exploitation and disturbance of soil quality are also problematic, which is additionally aggravated by negative impact of climate change. As a consequence of such processes, availability of natural resources and their productivity are reduced, which directly threatens provisioning of food and increases poverty rate. Further loss of productive soil will increase instability of food/price ratio and lead millions of people globally to poverty. Failure to recognise these facts is one of the major causes of irresponsible relation to this extremely important resource.

As a response to indicated problems and challenges, the focus is on paradigms of sustainable development, in general, and sustainable land use, specifically. Sustainable land management increases average productivity, reduces season fluctuations in yield, provides support to diverse production and increases income. The main focus of sustainable land management are the people taking care of the land for current and future generations. The main motivation for sustainable land management is human coexistence with nature on a long-term basis (WOCAT, 2011). Careful land management not only ensures sustainable agriculture but also provides a precious mechanism for mitigating effects of climate change, and path for safeguarding ecosystem services. The sustainable land use is defined in line with Principle 3 of revised World Charter (FAO, 2017): "Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity".

The United Nations Convention to Combat Desertification (UNCCD) represents the global response to desertification problems. The main goal of the UNCCD is to combat desertification and mitigate consequences of drought, with a focus on preventive measures (prevention and/or mitigation of land degradation), restoration of partly degraded land and reclamation of soil affected by desertification.

The purpose of the Guide is to raise awareness of values of soil and promote sustainable land management, which includes all activities regarding management of land and natural resources required for meeting political and social goals and achieving sustainable development at all levels. Long-term perspective of efficient management of natural resources requires synergy of action (inter-disciplinary approach of technical, biotechnical, natural and social sciences) at different levels of management, with particular focus on local level.

Land management at the local level means management of type of use and property over land in cities and municipalities. The main goals in doing so are: (a) to use available resources in the most rational manner, (b) to give positive impulses to economic development, (c) to protect environment and, at the same time, (d) to achieve social balance of development. Successful achievement of the goals means identifying proper planning and management instruments and their balanced use, because those goals often contradict each other.

Specifically, the purpose of the Guide is to get decision-makers, local administration and employees of relevant services, as well as other stakeholders in the field of natural resources management at the local level, familiar with: (a) basic notions of land degradation, (b) concepts such as Sustainable Land Management (SLM) and Land Degradation Neutrality (LDN) and (c) most widespread practice of sustainable land management in the region and beyond, and provide specific and applicable steps for the implementation of the indicated concepts in the context of local self-governance in the Republic of Serbia.

## 1.2 Guiding principles

The main principles of the Guide are that it should be:

- informative and educational (the Guide needs to encompass all required globally recognised concepts, definitions and practices),
- applicable (the listed concepts and practices should be applicable in environmental and socio-economic context of the Republic of Serbia),
- easily understandable (written in language that is simple, clear and comprehensible to all stakeholders).

## 1.3 Target beneficiaries

As already mentioned, target beneficiaries of the Guide are decision-makers, local administration and employees of relevant services, as well as other stakeholders in the field of natural resources management at the local level (agriculture, forestry, water management, environmental protection, etc.).

## 1.4 Structure of the Guide

The Guide is divided into six key thematic units, as follows: (I) Introduction, (II) Land degradation – definition and processes, (III) Sustainable land management – approaches and practices, (IV) Concept of land degradation neutrality, (V) Land management at the the local level, and (VI) Steps for adaptable SLM at the local level.

**Introduction** provides information on the purpose of the Guide, guiding principles of the Guide, its target beneficiaries and structure.

**Second chapter** provides information related to land degradation, loss of vegetation and biodiversity and pressures on water resources.

**Third chapter** contains description and definitions of sustainable land management paradigm, its principles and criteria and a series of recommended/sustainable practices.

**Fourth chapter** elaborates on the concept of land degradation neutrality, which also represents Sustainable Development Goal 15.3, and reflects on the importance of gender equality within the concept.

**Fifth chapter** provides in detail all competences and liabilities of local self-governments from the viewpoint of land management, underlining challenges and obstacles from the viewpoint of land management, and particularly emphasising the health issues of local population regarding land degradation.

**Sixth chapter** provides specific steps for adaptable sustainable land management at the local level, which includes assessment of land resources, planning and integrating this approach, implementation and funding, as well as monitoring and evaluation plan.

# 2.

# LAND DEGRADATION - DEFINITION AND PROCESSES

## 2.1 Land degradation

Land degradation is a process of disturbing quality and functions of land, induced naturally or by human activity, or because measures were not undertaken to prevent adverse effects. Types of land degradation are:

- **erosion** – destruction and removal of soil under the action of water, wind, extreme climate conditions and anthropogenic factor;

- **depletion of organic matter** – primarily in land under agricultural production, where the causes are intensive soil tillage, with reduced organic fertilisation, burning or removal of crop residues;

- **pollution** – there are local and diffuse soil pollutions, where the pollution sources are different, such as pollutant emissions from industry, traffic, as well as uncontrolled application of chemicals in agriculture (complex mineral fertilisers and pesticides);

- **compaction** – type of physical degradation of soil micro- and/or macroaggregates deformed or destroyed under pressure, mainly by heavy machinery or frequent livestock grazing, particularly on moist soil;

- **land-use change (conversion)** – mainly represents permanent loss of soil by covering it with urban infrastructure (settlements, industrial zones, roads, landfills, etc.);

- **salinization** – accumulation of salt in soil caused by high level of saline groundwater and/or floods by saline surface water (primary salinization), or by applying water with increased content of salt in irrigation and/or increased quantities of mineral fertilisers (secondary salinization);

- **acidification** – process of losing base cations (calcium, magnesium, potassium and sodium) by leaching to deeper layers and their replacing with acid elements, mainly soluble compounds of aluminium and/or iron;

- **landslides** – gravity movement of rocks, soil and detritus (mixture of rock fragments and earth) down the slope.

## 2.2 Impact of land degradation on the loss of vegetation and biodiversity

*Soils host a quarter of our planet's biodiversity.*[23]

The forms of loss of vegetation are caused by forms of land degradation. Degradation processes of salinization and acidification change also natural aboveground flora by favouring halophyte[24] or acidophil[25] vegetation. Some forms of degradation, depending on its intensity, completely prevent growth and development of plants (e.g. pollution). Surely, all land degradation processes have negative impact on agricultural production, starting from the selection of cultivated plant species to quantity of produced biomass.

Soil biodiversity is defined by variation in genetic, species and ecosystem diversity, as well as a variety of habitats to microaggregates (UN, 1992; EEA, 2010). Soil biodiversity, or land biodiversity, represents a mixture of living organisms in soil (e.g. bacteria, algae, fungi, nematodes, ants, worms, insects, moles etc.), as indicated in Figure 1. Those organisms mutually interact, but also interact with plants and small animals with which they build up a network of biological soil activities. Soil is by far the most biologically diverse part of the Earth. The soil biota, i.e. flora and fauna of a certain area, has many fundamental roles in different processes in the ecosystem, such as the release of nutrients from organic matters, forming and maintaining structure of soil, introduction, keeping and movement of water in soil (*Lavelle and Spain*, 2001).

[23]Source: http://www.fao.org/document/card/en/c/43b565e7-57c2-43c6-b4f0-812091486ed3/ (accessed: 19.07.2017)
[24]Life forms of plants adapted to grow on non-salinized and salinized soils; e.g. adaptation is the accumulation of water in vegetative organs.
[25]Life forms of plants adapted to grow on acid soils, low pH value.

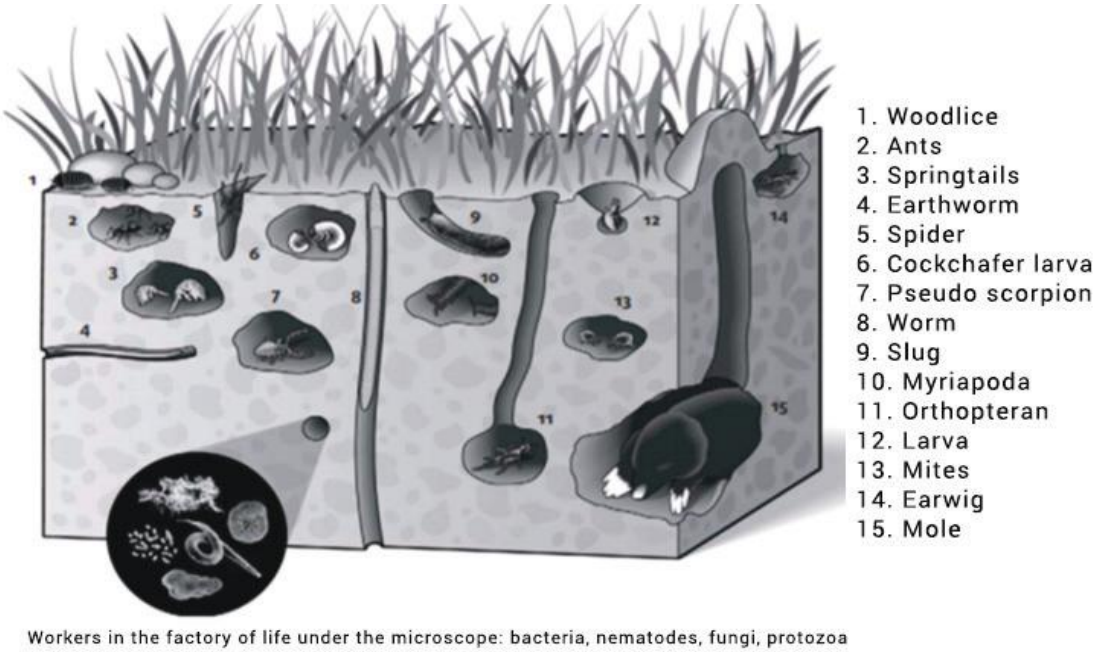



**Figure 1:** Overview of main groups of organisms in soil

*Source: https://globalsoilbiodiversity.org/sites/default/files/GSBA/soil_biodiversity_brochure_en.pdf*

*To date only 1% of species of microorganisms from soil has been identified.[26] It is presumed that there may be a trillion different species.[27]*

Different degradation processes in soil threaten soil biodiversity by destroying, partly or fully, the habitat of soil biota. Management measures (e.g. agro-technical measures in agriculture) that reduce the introduction and keeping of organic matter in soil or bypassing biologically conditioned cycle of movement of organic matter, also considerably reduce abundance, activity and complexity of different communities of organisms in the soil.

However, it is evident that even contaminated or considerably damaged soils continue to support a certain level of microbial diversity. The consequences of certain aspects of intensive land use (inadequate fertilising and application of pesticides) could be not only the reduction of biodiversity but also favouring individual species of soil organisms over others.

[26]Source: http://www.fao.org/document/card/en/c/43b565e7-57c2-43c6-b4f0-812091486ed3/ (accessed: 19.07.2017)
[27]Source: http://www.pnas.org/ (accessed: 19.07.2017)

Specific groups of organisms can be more susceptible or sensitive to individual pollutants or different pressures than others. For example, nitrogen-fixing bacteria (Rhizobium sp.), that live in symbiosis with leguminous plants, are particularly sensitive to the presence of copper; colonies of ants cannot endure frequent soil tillage as it damages their nests, while, in general, soil mites is a very strong and resistant group of organisms. This often has an adverse effect on the primary purpose of the land use – production of sufficient quantities of safe and wholesome food for animals and humans.

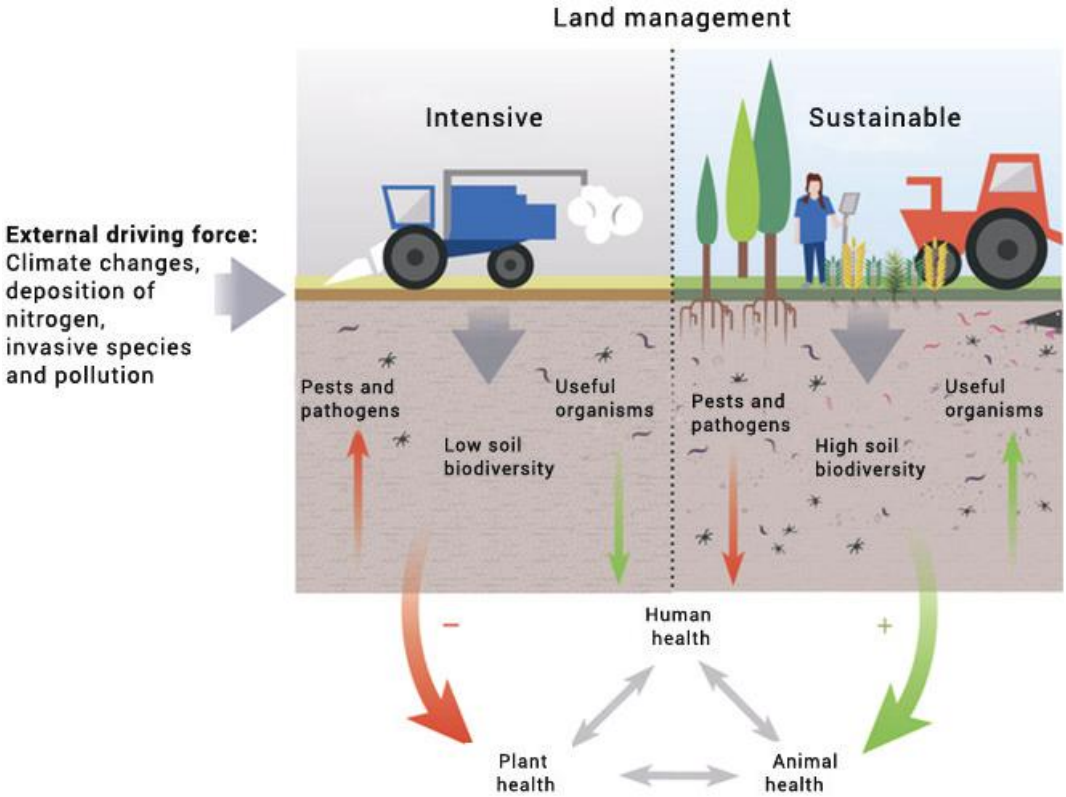



**Figure 2:** Overview of impact of different practices of the land use to soil biodiversity

*Source: Wall H., D., Nielsen N.,U., Six, J. (2015). Soil biodiversity and human health. Nature 528, page 69–76*

The goal of sustainable land use is a balanced relation in terms of abundance and activities of individual groups of soil organisms. In addition to the type of land use, biodiversity in soil is also affected by other external factors, such as climate change, spreading of invasive species, pollution, etc.

## 2.3 Impact of land degradation on water resources

The importance of water for human beings should not only be perceived with regard to quenching satisfying thirst but also the need to have huge quantities of proper quality water for food production. Soil is an enormous water reservoir, therefore damaging its physical properties and loss of organic matter considerably reduce water capacity of soil, making it vulnerable in case of extreme weather conditions, e.g. heavy rain or drought.

Land degradation, especially some degradation processes, represents a great pressure, or threat to water resources, as follows:

- **Change in land use:** e.g. draining wetlands, thus eliminating key components of water ecosystems, losing functions, integrity, habitats and biodiversity, changing mechanisms of surface run-off and natural circulation of groundwater. This inevitably threatens the functions of natural flood control, habitats for fish and waterfowl, recreational functions, water supply, water quantity and quality, etc. In addition, conversion to urban land, i.e. expansion of settlements and industrial zones, increases the risk from pollution of natural water ecosystems with waste waters.

- **Water and wind erosion:** its final consequence is deposit of sediments, most often to water ecosystems (rivers, lakes, wetlands, etc.). The sediment, depending on its use at previous location, may contain different quantities of agrochemicals (fertilisers and pesticide residues) and other hazardous and noxious substances affecting the water ecosystem.

- **Soil pollution**: as a degradation process, particularly that of light soil, may cause pollution of groundwater, and through it, pollution of greater water ecosystems. Namely, with soils that naturally have lower content of organic matter and clay, the descending movement, or leaching of substance, is accelerated and affects groundwater. In this sense, water ecosystems are also affected by the degradation process – content of organic matter of the soil drops as it reduces its buffering ability.

- **Eutrophication process:** one of the most obvious and greatest impacts of soil on water ecosystems. This is the process of increased water recharge by introducing nutrients, and their impact on water resources (Rulebook, 2011). Its causes can be natural, i.e. extinction of wildlife in water ecosystems (development phases of lakes, through wetlands to terrestrial ecosystems over a long period of time), but are mainly artificial, i.e. inadequate application of nitric and phosphoric fertilisers (primarily mineral, but it is also possible to use organic – manure, liquid manure). Such application leads to leaching the elements and, through groundwater, their introduction into water ecosystems. The presence of increased qualities of these nutrients facilitates the replication of algae, the extinction of which leads to increased content of organic matter. Decomposition of this organic matter is done by saprophytes, which use oxygen from water in the process, which results in tremendous losses of water organisms.

# 3.

# SUSTAINABLE LAND MANAGEMENT - APPROACHES AND PRACTICES

## 3.1 Sustainable land management

Sustainable land management (SLM) is one of 17 Sustainable Development Goals (SDGs) within the 2030 Agenda for Sustainable Development adopted by world leaders in September 2015 at the UN Sustainable Development Summit.

In January 2016, 17 goals of the 2030 Agenda for Sustainable Development officially came into force. Over the next fifteen years, with these new Goals that universally apply to all, countries will mobilize efforts to end all forms of poverty, fight inequalities and tackle climate change. SDGs also known as global goals, are built on the success of the Millennium Development Goals (MDGs) with the aim to go further in tackling fundamental causes of poverty and universal need for development for the well-being of all.[28] Goal 15 specifically relates to sustainable land management: "*Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss*".[29]

Besides Goal 15, sustainable land management has been integrated into other SDGs, such as:

- **Goal 1:** reducing poverty is related to security of owning land;
- **Goal 2:** emphasises the significance of small farmers for feeding the most vulnerable categories of society;
- **Goal 5:** includes one more goal - access of women to ownership and control over land.

Other goals, such as Goal 10, Goal 11 and Goal 16, are not directly linked to sustainable land management, but their outcomes are the result of certain actions including land management.[30]

> *Sustainable land management requires the integration of technologies, policies and activities in the rural sector, particularly agriculture, in such a way as to enhance economic performance while maintaining the quality and environmental functions of the natural resource base.*[31]

[28]Source: http://www.un.org/sustainabledevelopment/development-agenda/ (accessed: 3.4.2017)
[29]Source: http://www.un.org/sustainabledevelopment/biodiversity/ (accessed: 3.4.2017)
[30]Source: http://blog.chemonics.com/know-your-sdgs:-land-matters-for-sustainable-development (accessed: 3.4.2017)
[31]Dumanski (1997). Soil health and sustainability: managing the biotic component of soil quality.

## 3.2 Sustainable land management - principles and criteria

One of definitions of sustainable land management used by the UN Food and Agriculture Organization (FAO) reads[32]: „Sustainable land management combines technologies, policies and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously achieve the following five sub-goals:

1. maintain or enhance production/services (productivity)
2. reduce the level of production risk (security)
3. protect the potential of natural resources and prevent degradation of soil and water quality (protection)
4. be economically viable (viability)
5. and socially acceptable (acceptability)".

These five objectives are seen to be the basic pillars on which the SLM edifice must be constructed and against which its findings must be tested and monitored. Each objective is complex, and requires further brief examination:

- **Productivity:** the return from SLM may extend beyond material yields from agricultural and non-agricultural uses to include benefits from protective and aesthetic aims of land use.

- **Security:** management methods that promote balance between a land use and prevailing environmental conditions.

- **Protection:** the quantity and quality of soil and water resources must be safeguarded, in equity for future generations. Locally, there may be additional conservation priorities such as the need to maintain genetic diversity or preserve individual plant or animal species.

- **Viability:** if the land uses being considered are locally not viable, the use will not survive.

- **Acceptability:** land use methods can be expected to fail, in time, if their social impact is unacceptable. The populations most directly affected by social and economic impact are not necessarily the same (e.g. desired economic effect may have adverse social impact).

[32]Source: http://www.fao.org/docrep/T1079E/t1079e04.htm (accessed: 3.4.2017)

Goals of sustainable land management may be achieved by complying with the **three fundamental principles:**

- Increased soil productivity;
- Increased income;
- Improved state of ecosystem.

In order to increase soil productivity, it is necessary to improve efficiency and productivity of the use of water. This can also be achieved by reducing huge losses of water through run-off and undetectable evaporation of water from the unprotected area, by collecting water, improving infiltration, increasing water storage capacities, as well as by improving the irrigation system and managing surplus water. The top priority should be enhancing efficiency of the use of water in areas where agriculture relies on natural water regime because this is where the biggest potential lies for a better yield with all accompanying benefits. For irrigation-dependent agriculture, efficiency of transmission and distribution of water are key strategies for safeguarding available water.

Despite the constraints and problems they face, farmers are ready to adopt practices of sustainable land management if the practices ensure faster return on investment, lower risks or a combination of the two benefits. Efficiency of costs, including short-term and long-term benefits, is the main problem when adopting the concept of sustainable land management.

> *Farmers are increasingly receptive to adopting practices ensuring fast and sustainable return on investment in the form of food or income. If investments exceed their capabilities, and fast benefit is not guaranteed, the farmers will need support (especially local support) to introduce some measures.*[33]

The maintenance costs should be borne by farmers to ensure self-initiative. This means that the estimates of costs and benefits, in both monetary and non-monetary sense, should be determined precisely, and that part is the challenge. In addition, it is possible that the farmers will need additional funds to apply practices of sustainable land management, such as: material (machines, seed, fertiliser, equipment, etc.), labour force, market and knowledge. Changes towards sustainable land management should be based on values and standards, allowing flexibility, adaptation and innovations, to increase income. The most appropriate is the promotion of those practices of sustainable land management that are easily adopted and require minimum training and capacity building (WOCAT, 2011).

[33]Source: http://www.fao.org/3/a-i6361e.pdf (accessed: 15.05.2017)

Finally, in order to be truly self-sustainable, practices must be environmentally-friendly, reducing current land degradation, improving the state of biodiversity and increasing resilience to climate change. A precondition for sustainable use is the combination of measures which lead to integrated land and water management, growing agricultural crops and livestock production, soil enrichment and pest control.

## 3.3 Recommended practices of sustainable land management

Some of the best practices of sustainable land management are: (1) integrated soil fertility management; (2) conservation agriculture; (3) organic production (agriculture); (4) crop rotation; (5) integrated system of cultivation of crops and livestock production; (6) sustainable pasture management; (7) pastoralism; (8) agroforestry; (9) sustainable forest plantation management; (10) contour ploughing systems; (11) rainwater harvesting; (12) surface and groundwater management; (13) irrigation management on small farms; (14) improvement of water quality; (15) protection of river embankment; (16) protection from natural disasters; (17) waste management; (18) conservation of biodiversity and sustainable use of natural resources; (19) protected areas.

The following sub-chapters contain the explanation of principles of action of each practice.

### 3.3.1 Integrated soil fertility management

The baseline of Integrated Soil Fertility Management (ISFM) approach is the fact that the volume of agriculture cannot be increased without investments in soil fertility and that mineral and organic fertilisers are necessary to maintain soil health and increase production of agricultural crops. The effect is achieved by combining inorganic and organic nutrients for crops (WOCAT, 2011):

- Organic matter management – includes techniques of fertilising, composting, mulching and managing nutrients using plants such as those from the family of legumes – these practices improve the soil structure, infiltration of rainwater, moisture retention, while restoring nutrients.

- Use of fertilisers – applied to overcome the lack of nutrients. In this case, it is necessary to apply an advanced approach, ensuring optimal use of nutrients together with other components (water, seed, etc.), while carrying out soil fertility control.

**Figure 3**: Examples of integrated soil fertility management (composting, use of fertilisers and mulching)

*Sources:*
*https://www.ecokarma.net/composting/composter-reviews/*
*http://www.royalglobalenergy.com/Text?id=31*
*http://www.duboisag.com/en/biodegradable-compostable-black-mulch-film-bio360.html*

Integrated soil fertility management must include the use of improved agricultural practices adapted to local conditions (Lambrecht et al., 2014).

GAP rules in the Republic of Serbia are a set of recommendations on voluntary basis that farmers should apply in order to increase financial benefit as resources are used efficiently and economically.[34] One of the directives that the Republic of Serbia must implement to accede to the European Union is the Nitrates Directive, best known for establishing national GAP rules and introducing restriction to the application of manure to 170 kg N/ha annually.[35]

### 3.3.2 Conservation agriculture

Conservation agriculture (CA) is the approach to agro-ecosystem management for the purpose of improved and sustainable productivity, increase of profit and food security, while maintaining and improving resource base and state of environment (FAO, 2015). The aim of conservation agriculture practice is to achieve sustainable and profitable agriculture, as well as to increase income of farmers by applying three basic principles:

- Continued minimum soil disturbance (e.g. minimum tillage and direct planting to avoid damage to soil by permanent tillage);
- Permanent soil cover to the greatest extent possible to improve soil structure and infiltration, and to reduce erosion caused by wind and water;
- Land use rotation (diversification of species through crop sequences and associations to optimise land use).

**Figure 4**: Example of system of no-till farming

*Source: https://cfæs. osu. edu/news/articles/aug-31-field-day-digs-deep-no-till-farming*

[34]Source: http://www.ruralinfoserbia.rs/publikacije/Pravila%20dobre%20poljoprivredne%20prakse.pdf (accessed: 27.5.2017)
[35]Source: http://eukonvent.org/wp-content/uploads/2016/11/Poglavlje-27-Mogucnosti-Srbije-za-dostizanje-standarda-EU-u-oblasti-upravljanja-vodama1.pdf (accessed: 27.5.2017)

This approach has a huge potential for farms and agro-ecological systems of any size, but small farmers could be the ones who would benefit the most form its adoption, especially those facing the challenge of labour force reduction.[36]

Conservation agriculture allows farmers to reduce costs of production, invested time and work, especially in the period when the requirements are high, e.g. in the period of soil preparation and planting. In addition, the costs of investment and maintenance of machinery are reduced if the system is mechanised. In the short term, disadvantages of the approach can be, above all, high initial costs for equipment procurement, changes in the work regime, and the need for additional education.[37]

**Figure 5**: Plant diversification over three years

*Source: https://www.fix. com/blog/three-year-garden-crop-rotation-plan/*

### 3.3.3 Organic production (agriculture)

According to the International Federation of Organic Agriculture Movements (IFOAM)[38], organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on organic processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

[36]Source: http://www.fao.org/ag/ca/ (accessed: 16.4.2017)
[37]Source: http://www.fao.org/ag/ca/1a.html (accessed: 16.4.2017)
[38]Source: http://www.ifoam.bio/en/organic-landmarks/definition-organic-agriculture (accessed: 18.4.2017)

It is a system that begins to consider potential environmental and social impacts by eliminating the use of synthetic inputs, such as synthetic fertilizers and pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation.[39] Agronomic, biological and mechanical methods are used whenever possible instead of synthetic materials, in order to maintain functions within the system. Organic agriculture is unique due to two principles: (1) almost all synthetic materials are prohibited (e.g. those detrimental to human health and environment), (2) plant diversification is mandatory (deigned to improve soil structure and fertility, while reducing the nitrogen loss and problems with weeds, insects and diseases) (WOCAT, 2011).

The production of organic products in the Republic of Serbia is governed by the Law on Organic Production (*Official Gazette of the RS*, no. 30/10).[40] The methods of organic production, technological procedures, storage, transport, control and certification, records of control organisations, use of national mark on organic products are governed by the Rulebook on control and certification in organic production and methods of organic production (*Official Gazette of the RS*, no. 48/11 and 40/12). The Rulebook contains the list of substances allowed for nutrition and protection of plants, maximum annual introduction of nitrogen, etc., in other words all those measures related to soil conservation. These issues are also related to the Rulebook on documentation submitted to the authorised control organisation for the purpose of issuing certificates, and the terms and conditions of sales organic products (*Official Gazette of the RS*, no. 88/16).

Every year, the Ministry of Agriculture, Forestry and Water Management authorises control organisations that meet the requirements to perform control activities and certification in organic production. The certification procedure starts with the producer's applying to the authorised control organisation and concluding a Contract on control and certification in organic production. There are two main types of certification: individual and group certification. In case of individual certification, the producer concludes a contract directly with the control organisation and bears the costs of control and certification. In case of group certification, the producer concludes a contract on cooperation with subcontractors, indicating them in the Contract on control and certification and thus bearing the costs of the group certificate.[41] The list of authorised control organisations can be found on the website of National Organic Production Association: http://www.serbiaorganica. info/kako-do-sertifikata/kako-dosertifikata/.

*In the Republic of Serbia, there has been established the certification system for organic production. According to the most recent data from 2016, 0.41% of the used agricultural area was under organic production.*[42]

[39]Source: http://www.fao.org/organicag/oa-faq/oa-faq1/en/ (accessed: 19.4.2017.)

[40]Source: http://www.serbiaorganica.info/zakonska-regulativa/domaca-regulativa/ (accessed: 18.4.2017.)

[41]Source: http://www.pks.rs/SADRZAJ/Files/OPC%20Brosura.pdf (accessed: 18.4.2017)

[42]Environmental Protection Agency of the RS (2017)

### 3.3.4 Crop rotation

Sustainable rotation systems are characterised by rotating of various uses of plots, so that reduced intensity of tillage or planting grass-legume mixtures and trees would enable natural rehabilitation of land, which would be followed by repeated intensive tillage. (WOCAT, 2011).

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, then abandoned. This method is much different from crop rotation. In shifting cultivation, soil is first cleared and cultivated over a short period of time. After that, soil is allowed to revert to their natural vegetation while the cultivation moves on to another plot. The period of cultivation is usually terminated when the soil shows signs of exhaustion or, more commonly, when the field is overrun by weeds. The length of time that a field is cultivated is usually shorter than the period during which the land is allowed to regenerate by lying fallow. Natural rehabilitation of soil fertility is an important aspect of the system, which is why this method is considered useful and environmentally acceptable when the period of lying fallow is long enough to restore soil capacity and vegetation cover (*Rasul and Thapa*, 2003).

### 3.3.5 Integrated system of cultivation of crops and livestock production

Increased pressure on soil and increased demand for livestock products require an efficient use of feedingstuffs, including crop residues. Integrated cultivation system consists of a series of practices that preserve resources, aimed at achieving adequate profit, and high and sustainable level of production, while reducing adverse effects of intensive farming, and environmental protection.

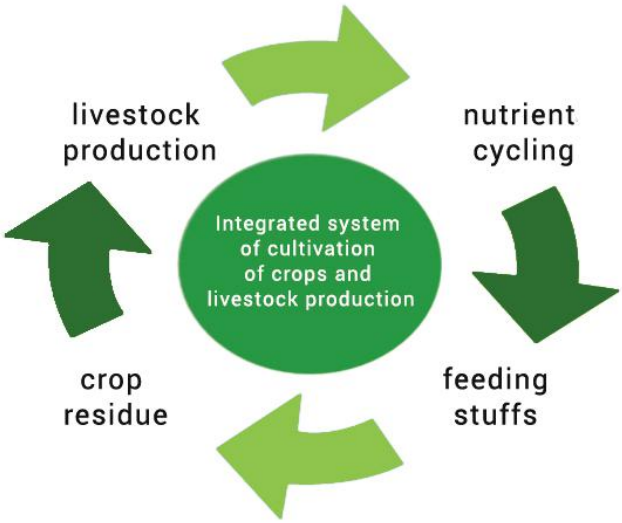



**Figure 6**: Integrated system of cultivation of crops and livestock production

*Adapted: IFAD, 2010*

Integrated system of cultivation of crops and livestock production in a certain area of land ensures: (1) reducing soil erosion; (2) increasing yield, biological soil activity and nutrient cycling; (3) increasing land use, increasing profit; (4) reducing poverty and malnutrition. Livestock production and cultivation of agricultural crops is done as part of coordinated order. Residues of one component serve as resources for the other, e.g. manure is used for enhancing crop production, and residues of crops as feedingstuffs, thus contributing to improved nutrition and productivity.

### 3.3.6 Sustainable pasture management

Sustainable pasture management ensures that the pasture, either native or improved, is available for sheep, cattle or other grazing animals year-round, and that the soil remains healthy. A well-managed pasture will provide high quality feedingstuffs, while livestock can serve for managing the pasture composition and quality (NSW Government, 2009). Good grazing management enables the movement of livestock so as to make the best use of the pasture and helps conserve biodiversity - a key element of every healthy environment. There are several factors affecting pasture management: (1) climate; (2) soil condition; (3) pasture quality and quantity; (4) grazing frequency and intensity. Good management practices will have a positive impact positively on the soil and livestock health, and the long-term profitability of livestock production.[43]

Active pasture management increases productivity and profit, as well as sustainability of agricultural holdings. Farmers should manage: time (when), frequency (how often) and grazing intensity. Pasture management can be an efficient practice in sustainable livestock production, increase of income of agricultural holdings and conservation of pastures. Farmers are most often recommended to apply rotational grazing in order to get a pasture which is perennial, productive and resistant to weed invasion, with degree of cover above 80% and which does not require undersowing. Other recommendations also include: harmonising soil capacity with the use of fenced pastures, increasing the presence of perennial plants on permanent pastures, applying the grazing rotational system, replenishing soil and maintaining drainage system (NSW Government, 2009).

### 3.3.7 Pastoralism

Pastoralism refers to extensive livestock grazing in dry and semi-dry areas. It is based on the use of areas available for grazing and creating water supplies where possible. Mobility may be seasonal, regular between two well-defined pasture areas, or may follow the occurrence of rain in pasture lands.

[43]Source: https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/grazing-pasture/sustainable-grazing (accessed: 19.4.2017)

Pastoral activities have conventionally been considered unprofitable or environmentally unsustainable. Nowadays, this strategy is recognised as economically and environmentally friendly, and in line with sustainability principles. The challenge is the harmonisation of traditional pastoralism with current changeable environmental conditions. Establishing banks of feedingstuffs, improving health and composition of herds, denser arrangement of wells, collection and storage of surface water are merely some of the possibilities. The main advantages of pastoralism are: (1) economic production in marginalised areas and environmental protection of vulnerable ecosystems; (2) enhanced food security; (3) sustenance of marginalised population in unfavourable position. Traditional pastoral systems use, change and conserve ecosystems by extensive rotational grazing, and by using different types of livestock. The benefits of pastoralism in the field of environmental protection are: increase of land cover for the purpose of conserving rangelands, reduction of soil erosion, improvement of state of biodiversity, reduction of dry vegetation (fire risk), preservation of integrity of ecosystem and resistance to climate changes (WOCAT, 2011).

### 3.3.8 Agroforestry

Agroforestry is a collective name for land-use systems and technologies where woody perennials are deliberately used on the same land-management unit as agricultural crops and/or animals, for a series of benefits and services (WOCAT, 2011). It includes technologies applied in forestry and agriculture for the purpose of increasing productivity, economic feasibility, environmental performance and sustainable land use. It may vary from those very simple and rare to very complex and dense systems. Agroforestry includes the concept of integration of forest lands, in combination with arable land and pastures to achieve multi-functionality. The border between agroforestry and forestry is not clear, nor is the one between agroforestry and agriculture. Agroforestry systems have a great potential for diversification of food and sources of income, improved soil productivity, and potential to halt and convert land degradation, to form favourable microclimate conditions, permanent soil cover, increase the content of organic carbon, improve soil structure, water infiltration, fertility and biological activity. (WOCAT, 2011; FAO, 2016).

**Figure 7**: Example of agroforestry

*Source: http://www.agroforestry.eu/*

**An example of improving productivity on a farm in Mali, supported by agroforestry**

*Research by Oakland Institute on the fields in Mali showed that maize yield increased when agroforestry was applied. Maize growing with gliricidia sepium led to the increase of maize yield by 8%. Yield of maize grown by using synthentic fertiliser was less than the yield obtained when applying agroforestry measures. Results were even better when maize was combined with gliricidia sepium and stylosanthes. Yield was 45% higher than the yield of maize grown conventionally, and higher than the yield of maize grown with the use of synthetic fertiliser.*

### 3.3.9 Sustainable forest plantation management

Forest plantations are the plantations of selected types of trees, in the high-density plantation system. It is possible to form plantations of domestic and foreign types of fast-growing and quality trees. The plantation can be on the area that either used to be a forest, or that never was a forest. Forest plantations can serve commercial purposes, but also have a protective function or serve for restoration of degraded areas. It is not simple to form a forest plantation with profitable production potential, while conserving all environmental functions. In developing countries, 70% of the population depends on forests and trees (biomass) as the main source of fuel. Given that stocks of fossil fuels decrease, forest plantations become an increasingly important source of energy and other products from forests. An adequate mode of forest management is the only way to avoid deficit of raw material for wood processing industry and halt further deforestation – forest plantations actually diminish the need to use natural forests. The main benefits from sustainable forest plantation management are: (1) rehabilitation of degraded soil; (2) greater availability of wood products, (3) wood fuels and other wood products. This system also contributes to the increase in employment and income, and reduction of pressure on natural forests (FAO, 2016). Sustainability of new forest plantations depends on their primary use, which includes the following: forestation, improving the state and structure of forests, fire protection, improved use of forest resources and control of logging (WOCAT, 2011). Fast-growing trees (with rotation period of 5–15 years) are increasingly popular in the region and may contribute to the improvement of the financial situation of the local population and sustainable rural development of certain areas.

### 3.3.10 Contour ploughing systems (anti-erosion measures)

Contour ploughing systems are measures undertaken on slopes in the form of earth mounds or stone stacks, narrow strips of selected types of grass and trees, aimed at forming terraces with the following functions: reduction of speed of water movement, reduction of surface runoff, increased infiltration and retention and minimising erosion intensity, which contribute to the conservation of the physical structure of soil and its production characteristics. It is desirable to form terraces with counterslopes in relation to the dominating terrain slope.


**Figure 8**: Contour ploughing systems

*Source: http://www.mdpi. com/2071–1050/6/8/4795/htm*

Terraces are formed above low earth moulds, set along contours, in combination with vegetation belts, or above low stone stacks. To preserve soil fertility on terraces, it is necessary to use measures such as composting, mulching, "green" fertilisation, application of protective crops, etc.

The main benefits achieved by this system are the following: reduction of speed of movement of surface runoff, low tangential stress, thus less erosion, as well as increase of soil capacity for infiltration and retention of water, which has a synergistic effect on the increase of fertility and yield. High costs of forming contour ploughing systems, primarily for the terrace construction, are often the main obstacle in applying them (FAO, 2016). If less efforts and funds are invested in forming contour system, the terraces formed will be unstable, subject to destructive activity of surface erosion. In addition, crop yield may be reduced if the original humus-accumulation layer of soil is removed during the terrace construction, which affects fertility (CARDI, 2010). In the absence of financial or other resources for the construction of proper terraces, it is possible to start forming protective, contour vegetation belts, which are considerably cheaper but cannot give as favourable effects as standard terraces.

### 3.3.11 Rainwater harvesting

If surface or groundwater is unavailable or the available water is too salty, acid or unsuitable for use, it is necessary to seek an alternative water source. In the areas with a lot of rainfall, the most suitable alternative is rainwater harvesting. Rain may provide the cleanest water, given that it is the product of natural distillation process, but one should bear in mind the possibility of contamination by products of dry or wet deposition of air-pollutants (Water Aid, 2013). The notion “rainwater harvesting” refers to all technologies of collecting rain for agricultural purposes or use in households. The aim of collecting rainwater is to reduce seasonal variations in availability of water in dry periods and improve reliability of agricultural production. A rainwater collection system mainly consists of three components: (1) area of basin where the water flows; (2) system of delivery directing the watercourse, e.g. embankments, channels or ditches; (3) storage system, where water is collected or preserved for use – in soil, pit, pond, reservoir. Rainwater collection systems are very useful because they increase the availability of water, reduce the risk of failure in production, increase the productivity of crop cultivation and livestock production, increase efficiency of the use of water, access to water, reduce the damage including floods, reduce erosion, and assist in restocking surface and groundwater (WOCAT, 2011).

**Figure 9**: Rainwater harvesting in south China

*Source: https://commons.wikimedia.org/wiki/File:Rainwater_Harvesting_and_Plastic_Pond_2.JPG*

### 3.3.12 Surface and groundwater management

Water management is a system of measures to use and control water resources to ensure efficiency of agricultural activities and eliminate potential risks, such as floods or watering deficit. Good water management on dams and embankments reduces the risk of damage due to floods. Water management systems ensure the most efficient use of limited stocks of water for agriculture. The term "surface and groundwater management" refers to the measures that ensure conditions for normal operation of this part of hydrological cycle: reduction of water level in case of floods, improvement of infiltration of water into soil, and increase of availability and quantity of water. Those measures include: improved irrigation techniques for the efficiency of use of water (e.g. drop-by-drop irrigation system), regulation of water salinity and safe collection and evacuation of rainwater.

### 3.3.13 Irrigation management on small farms

Irrigation on small farms is mainly conducted on surfaces under 0.5 ha, which is done by individuals, land users or groups of people/community.

The principle guiding this system is “more crop per drop”, or high efficiency of use of water which is achieved through the following processes: (1) water collection and separation; (2) water storage; (3) water distribution; and (4) use of water in the field. Two main categories of irrigation management are: traditional irrigation system and systems of microirrigation, including drop-by-drop irrigation. The application of this system may increase income of farmers through greater yield of high value. Furthermore, such a system contributes to the reduction of poverty, by increasing productivity of work and production potential of land. The risks of agricultural production can be reduced and quality of produced food can be improved. The costs of establishing the irrigation system considerably vary depending on local conditions. A drop-by-drop irrigation system is a rather big investment which means it is not an option that small farmers could easily adopt without access to credit funds. In that case, the proposal is that associated groups of farmers make a joint investment in equipment (FAO, 2016). Irrigation management may apply to: small and big systems, low and high pressure systems (sprinklers, drop-by-drop), vegetable gardens, irrigated oasis.

Applied locally, drop-by-drop irrigation means a completely new technology of crop cultivation, which requires an agreement by producers and proper training. In addition, irrigation systems can be formed only on the basis of proper technical documents (project designs), defining methodology of the use of water in line with characteristics of soil and need of certain plants. Inadequate irrigation concept may cause land degradation.

### 3.3.14 Improvement of water quality

Water resources have great economic, social and environmental significance, but if the quality of water is compromised, then this resource loses its value. The quality of water is an important issue not only for agriculture, water supply to the population, public health, tourist and recreational activities, but also for the conservation of biodiversity, given that water ecosystems are habitats to many plants and animal species. Degradation of water quality has a negative effect on the environment, water supply, tourist and recreational and agricultural activities. Water quality depends on conditions of the environment and particularly of the land use.[44] The measures that improve water quality are e.g. systems for retention of sediment by deposition, filtration/treatment systems and infiltration ponds. Infiltration ponds are open water ponds, depressions filled with water most often formed as a result of natural or anthropogenic process. Infiltration ponds are constructed in areas with hydro-geological features suitable for infiltration and storage capacity.[45]

[44]Source: http://www.environment.nsw.gov.au/water/waterqual.htm (accessed: 26.4.2017)
[45]Source: http://demeau-fp7.eu/toolbox/introduction/basic-concepts/classification-mar/infiltration-ponds (accessed: 26.4.2017)

### 3.3.15 Protection from fluvial erosion

Fluvial erosion is a natural occurrence in permanent and occasional watercourses, but it may be accelerated by direct and indirect human interaction. Fluvial erosion has the following environmental impact: deposition of finer granulometric fraction (mud, sand), presence of organic matter and pollutants, which may lead to degradation of water quality, threat to water habitats and eutrophication.[46] Retention of bigger quantities of sediment in riverbeds reduces discharge profile, where the occurrence of large quantities of water may cause spilling and flooding of the surrounding land, deposition of sterile material in fertile soil and damage to riverbank vegetation. The riverbank can be protected by applying regulation works (bank revetments; regulation of riverbeds by using earth or artificial materials), as well as biotechnical measures for the stabilisation of riverbank slopes (special grass and leguminous mixtures, weeping willow roots, fascine, contour stabilisers), while using indigenous plant material.[47] By applying these measures, soil and infrastructure are protected from destructive influence of watercourse and waves appearing during intensive windy episodes.

### 3.3.16 Protection from natural disasters

Natural disasters are processes in the atmosphere, on land or in water which may endanger human lives, cause great material damage and impair the state of the environment. The position of a settlement or farm very often aggravates the influence of current natural disasters.[48] In the period from 2003 to 2013, natural disasters and catastrophes in developing countries had adverse effects on 1.9 billion people and caused damage of over USD 494 billion (RSD 5,361,994,560,000.00). When they occur, natural disasters have a direct impact on life and security of food of millions of people in developing countries: farmers, pastoralists, fish farmers and communities depending on forests. The forecast (FAO, 2015) is that 22 percent of damage caused by natural disasters relates to agriculture, while major damage and losses are in: (1) crop cultivation, (2) livestock production, (3) fish farming, (4) forestry, and (5) irrigation. Measures for natural disasters risk reduction are necessary to reduce, prevent or mitigate considerable impacts on the environment. Measures, technologies and practices undertaken should be adapted to respective sectors, and the management of primary resources such as land, water and genetic resources and their sustainable use is certainly of great importance as well. In the Republic of Serbia natural disasters are typically thought about when they have already occurred, and often only the consequences are recovered instead of applying preventive measures to reduce impact of potential threats.

[46]Eutrophication = nature's response of ecosystem to the presence of increased natural or artificial substances in water, such as phosphates or nitrates, waste and fertilisers from agricultural area, etc. Eutrophication may be caused by nature or human activities.

[47]Source: https://www.engr.colostate.edu/~pierre/ce_old/classes/ce717/PPT%202013/River%20Bank%20Protection.pdf (accessed: 26.4.2017)

[48]Source: https://www.waikatoregion.govt.nz/services/regional-services/regional-hazards-and-emergency-management/what-are-natural-hazards/ (accessed: 26.4.2017)

The focus of preventive measures should be on hazards mainly threatening the Republic of Serbia and its surrounding areas, such as: torrential floods, river floods, heat waves, forest fires, droughts, storms, earthquakes and other disasters. Strong public awareness is a very important segment of reducing risk from the natural disasters. Accurate weather forecast and improvement of the system of developing forecasts for early and timely warnings of climate extreme occurrences are just as important. The risk is reduced by increasing capabilities and preparedness of the society to face the catastrophe.

*Anomaly hot Spots of Agricultural Production (ASAP) allows early planning of actions to assist vulnerable areas, as well as adapting rural development programmes. The system encompasses 80 countries and is mainly based on measurements on the Earth's surface and in the atmosphere. It is an online early warning decision support system that maps critical hotspots in agricultural production (crops and areas under natural vegetation), thus enabling prevention of food and security crisis and prediction of planned response to potential crisis. ASAP provides information by issuing monthly reports (identification of countries with critical hotspots in agricultural production) and automatic warnings once in ten days at the provincial level together with vegetation indicators.*

### 3.3.17 Waste management

Waste is a broad term that includes majority of unwanted substances and materials. Waste includes any substance or object which the holder discards or intends or is required to discard (Law on Waste Management, *Official Gazette of the RS*, no. 36/2009, 88/2010 and 14/2016). Waste consists of those substances that are out of commercial cycle or use cycle (CIPS, 2007). Good waste management starts by preventing waste production, primarily, because what has not been produced does not require disposal. Preventing or minimising waste production should be top priority in any waste management plan. Where waste is produced, operators and designers must always choose the optimal option of treating waste with minimum threat to human health and the environment.

Figure 10 shows the right waste management order. This hierarchy clearly shows that, first and foremost, the amount of generated waste should be reduced. Next, the waste produced should be reused and converted (by recycling, composting or converting waste to energy). Finally, as the last resort, waste should be disposed to the landfill.


**Figure 10**: Waste management hierarchy

*Adapted: CIPS, 2007*

Explanation of key notions following the diagram order:

**Waste reduction at source** – reduction must be considered whenever any decision is made on the use of resources. Reduction should be applied in all stages of life cycle of products, i.e. design, production, packaging, transport and distribution of products.

**Reuse** – some products are designed so that they can be used several times. This reduces the costs of waste disposal, and generates savings in energy and raw materials.

**Recycling** – the most significant effect of recycling is the drastic reduction of waste quantity that must be disposed to sanitary landfills, thus extending the lifespan of using landfills and considerably slowing down the process of depleting natural resources and emissions from landfills.

**Composting** – main advantages are certain market value of the final product, relatively small space needed for composting and lower transportation costs.

Once the waste is to be finally disposed, the choice is between disposal to a landfill or burning the waste. Neither of these options is a perfect solution as they are both potentially detrimental to the environment and human health (EC, 2008).

The key principles that should be taken into account when developing and implementing a waste management plan are: sustainable development principle, hierarchy principle in waste management, precaution principle, proximity principle and regional approach to waste management, principle of selecting the most optimal option for the environment, "polluter pays" principle and producer's liability principle.[49]

If a sustainable waste management system is to be achieved, it is necessary to consider all options of waste treatment. Some of the new technologies to be considered are: pyrolysis, gasification, plasma process, waste as fuel, etc.

### 3.3.18 Conservation of biodiversity and sustainable use of natural resources

Biodiversity – diversity of life on Earth is essential for the economy and human wellbeing. By conserving biodiversity, species and habitats are protected, and the natural capacity of ecosystem goods and services for people is maintained. In May 2011, the European Union adopted the new strategy to halt the loss of biodiversity in the EU, restore ecosystems where possible and step up efforts in preventing global loss of biodiversity. New biodiversity strategy contains six measurable targets focused on main factors driving biodiversity loss. Each target is accompanied by a set of adequate actions to be undertaken in order to achieve the set targets. The targets are: (1) to fully implement the Birds and Habitats Directives; (2) to maintain and restore ecosystems and their services; (3) to increase the contribution of agriculture and forestry to biodiversity; (4) to ensure the sustainable use of fishery resources; (5) combat invasive alien species; (6) step-up action to tackle the global biodiversity crisis (EC, 2011).

The two main categories of biodiversity conservation measures are (Mutia, 2009):

- *ex-situ* conservation – involves the conservation of biodiversity components outside of their natural habitats (e.g. zoos, museums, gene banks, seed banks, cryopreservation, captive breeding of animals that are likely to become extinct, botanical gardens, animal migration). This type of conservation is used for endangered species to avoid their extinction.

- *in-situ* conservation – means the conservation of ecosystems and natural habitats, including keeping and recovery of plant or animal species within their natural habitats. *In-situ* conservation is used by proclaiming the affected area as protected area (national parks and other categories of protected areas).

[49]Source: http://www.rpkpancevo.com/akti/Tema44.pdf (accessed: 20.5.2017)

### 3.3.19 Protected areas

Protected areas represent *in-situ* conservation of areas of exceptional biodiversity and the most widespread tool for the protection of nature in the world. Establishing a network of protected areas, which are efficiently managed and financially sustainable, is a key strategy not only for the conservation of biodiversity but also for securing ecosystem goods and services, adapting to climate change and reducing the impact of climate change. Presently, protected areas are expected to provide much more than that, in the sense of their environmental, social and particularly economic contribution (increase of local communities' income, initiating income through tourism, strengthening local and national economy, etc.) (UNDP, 2010).

According to the International Union for Conservation of Nature (IUCN, 2017),[50] there are several categories of protected areas:

- **Category Ia:** Strict nature reserve – strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features.

- **Category Ib:** Wilderness area – protected areas which are usually large unmodified or slightly modified areas, retaining their natural character.

- **Category II:** Natural park – large natural areas set aside to protect large-scale ecological processes.

- **Category III:** Natural monument or feature – protected areas set aside to protect a specific natural monument.

- **Category IV:** Habitat/species management area – the aim is to protect particular species or habitats.

- **Category V:** Protected landscape – a protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value.

- **Category VI:** Protected area with sustainable use of natural resources – conservation of ecosystems and habitats together with associated cultural values and traditional natural resource management systems.

[50]Source: https://www.iucn.org/theme/protected-areas/about/protected-areas-categories (accessed: 20.5.2017)

# 4.

# LAND DEGRADATION NEUTRALITY CONCEPT

## 4.1 SDG 15.3 on land degradation neutrality

In line with Decisions 2 and 3/COP 12, from the 12th Conference of Parties (COP) of the United Nations Convention to Combat Desertification (UNCCD), held in Ankara in 2015, land degradation neutrality (LDN) was defined as "A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales". In line with the above, all signatory countries were invited to voluntarily formulate goals to achieve LDN and include them in their UNCCD action programmes.

Land degradation neutrality concept is the integral part of Goal 15 of the 2030 Agenda for Sustainable Development, which was officially adopted in 2016. Goal 15.3.: "*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*".[51]

> *Nowadays, more than 1.5 billion of people (whereof 74% live in poverty) depend on land that is already degraded.*[52]

Soil and land resources (soil, water, biodiversity) feed the planet and ensure that society and economy advance. Land degradation is an accelerated process affecting sustainable development.

Land degradation neutrality means that the quantity of land degraded annually may not exceed the quantity of land restored from degradation. The aim of LDN is to maintain and increase the quantity of healthy and productive land resources, in line with national development priorities. LDN is a flexible goal, which can be achieved at the local, regional or national level. Goal 15.3 addresses a serious and current challenge: how to produce food and meet other needs in a sustainable way and respond to future needs without further depletion of limited land resources?

The practices of sustainable land management, such as agroforestry or conservation agriculture, may increase yield and improve resistance of operating areas and their ecosystems, preventing further land degradation.

[51] Source: http://www.un.org/sustainabledevelopment/biodiversity/ (accessed: 18.4.2017)
[52] Source: http://www.unccd.int/Lists/SiteDocumentLibrary/WDCD/DLDD%20Facts.pdf (accessed: 18.4.2017)

*The state of soil is determined by daily practices of population at the local level. The involvement of communities and use of local initiatives is of crucial importance for achieving the land degradation neutrality goal.*[53]

One of the objectives of this approach is that the local community and authorities at regional and national level start clearly defining land use planning activities. Thus, suitable base is ensured for progress in monitoring and prioritisation of actions in the field. Advancing towards the land degradation neutrality goal can be monitored in the sense of increased productivity, plant cover, services of biodiversity and ecosystem, and resulting socio-economic advantages (UNCCD, 2016).

## 4.2 Gender equality

Land degradation neutrality is a gender-sensitive issue. Women have a very important role in the production of goods and services from land, and ensuring income for their families, which makes them a strategic partner in the implementation of sustainable development goals. Very often, land use is linked with ownership over land, and therefore land degradation has a strong gender component.

Ownership over land and management are also related to cultural roles assigned to men and women. With climate change, it is expected that land productivity will rapidly decline in some areas, and increase in others, making it more difficult for land-dependent households to support themselves without additional income. As a result of such events, the role of women in sustainable land management becomes more prominent. At the same time, urbanisation, constantly growing need for food, water and energy, as well as a unique set of skills women have (e.g. unique knowledge of plants they cultivate, cultivation of plants necessary for survival) may affect these changes.[54]

In order to achieve land degradation neutrality, it is necessary to focus attention not only on the role of women and men in land use, but also other factors important for land management. Primarily, climate change – as land productivity decreases, more and more men move to urban areas, leaving women to manage land, which is typical for some Asian and African countries.

[53]Source: http://www.un.org/sustainabledevelopment/biodiversity/ (accessed: 18.4.2017)
[54]Source: https://static1.squarespace.com/static/5694c48bd82d5e9597570999/t/56e7cbd29f72660188deab10/1458031570966/GLO+Concept+Note+on+Gender.pdf (accessed: 20.5.2017)

*Given the important role of women in agriculture and procurement of food, water and energy, and management of natural resource base, there are plenty of opportunities to increase productivity and income of women, reduce the gap between genders and create new possibilities for women.*[55]

It is very important to understand how changes in consumption patterns and an increasing household demand can affect land use in rural areas by men and women, as well as restoration and rehabilitation in return. Furthermore, urbanisation of developing countries over the next thirty years may change gender structure in rural areas in different ways. Once inhabited areas may be abandoned, and in need of restoration. However, in the lack of population that could do it, governments will have to try a new approach – such as import of labour force. Women should have access to such new opportunities.

*Women make up 43% of agricultural labour force in developing countries.*[56]

This labour force grows every year. The possibilities of restoration and rehabilitation brought about by these changes should not only contribute to men and women equally but also be in line with their use of land and strive for rectifying gender inequality. Responsibility for land restoration should not only lie with women because of easy access to their work, particularly in cases where they do not have the right to own or manage land. It is also very important to take into account land-related interests, needs and benefits of men and women. Changes that should be considered also include changes in rural demography – there is a need to pay more attention to special skills of women, which could be upgraded to step up efforts for restoration and rehabilitation. Unlike men, women try to work together and their self-organised groups tend to be more self-sustainable. Although the majority of women do not have access to co-ownership of land, their social capital is unutilised advantage which may be used by associations and groups of women to get access to funds, and thus help in redressing current inequality in access to funds.[57]

[55]Source: http://eige.europa.eu/sites/default/files/document/ti_pubpdf_mh0116799enn_pdfweb_20170124110315_no_white_pages.pdf (accessed: 20.5.2017)
[56]Idem.
[57]Source: https://static1.squarespace.com/static/5694c48bd82d5e9597570999/t/56e7cbd29f72660188deab10/1458031570966/GLO+Concept+Note+on+Gender.pdf (accessed: 20.5.2017)

The management of land and natural resources with integrated gender equality aspect is of crucial importance for a sustainable future, where increase in secure and high-value food, increase in income, creating better and sustainable households are possible. When women have a central rather than marginal role in rehabilitation and restoration of land, sustainable development goals are achieved faster.[58]

[58]Source: http://www.unccd.int/Lists/SiteDocumentLibrary/COP/COP12/Gender%20Day/Gender%20Day%20Concept%20Note.pdf (accessed: 20.5.2017)

# 5.

# LAND MANAGEMENT AT THE LOCAL LEVEL

## 5.1 Competences and liabilities

### 5.1.1 Legal framework

Sustainable land management at the local level is implemented by monitoring and implementing legal competences and liabilities, as well as goals and recommendations given in strategic documents. The main law containing principles of sustainable land use in the Republic of Serbia is the Law on Environmental Protection[59] and its Article 22, which reads: "*Soil protection area (land) and its sustainable use shall be achieved through the measures of systematic monitoring of land quality, monitoring of indicators for the assessment of risk of land degradation, as well as through the implementation of remediation programmes for removing consequences of land contamination and degradation, regardless if they occur naturally or are caused by human activities*". According to Article 9 of the Law on Soil Protection,[60] "*prevention of land degradation is achieved through planning, spatial planning, use of natural resources and goods in line with spatial, urban and other planning documents, adopted in line with special laws*". It is also worth mentioning the Law on Agricultural Land,[61] the Law on Planning and Construction,[62] the Law on Forests[63] and the Law on Waters.[64]

In the field of land management, the key competences of local self-governments are:

- Adopting management plans and programmes, control of use and protection of soil as natural resource;
- Liability for the implementation of activities deteriorating or which may deteriorate natural state and quality of land;
- Systematic monitoring of the state and quality of land and maintaining database.

Table 7 (*Annex 1— Competence and liabilities of local self-governments defined under legislation*) shows in detail the competences and liabilities of local self-governments related to measures of soil protection with principles of sustainable use and prevention of land degradation, in line with the mentioned legal framework.

[59] *Official Gazette of the RS*, no. 135/2004, 36/2009, 36/2009 — other law, 72/2009 — other law, 43/2011 — Constitutional Court decision, and 14/2016
[60] *Official Gazette of the RS*, no.112/2015
[61] *Official Gazette of the RS*, no. 62/2006, 65/2008 — other law, 41/2009 and 112/2015
[62] *Official Gazette of the RS*, no. 72/2009, 81/2009 — correction, 64/2010 — Constitutional Court decision, 24/2011, 121/2012, 42/2013 — Constitutional Court decision, 50/2013 — Constitutional Court decision, 98/2013 — Constitutional Court decision, 132/2014 and 145/2014
[63] *Official Gazette of the RS*, no. 30/2010, 93/2012 and 89/2015
[64] *Official Gazette of the RS*, no. 30/2010, 93/2012 and 101/2016

#### 5.1.1.1 Liability for contaminated sites

Special attention at the local level should be paid to potentially contaminated and contaminated sites, which pose a threat to human health and environment.

There does not exist a special regulation related to environmental liabilities in the Republic of Serbia, but some provisions of Directive 2004/35/CE on environmental liability for damage are integral part of the Law on Environmental Protection (*Official Gazette of the RS*, no. 135/2004, 36/2009, 36/2009 — other law, 72/2009 — other law and 43/2011 — Constitutional Court decision, and 14/2016) and the Regulation on programme of systemic monitoring of land quality, indicators for land degradation risk assessment and methodology for developing remedying programmes (*Official Gazette of the RS*, no. 88/2010).

In the Republic of Serbia, liability for contaminated sites is conducted following the principle of liabilities of the polluter and his successor. Natural person or legal entity polluting the environment by unlawful or faulty activities is liable pursuant to the law. Polluter or his successor is liable to eliminate the cause of pollution and consequences of direct or indirect pollution of the environment. Polluter is liable for the pollution of the environment also in case of liquidation or bankruptcy of the company or other legal entities, pursuant to the law. Any change in the ownership of the company and other legal entities or other forms of change of property must include the assessment of the state of environment and determination of liabilities for the pollution of the environment, as well as debt recovery of previous owner for committed pollution and/or damage to the environment.

In case the polluter is unknown, the principle of subsidiary liability will apply. This means that state bodies, within their financial capabilities, should eliminate consequences of the pollution of the environment and reduce damage when polluter is unknown, as well as in the case when pollution results from the source outside of the country territory. When the contamination is new, implementation may follow urgent procedure. Pursuant to the Law on Soil Protection (*Official Gazette of the RS*, no. 112/2015), it is defined that funds necessary for the implementation of remedying projects and re-cultivation projects will be provided by responsible person. In case when responsible person in unknown, unavailable or does not comply with the inspector's order, the project will be implemented by a local self-government and/or autonomous province, or the Republic according to budget via authorised legal entity meeting requirements for remediation and re-cultivation.

### 5.1.2 Strategic framework

Strategic framework in the Republic of Serbia for sustainable land/environment management is composed of the following:

- National Environmental Protection Programme (*Official Gazette of the RS*, no. 12/2010),
- National Sustainable Development Strategy of the Republic of Serbia (*Official Gazette of the RS*, no. 57/2008),
- Action Plan for the implementation of the National Sustainable Development Strategy 2009–2017 (*Official Gazette of the RS*, no. 22/2009),
- Waste Management Strategy 2010–2019 (*Official Gazette of the RS*, no. 29/2010),
- Agriculture and Rural Development Strategy 2014–2024 (*Official Gazette of the RS*, no. 85/2014).

**National Environmental Protection Programme** defines short-term and continuous goals in the area of soil protection. Short-term goals of the Programme (2010–2014) include: (I) establishing a cadastre of landslides and unstable slopes in the Republic of Serbia for major part of territory and developing cadastre of terrain sensitivity from the viewpoint of stability, (II) establishing Programme of systematic monitoring of soil quality and forming databases on the state of land in urban areas, as well as forming a list of sites with the status of particularly vulnerable environment, status of vulnerable environment and determining priorities for rehabilitation and remediation on 20% of the territory of the Republic of Serbia, (III) adopting standards of quality for non-agricultural – industrial land. Continuous goals of the Programme (2010–2019) include: (a) reduction of areas under eroded land by 40% by conducting anti-erosion works and introducing effective measures for control of erosion, (b) remediation of contaminated sites from the priority list, rehabilitation of current landfills and remediation of sites posing major threat to the environment, (c) development of systems for monitoring, protection and improvement of quality of soil by polluters.

The Programme defines specific goals related to the system of soil monitoring and information system. A number of specific goals related to the environmental media or economic sectors can be implemented only with better monitoring, polluters' own monitoring and establishing integral information system and reporting.

The list of proposed reforms of system of soil monitoring and information system contains: (a) Establishing systematic soil monitoring with precisely determined sites for sampling and standardised methods for the collection and analysis of samples; (b) Determining specific parameters and monitoring factors of land degradation, erosion, depletion of organic matter, contamination, salinization, compacting, loss of biodiversity, land conversion, floods and landslides; (c) Defining criteria for determining zones threatened by land degradation; (d) Identifying sites where the presence of hazardous matter was confirmed to be in quantities considered significantly risky to human health or environment – contaminated sites; (e) Developing a database of contaminated sites; (f) Introducing monitoring of quality of mud.

In addition, **Waste Management Strategy** also has short-term goals which foreseen the rehabilitation of existing waste dumps that pose the biggest threat to the environment, as well as rehabilitation of "black spots" from historic pollution by hazardous waste.

Strategic goals of sustainable land use have been defined within the ***National Sustainable Development Strategy of the Republic of Serbia*** and refer to: (I) alignment of legislation on the use and protection of soil with EU legislation; (II) prevention of further loss of land and conservation and improvement of its quality, in particular by industrial, mining, energy, traffic and other activities; (III) prevention from degradation and conversion of land, as well as development of agricultural land. To achieve these goals, it is necessary to: (a) align current legislation with EU legislation and goals and recommendations of UN conventions; (b) establish and select parameters of land quality which will apply in monitoring and control of fertility; (c) develop networks of soil fertility control; (d) strengthen institutions which will address protection, development and use of agricultural land and establish a national laboratory to tackle land and mineral resources. Goals defined within the Strategy refer also to necessity of establishing a database on land and land plots. The database would be the result of hitherto research in that field, but also of permanent monitoring which would be the task of certain existing professional institutions addressing land quality control.

Within the National Sustainable Development Strategy there are key land-related indicators based on which the state of soil is monitored for the purpose of sustainable development:

- Land conversion;
- Land degradation;
- Land desertification;

Action Plan for the implementation of the National Sustainable Development Strategy 2011–2017 determines measures and/or activities for the implementation of the National Sustainable Development Strategy of the Republic of Serbia (*Official Gazette of the RS*, no. 62/2011). Action Plan defines the goals and activities/measures implemented by local self-governments independently and/or in partnership with other competent institutions. The goals and measures are represented in Table 1.

**Table 1**: *Goals and measures of local self-governments for the implementation of the National Sustainable Development Strategy*

| Goals | Measures |
|---|---|
| **Rehabilitation of existing waste dumps of municipal waste and location of hazardous waste** | Rehabilitation of existing waste dumps: closing, rehabilitation and re-cultivation of existing waste dumps; rehabilitation of locations contaminated by hazardous waste posing threat to the environment |
| **Rehabilitation of contaminated industrial locations** | Decontamination and remediation |
| **Encouraging investments in reducing pollution from agriculture, conservation of agro-diversity, traditional (combined) systems of holdings for the purpose of preserving biodiversity in terms of landscape and species in sensitive agro-environmental conditions, development of system of protection of animal wellbeing, reducing erosion, as well as conservation and improvement of environment as a whole** | Encouraging research and development projects, as well as education; establishing demonstration spots for applying "good agricultural practice", organic agriculture, unique conservation of agro-diversity, with sustainable diversification of rural economy at the level of holdings and rural community, etc.; |
| | Building infrastructure for more efficient recycling and disposal of organic waste from livestock production (individual and joint landfills and reservoirs, etc.) and improvement of livestock production management in line with the needs of conserving the environment; |
| | Improvement of farming by applying unique measures of plant protection, preservation of land from erosion, preservation of quality and structure of soil while improving its fertility. |
| **Introducing "good agricultural practice"** | Creating and development of "good practice" in different forms of agricultural production; |
| | Education of producers on applying "good practice". |

**The Strategy of Agriculture and Rural Development** defines main threats to soil quality, according to their intensity: erosion, disturbing the soil structure, depletion of organic matter, acidification and soil pollution.

Conservation and improvement of fertility of agricultural land, and creating an efficient system of managing land resources are the priorities of agricultural policy. The Strategy defines the following operational goals:

- Higher degree of utilisation of agricultural areas;
- Increase of land parcels and consolidation of parcels;
- Establishing functional land market;
- Improving land infrastructure;
- Increase of reclaimed areas and improving soil fertility;
- Speeding up of property recovery or restitution (including cooperative assets) and (re) privatisation;
- Reducing loss and degradation of land;
- Controlled conversion of agricultural land;
- More efficient use of land of poor quality, or irreclaimable agricultural land;
- Systematic monitoring of soil quality;
- Establishing an efficient land management system (cadastre, Geographic Information System (GIS), Land Parcel Identification System (LPIS).

The principles and mechanisms of action – accomplishing the mentioned operational goals requires significant changes in legislation, taxation policy and budgetary incentives. Special attention will be given to the improvement of soil quality and its production capacities. A special set of activities is foreseen for strengthening institutional capacities for efficient land management, such as establishing functional recording systems, registers and databases (LPIS, land register, soil maps, etc.).

## 5.2 Challenges and obstacles

### 5.2.1 Challenges

Soils have diverse chemical, physical and biological characteristics. Consequently, soils differ in (a) sensitivity to different management practices, (b) capabilities to provide different ecosystem services, (c) level of resistance to disturbance and susceptibility to degradation. The Status of the World's Soil Resources report (FAO and ITPS, 2015)[65] identifies ten key threats aggravating the achievement of sustainable land management: (I) soil erosion by water and wind, (II) loss of organic carbon, (III) nutrient imbalance, (IV) soil salinization, (V) soil pollution, (VI) acidification, (VII) loss of soil biodiversity, (VIII) land take, (IX) compaction and (X) waterlogging. Those threats differ in intensity, and trend depends on geographic context. Those threats should be addressed to achieve sustainable land management.

Taking into account the above, the key challenges for promoting sustainable land use at the local level are in the implementation of key activities summarised in the table below (Table 2).

[65] *FAO and ITPS (2015). The Status of the World's Soil Resources report.*

**Table 2**: *Main challenges from the viewpoint of sustainable land management at the local level*

| Key activities | Description of activities |
|---|---|
| **Establish and strengthen inclusive policies of sustainable use of land through policies of support to agriculture, while preserving the environment** | Where possible, inclusive policy promoting sustainable use of land should be linked with agricultural policies and those related to environmental protection, so that their implementation provides multiple benefits. Those policies, if any, should be revised to support the concept of sustainable use of land, where appropriate. |
| **Increase investments and positive incentives to promote sustainable land management** | Providing positive incentives to stakeholders implementing principles of sustainable land management, while respecting values of ecosystem services where inclusion is possible. Promoting secure lease rights in line with principles of sustainable land use properly implemented by beneficiary will ensure long-term planning. |
| **Encourage and strengthen target land surveys** | It is necessary to increase investment in land survey, which will allow that participants in national land survey programmes work with land users on identifying and overcoming limitations they face in increasing ecosystem services provided by soil (e.g. soil productivity). |
| **Prevent or minimise land degradation and restoration/rehabilitation of degraded land (including historically degraded land)** | Land degradation will be reduced to minimum by sustainable use of land, especially by land conservation which allows successful application of this principle. Land rehabilitation and/or restoration should also be a priority, restoring productivity to degraded soils, particularly in the direction of agricultural ecosystems or to other production systems currently under threat. |
| **Promote efficient educational programmes** | It is necessary to intensify the process of education related to soil (formal or informal). It may begin by pointing out the importance of their inclusion in curricula and expansion from school level to a higher, professional level. Capacity development for sustainable land management should be improved so to have more professionals who will introduce most modern methods and resources. |
| **Adequate inclusion of sustainable land use principle in the work and educational programmes of extension services** | Extension services in agriculture should promote principles and practices of sustainable land use and codex of good agricultural practice. |

| Key activities | Description of activities |
|---|---|
| **Establish/strengthen soil information system** | Given that soil is a dynamic ecosystem, assessment of its status should be a prerequisite for planning any intervention related to sustainable use of land. Data and information on soils (including local knowledge) are crucial for understanding the conditions of soil and trends in soil functions, as well as for target interventions to increase productivity. Soil information system should be established or strengthened to increase capacity for monitoring soil conditions. |
| **Strengthen cooperation in the field of soils** | It is necessary to promote and expand practices of sustainable land management given that they ensure important ecosystem services. It is necessary to ensure an integral, coherent, cross-sectoral and interdisciplinary approach. Connecting competent institutions, scientific and professional organisations in the field of agriculture, forestry, mining and environment and financial sector will lead to harmonised policies and investment in management of land as natural resource. |

### 5.2.2 Obstacles from the viewpoint of sustainable land management

Obstacles from the viewpoint of sustainable land management may be grouped in four thematic groups of problems:

**Social problems**

- Fragmentation of property;
- Lack of social security of land owners (land owners do not have safe jobs, they pay small tax on agricultural land and do not want to sell it);
- Incomplete procedure of property restoration (restitution);
- Lack of interest and motivation on the part of land owners to accept new knowledge and technologies.

**Environmental protection problems**

- Inadequate waste management;
- Unsystematic approach to contaminated sites management;
- Absence and/or inadequate monitoring of the environment;
- Climate change;
- Occurrence of natural disasters;
- Degraded ecosystems (due to mining activities, activities of energy sector...).

**Technical problems**

- Inadequate working space;
- Lack of infrastructure for introduction of modern GIS technologies (hardware, software) in land management, development planning, spatial planning, cartography and infrastructural planning;
- Lack of training on the application of new technologies;
- Lack of administrative support in managing spatial data (integration, storage, editing, analysis and display of information and data in space).

**Legal, institutional and financial problems**

- Absence of the green fund and/or inadequate implementation of projects funded from this and similar fund;
- Insufficient capacity for project preparation and applying to donors/funds;
- Lack of favourable credit terms;
- Inadequate taxation policy;
- Insufficient capacity of local self-governments for the preparation of plans and projects (ban on new employment in public administration naturally led to reduction of number of employees in local self-governments);
- Lack of coordination of cross-sectoral activities;
- Inefficiency of the system of land potential management due to insufficient coordination and shared competences;
- Inefficiency of the judicial system;
- High costs of learning and transferring knowledge;
- Insufficiently innovative potential of scientific and research staff;
- Insufficient and poorly diversified offer of education modules, practical training;
- Absence of systematic reaction to threats to land at all levels.

# 6.

# STEPS FOR ACHIEVING SUSTAINABLE LAND MANAGEMENT AT THE LOCAL LEVEL

## 6.1 Estimates of land resources

### 6.1.1 Land resource database

For the purpose of land management and making relevant decisions, competent authorities of local self-governments use existing databases and information systems, creating their own databases and information system of land resources as integral part of the environmental protection information system.

Current databases and sources of information for developing plans and programmes of local self-governments, as well as for creating land resource databases are:

- National infrastructure of geospatial data (Geodetic Institute of the Republic of Serbia)
- Land cadastres (Geodetic Institute of the Republic of Serbia)
- Real estate database (Geodetic Institute of the Republic of Serbia)
- Registers of aerial and satellite images (Geodetic Institute of the Republic of Serbia)
- Register of taken and certified orto-photo images (Geodetic Institute of the Republic of Serbia)
- Register of agricultural holdings (Directorate for Agrarian Payments)
- LPIS – Land Parcel Identification System (in the process of establishing within Directorate for Agrarian Payments)
- Corine Land Cover land use database (Environmental Protection Agency)
- National register of sources of pollution (Environmental Protection Agency)
- Cadastre of contaminated sites (Environmental Protection Agency)
- Database of agricultural land fertility control (Agricultural expert services)
- Database for fertility control and content of hazardous and noxious matter in soil in the territory of Central Serbia (Soil Institute)
- Municipal statistical data (Statistics Institute of the Republic of Serbia)
- Landslide cadastre (GeoIISS Ministry of Mining and Energy)
- Geological information system of Serbia (GeoIISS Ministry of Mining and Energy)

Local self-governments are reporting entities obliged to collect and submit data and information for the purposes of national information system of environmental protection, in line with the law. Environmental protection information system contains IT interrelated electronic databases and data sources on the state, pressures on the environment and landscape features, as well as other data and information of importance for monitoring the state of environment at the national level.

The information system is a decentralised and integrated system based on which information and data are jointly used and which is organised through GIS concept, available through a unique web portal and based on a network of reporting entities and reference centres.

The information system allows collection and providing information and data processed and analysed in line with international and European methodology, or allows data exchange on environment with existing similar systems at the level of the European Union and Member States, connected into European Information and Observation Network (Eionet).

Land resource databases include other reporting entities and existing data and information collection systems. Databases include parameters and information defined on the basis of the Regulation on the programme of systematic monitoring of land quality, indicators for land degradation risk assessment and methodologies for developing remediation programmes[66] describing indicators for land degradation risk assessment.

A separate database is the Cadastre of contaminated sites at the local level. The database is connected with the local register of sources of environment pollution, maintained by the competent authority of the local self-government, and with the National register of sources of environment pollution kept by the Serbian Environmental Protection Agency (SEPA).

Land resource databases are updated in line with obligations to report to competent authorities and inform the public about the state of the environment. Pursuant to the Law on Environmental Protection, public authorities are obliged to ensure that information on environment are available in the form of electronic databases easily accessible for the public through public telecommunication networks (Article 80). Public authorities are obliged to regularly update, publish and disseminate environment-related information.

### 6.1.2 Local assessment and determining cause of soil contamination

Based on data from land resource databases and environmental protection information system, the competent authority of local self-government determines the causes of soil contamination and makes decisions to rehabilitate contamination process (hot spots – contaminated sites) in line with their competences. Soil contamination is determined on the basis of general elements for land degradation risk assessment from the Regulation on the programme of systemic monitoring of land quality, indicators for land degradation risk assessment and methodologies for developing remediation programmes.[67]

*Identification of potentially contaminated sites is the first major step in contaminated sites management.*[68]

[66] *Official Gazette of the RS*, no. 88/2010
[67] *Official Gazette of the RS*, no. 88/2010
[68] *FAO (2016)*

Identification of contaminated sites, collection and submission of data are done pursuant to Article 34, paragraph 5 of the Law on Soil Protection.[69]

The Law on Soil Protection provides the basis for adopting a by-law, a Rulebook which prescribes in more details the content and manner of keeping the Cadastre of contaminated sites, as well as type, content, forms, manner and deadlines for data submission. The cadastre contains data submitted by state bodies, organisations, authorities of the autonomous province, local self-governments and polluters who, pursuant to the Law on Soil Protection[70] and other laws have available data on the state and quality of soil and who are obliged to submit data to the SEPA timely and free of charge.

Companies and other legal entities, as well as different sole traders whose activities may be potential localised sources of soil pollution are obliged to report for the Cadastre of contaminated sites. List of activities will be an integral part of the Rulebook. Local self-governments will be obliged to report for Cadastre of contaminated sites on sites with abandoned activities (where production activity is no longer conducted), sites with historical pollution, as well as on the sites of companies that are bankrupt which represent an increased risk to the environment and human health.

For the purpose of reporting, local self-governments collect data from other competent authorities and institutions. Data are collected for one calendar year. For the purpose of the Cadastre, the collected data include those pollutants that are the factors of soil pollution. Data on the volume of pollution submitted to the Cadastre may be obtained through measuring, calculation or engineer assessment. Data on values of pollutants in soil provided to the Cadastre must be obtained by measuring conducted by the authorised organisation. Measuring, or mathematical methods and engineer assessment must be in line with relevant national, European and international instructions and standards.

Data for the Cadastre will be provided on the forms which include general data and additional data necessary for defining risks on contaminated sites.

[69] *Official Gazette of the Republic of Serbia*, no. 112/15
[70] *Official Gazette of the Republic of Serbia*, no. 112/15

**Assessment of threat or danger (risk) to human health**

*The impact of polluters present in the environment, particularly those present for many years, may result in deterioration of health of different intensity. The threat or danger (risk) to human health is assessed on the basis of epidemiological studies done on certain locations and conducted in multidisciplinary manner by engaging different health specialists in their respective fields. As part of the epidemiological study, groups of people are selected for the examination and divided into groups according to age, duration of exposure, place of living and other specific characteristics. A multidisciplinary medical team conducts systemic monitoring of health through analysis of blood, immune status, urine, X-ray, clinical check-ups and other individual medical procedures, analyses and diagnostic procedures. In a unit of time, changes in the health condition of observed groups are recorded individually, whereas serious epidemiological studies on non-contagious diseases may be conducted over a period of more than ten years. Monitoring of the health condition of a population, enables recording of the most frequent and most severe diseases, total number of affected individuals, age distribution of diseases and other data assessing risk, or danger from a pollutant.*

## 6.2 Planning and integration of sustainable land management

### 6.2.1 Planning

In the implementation of soil protection system, local self-governments (and other entities competent for soil protection) are responsible for any activity that disturbs or is likely to disturb natural state and quality of land unless protective measures pursuant to the Law on Soil Protection, Law on Environmental Protection and other laws are taken. **Prevention of land degradation is achieved by planning**, landscaping, utilisation of natural resources and goods in line with spatial, urban and other planning documents, adopted in line with specific laws. Local self-governments **ensure integration of protection and improvement of the state of soil** in all sectoral policies by implementing mutually harmonised plans and programmes and by applying regulations through the system of licences, technical and other standards and norms, funding, incentives and other measures of soil protection.

When adopting any strategic/planning document and planning the vision of the future of local community, one should bear in mind that basic functions of soil may be conserved by adequate measures of sustainable land use with multiple effect not only at the local level but also beyond. In order to have efficient measures, the principles presented in Table 3 will apply.

**Table 3**: Principles for planning sustainable land management with case studies

| Principle | Case study |
|---|---|
| **Integral systemic approach based on features of areas and soil features management adapted to local climate conditions, soil types and characteristics of agricultural production** | There does not exist one single suitable solution for land management. Optimal strategy depends on local conditions, and the explanation is simple: local conditions have strong effect on dynamics of soil features. Surveys show that conditions and status of certain soil features should be carefully assessed before proposing changes in land management. Therefore, planning of sustainable land use should be based on data from databases of information systems established at both national and local level.<br><br>Use of data related to soil features in the process of planning sustainable land use is ensured by classifying data obtained through development of soil maps, as well as other thematic maps of types of use and state of soil.<br><br>Good example of use of such data is Macedonian Information system on soil (MASIS) developed within FAO project in the Agricultural Institute from Skopje. The project ensured collection and classification of current data, digitalisation, creation of soil maps and georeferenced databases containing field and laboratory data for more than 4,500 soil profiles (Zduli, P. and Cukaliev, O. edts. 2017). There have been created thematic maps such as land erosion map, map of special soil features, while using climate data, geological, digital model of terrain, data of chemical and physical properties of soil, vegetation, etc. All graphical and alphanumerical data are stored in SQL database which allows its easy use. In order to allow distribution of data from MASIS database, a WEB GIS portal was installed, thus allowing the use of data on soil to a bigger number of interested parties for the purpose of better planning and use of land, creating spatial, urban plans, agricultural base, rehabilitation and remediation plans, etc. Such examples are recognised as useful not only at the national level but also at the local level. |
| **It is easier (and probably cheaper) to protect and conserve soil, than restore its properties through rehabilitation and remediation** | Although restoring degraded environment is advisable, it is even more important to prevent further degradation. Advantages of soil protection may seem obvious from the scientific perspective, but protection may not easily be achieved. Development of a strategy leads to including protection in the lifestyle of the local population, which represents a big challenge. In some cases this challenge may be overcome only by significant financial incentives which will allow compensation for possible costs. |

| Principle | Case study |
| --- | --- |
| **Goals related to sustainable use of land should be carefully set and realistic** | In cases where the system is degraded, it is difficult to achieve considerable gain in productivity of agricultural production and maintaining reserves of organic carbon in soil even if the system is well managed. In such systems, the main goal should be maintenance of current state of soil fertility and agricultural production. Agricultural land has high potential for sequestration of carbon due to its generally low stocks of organic carbon. Surveys that were carried out in France, lasting between 16 and 18 years and monitoring effects of alternative cultivation systems of conservative agriculture (e.g. without tillage and permanent cover crops) and agroforestry on stocks of organic carbon in soil, indicated the increase of storing of organic carbon in soil in the surface layer (0–30 cm) in relation to reference situations. Although there was no difference in mineralisation rates of organic carbon in soil, organic carbon inputs were considerably increased in alternative systems of cultivation due to accompanying vegetation (cover crops, trees). This indicates that the practices that increase carbon inputs in soil through additional production of biomass would be more efficient for storing carbon in soil than practices such as no-till farming, which are presumed to reduce mineralisation rates of organic matter in soil (Chenu et al, 2017).<br><br>We will also take the example of Serbia and the content of organic carbon in soil. Setting goals for the increase of content of organic carbon in soil in our case should be based on results indicating that the agricultural land mainly has low content of organic carbon (1.58%) (Vidojević et al., 2015). A conclusion can be made that applying techniques of land management in order to increase organic carbon in soil has a limiting factor which, in our case, represents the initial status of reserves of organic carbon in soil. Maintaining or increasing reserves of organic carbon in most cases is not yet economically sustainable. Nevertheless, it brings advantages to the coming generations. These advantages may relate to the increase of yield (better management of fertilisers), reduction of work (concentrated plant production in smaller areas) or conservation of biodiversity. In addition, it is worth mentioning that the long-term process of sustainable land use leading to multi-fold advantages (an example of acquiring organic carbon in soil) may be lost quickly when the practice of land management enabling such multi-fold advantages – is abandoned. |

### 6.2.2 Integration

Strategic/planning documents include creating of a vision of future of the local community, assessment of state of environment, identifying priorities in protection, selection of efficient ways for the management in emergency, while using measures for real improvement of the state of environment and human health. The drafting of strategic/planning documents requires the use of different tools for analysis, assessment, strategic planning and institutional development of local communities, including the assessment of needs of community, public consultations, environmental risk assessment, financial analysis and many other elements. Planning documents of local self-governments should include goals and measures defined by strategic documents of the Republic of Serbia, distribute them to the local level and adapt them to local specific characteristics.

**Table 4**: Integration of goals and measures of sustainable land management into planning documents adopted by local self-governments

| Planning document (legal basis) | Goals and measures for SLM |
|---|---|
| **Plans and programmes of the management of natural resources and goods, spatial planning, use of natural resources and goods (Law on Environmental Protection**, ***Official Gazette of the RS, no. 135/2004, 36/2009, 36/2009 — other law, 72/2009 — other law, 43/2011 — Constitutional Court decision, and 14/2016***) | Plans and programmes of the management of natural resources and goods, spatial planning, use of natural resources and goods include:<br><br>1. Identifying special regimes of conservation and use of areas of protected natural goods, sources of water supply, thermal and mineral sources, forests, agricultural land, public green areas, recreational areas and spas;<br><br>2. Identifying areas of vulnerable parts of environment (polluted areas, areas threatened by erosion and torrents, exploitation of mineral resource, floodplains, etc.) and identifying measures for rehabilitation of these areas;<br><br>3. Identifying measures of integrated protection and planning of landscapes to determine long-term concept, purpose and organisation of landscapes and harmonise multipurpose use of space threatening landscape (agriculture, forestry, water management, mining, energy, traffic, dwelling, recreation, etc.);<br><br>4. Identifying areas which will in the long run maintain adequate distance between the facilities that contain or are likely to contain one or more hazardous substances in quantities exceeding those that are prescribed and residential areas, public spaces, as well as areas of particular importance, to protect the life and health of people and the environment;<br><br>5. Identifying measures and conditions of environmental protection according to which the space intended for exploitation of mineral resources will be used, or construct industrial and energy facilities, storage facilities, preparation for reuse, treatment, or reuse and disposal of waste, infrastructural facilities and other facilities whose construction or use may threaten the environment. |

| Planning document (legal basis) | Goals and measures for SLM |
|---|---|
| **Programme of environmental protection with local action and rehabilitation plans (Law on Environmental Protection, *Official Gazette of the RS, no. 135/2004, 36/2009, 36/2009 — other law, 72/2009 — other law, 43/2011 — Constitutional Court decision, and 14/2016)*** | The programme of environmental protection particularly contains:<br><br>1) description and assessment of the state of soil;<br>2) main goals and criteria for conducting soil protection with priority protective measures;<br>3) conditions for applying the most favourable economic, technical, technological, and other measures for sustainable development and soil protection management;<br>4) long-term and short-term measures for prevention, mitigation and control of soil pollution;<br>5) responsible bodies, development modality and schedule;<br>6) funds for implementation.<br><br>The programme should include also the proposal of monitoring system and information system for soil which particularly includes:<br>– Establishing systematic monitoring of soil with precisely determined sites for sampling and standardised methods for collection and analysis of samples;<br>– Identifying specific parameters and monitoring factors of land degradation, erosion, depletion of organic matter, contamination, salinization, compaction, loss of biodiversity, land conversion, floods and landslides;<br>– Identifying sites where the presence of hazardous matter is confirmed in quantities considered to potentially cause risk to human health or environment<br>– Contaminated sites;<br>– Creating contaminated sites database. |
| **Remediation programmes (Law on Environmental Protection, *Official Gazette of the RS, no. 135/2004, 36/2009, 36/2009 — other law, 72/2009 — other law, 43/2011 — Constitutional Court decision, and 14/2016)*** | Remediation programmes contain plans and activities for eliminating the consequences of land contamination and degradation, whether they occur naturally or are caused by human activities. They should particularly contain plans for remediation of contaminated sites from the priority list, rehabilitation of existing landfills and dumpsites, as well as the remediation of sites posing the biggest threat to the environment. |

***Examples of good practice:***

Only a few local self-governments in Serbia have recognised the importance of revitalisation and included brownfield sites (previously active, now abandoned sites in urban areas or contaminated zones) in their planning documents or adapted them to revitalisation goals, which is the consequence of insufficient funds for adopting or amending such documents, but also of lack of accurate data on the number of brownfields in their territories. However, several cities and municipalities may serve as examples how revitalisation can be conducted and encouraged by spatial and urban planning documents.

More information available at: *http://pdf. usaid. gov/pdf_docs/PA00KXXZ. pdf*

The City of Niš in its planning documents, for example, established the following:

- Definition of the term brownfield;
- Possibility of activating brownfield compounds as one of mandatory principles of spatial development;
- Existing capacities for brownfield investment are indicated as a (special) potential of economic development;
- The most significant compounds defined as brownfields are indicated, whose purpose is determined in line with the revitalisation process;
- The distribution of industrial capacities is foreseen to be carried out in indicated brownfield sites;
- Gradual transformation of military compounds in the city center to different civilian purposes.

The City of Valjevo acted in a similar manner and confirmed the importance of revitalisation as follows:

- Definition of the term brownfield;
- Activation of brownfields indicated as potential for spatial development;
- Revitalisation of brownfield is indicated as a special goal of economic development, or as priority activity;
- Implementation of new production capacities and small and medium sized enterprises (SMEs) until 2022 will be directed, inter alia, by the use of brownfields, including military facilities, whereas they state that providing conditions to attract investments/sources of funding (with favourable local regulations), developing register of brownfield sites and investment catalogues for brownfield sites, and strategic projects of activating brownfields will be main measures and instruments used in implementing this goal;
- Sites were identified as brownfields and as economic and industrial zones.

The City of Subotica indicated reactivation of brownfields as one of main principles of spatial development, indicating some sites that particularly must be revitalised.

The City of Zrenjanin indicates the necessity of drafting Strategy of revitalising industrial brownfield sites.

The City of Leskovac, in addition, underlines the necessity of urban restoration of brownfield industrial sites and its role in creating reputation and brand of the City of Leskovac. Therefore, revitalisation was indicated as one of the goals of spatial development and as an important element of concept of sustainable development of industry and agriculture, or economic development and urban restoration and recycling; there were identified many operating zones with a number of individual sites identified as brownfields; there were foreseen measures and instruments for the implementation and encouraging revitalisation within territorial development (supplementing brownfield sites map and application of instruments of fiscal, land and utility policy for creating business environment to attract (brownfield) investments).

The City of Belgrade in its Master Plan mentioned brownfields indicating the need, or importance of their revitalisation (e.g. within economic and sustainable development, or construction of new identity of Belgrade). One of the priorities is the use of old economic, utility and military facilities for transformation to places for cultural events. Special treatment should be given to business compounds by the rivers in order to grow into commercial and profitable facilities, or residential and business zones.

Example of good practice is the EXCHANGE Programme, funded by the European Union, and implemented by Standing Conference of Towns and Municipalities – The Union of Towns and Municipalities in Serbia. The Programme is focused on introducing EU models in the functioning and improving capacities of efficiency of local self-governments in Serbia. As part of the Programme, projects identified and developed by municipalities from Serbia there were funded, and implemented in cooperation with partner municipalities. All cities and municipalities implemented their projects in cooperation with at least one partner municipality from the European Union or from Serbia.

As part of Exchange 4 Programme, the project *"Clean Environment for a Better Life"* was implemented. Through activities in this project, the Municipality of Babušnica considerably contributed to the improvement of regional system of waste management in the county of Pirot, which resulted in measures for the improvement of state of soil. During the project, the landfill remediation project in the Municipality of Babušnica was revised, local planning documents in the field of waste management were revised and adopted, unsanitary landfill rehabilitation documents were developed. In cooperation with the population, the local self-government worked on raising awareness on the importance of environmental protection through education and promoting the importance of solid waste management.

More information available at: http://www.exchange.org.rs/sr/projects/11/Cista+environment+za+bolji+zivot)

| Planning document (legal basis) | Goals and measures for SLM |
|---|---|
| **Annual programme of soil protection (Law on Soil Protection, *Official Gazette of the RS, no. 112/2015*)** | Annual programme of soil protection contains protective measures and measures for the improvement of soil quality, activities and deadlines for their implementation, funds necessary for programme implementation and modality of their providing and use, as well as other data and documents.<br><br>Measures of soil protection include a ban or limitation on performing activities to prevent:<br>1) unplanned and/or uncontrolled conversion of agricultural land;<br>2) conversion of forest land to agricultural land;<br>3) discharge and disposal of hazardous and noxious matter and waste water to the soil surface and into the soil;<br>4) mode of tillage which is not in line with terrain configuration and relief;<br>5) negative changes in the structure of soil;<br>6) reduction of biological activities of soil;<br>7) compaction of soil;<br>8) exceeding optimal number of livestock in line with natural features of the site;<br>9) soil erosion;<br>10) depletion of organic matter in soil in relation to the level of natural content;<br>11) inadequate use of mineral and organic fertilisers;<br>12) inadequate application of plant protection products and other preparations;<br>13) inadequate use and arrangement of agricultural land;<br>14) unplanned and uncontrolled logging;<br>15) planting trees that do not correspond to the habitat;<br>16) uncontrolled and/or unplanned exploitation of mineral and organic resources;<br>17) unauthorised archaeological excavations and surveys;<br>18) unplanned and/or uncontrolled exploitation of gravel and sand from riverbeds, watercourses and their catchment areas. |

| Planning document (legal basis) | Goals and measures for SLM |
|---|---|
| **Rehabilitation plan (Law on Soil Protection, *Official Gazette of the RS, no. 112/2015*)** | Rehabilitation plan is adopted when pollution, or land degradation in a certain locality threatens capacity of the environment and health of the population to a greater extent, or when there is a risk of permanent disturbance of the environment and health of the population, while usual and undertaken measures are insufficient. |
| **Examples of good practice:**<br><br>To determine whether pollution, or land degradation on a certain site threaten capacity of the environment and health of the population to a great extent, the first step is to assess the risk to human health and the environment, by determining the likelihood of occurrence of adverse effects on population, or in the environment, as consequences of pollution. Risk assessment is applied in the territories which are known as or are assumed to be contaminated by the presence of pollutants or by conducting polluting activities. The usual procedure for assessing risk to human health and environment includes data collection on the source of pollution and pollutants, data on exposure and receptors. The analysis includes a number of parameters, some of them being quantity of pollutants on the site, disposal of substances, lithological properties of soil composition, terrain slope, depth to the level of groundwater, meteorological conditions of areas (quantity of rainfall, wind speed, etc.), distance to settlements, schools, protected areas, water resources, sources of water supply, etc. There are a number of methodologies and models of risk assessment calculating the mentioned parameters in order to obtain likelihood describing the level of threat to health of an individual, or adverse effects in the environment under the activity of pollutant(s). PRA.MS Methodology was adopted by the European Environment Agency, and it represents a model of preliminary risk assessment for identification and examination of sites with contaminated soils in the territory of Europe. As part of this methodology, the parameter scoring system was developed with the main purpose to compare a large number of sites and identify priorities for rehabilitation and remediation. This methodology was taken over by the Environmental Protection Agency of the Ministry of Environmental Protection, applying it to get priorities for rehabilitation and remediation of contaminated sites in the Republic of Serbia. | |
| **Annual programme of protection, development and use of agricultural land (Law on Agricultural Land, *Official Gazette of the RS, no. 62/2006, 65/2008 – other law, 41/2009 and 112/2015*)** | The Programme identifies: type and scope of works to be carried out in the period covered by the Programme, schedule of works and investments. Programmes should include goals and measures for:<br><br>• Higher degree of use of agricultural land;<br>• Expansion of land and consolidation of plots;<br>• Improvement of land infrastructure;<br>• Increase of reclaimed areas and improvement of soil fertility;<br>• Reduction of loss and degradation of land;<br>• Controlled conversion of agricultural land;<br>• More efficient use of land of poor quality, or non-arable agricultural land;<br>• Systematic monitoring of soil quality;<br>• Establishment of efficient system of land management (cadastre, geographic Information system). |

**Examples of good practice:**

Agricultural extension and professional services conduct permanent education of agricultural producers in line with training plan adopted and supported by the Ministry of Agriculture, Forestry and Water Management and Secretariat for Agriculture, Water Management and Forestry of the Province. The goal of the training is to train extension service professionals and agricultural producers to recognise problems in the chain of production and get familiar with contemporary knowledge for introduction of measures for the improvement of agricultural production and sustainable use of agricultural land. The development and implementation of Annual programmes of protection, development and use of agricultural land should be done in cooperation with local self-governments and agricultural extension and professional services in respective territory.

| Planning document (legal basis) | Goals and measures for SLM |
|---|---|
| **Spatial plan of local self-governments (Law on Planning and Construction, *Official Gazette of the RS, no. 72/2009, 81/2009 — correction, 64/2010 — Constitutional Court decision, 24/2011, 121/2012, 42/2013 – Constitutional Court decision, 50/2013 — Constitutional Court decision, 98/2013 — Constitutional Court decision, 132/2014 and 145/2014*)** | Spatial plan of a local self-governments contains in particular:<br><br>- planned uses of space;<br>- planned protection, arrangement, use and development of natural and cultural goods and environment;<br>- measures for balanced territorial development.<br><br>Key recommendations for better spatial planning in local self-governments include:<br><br>• Use of benefits and recognising guidelines foreseen by the Law on Spatial Plan of the RS and Spatial Development Strategy of the RS, in order to have systematic organisation and improved revitalisation process;<br>• Accomplishment of strategic priorities of spatial development of the RS within prescribed deadlines;<br>• Review of planning documents and development strategies at the local level, while taking care of their timely adoption and harmonisation with revitalisation goals, so that investors do not have to wait for their adoption or amendments;<br>• Adoption of adequate, flexible planning documents so that local self-government could initiate and support revitalisation of space, and including this issue in spatial and urban plans to emphasise the importance of revitalisation and establish adequate measures for its implementation, all for the purpose of attracting investors;<br>• Use of implementation programme of Spatial Plan of the RS and regional spatial plans as an encouraging instrument of revitalisation and one of regulatory basis for revitalisation and engaging private sector and access to proper funds in the process of revitalisation. |

**Examples of good practice:**

The following projects were implemented as part of EU Exchange 4 Programme:

Project: "*Creating preconditions for efficient spatial planning through establishing geographic information system (GIS) in the Municipality of Bujanovac*" was aimed at building and strengthening capacities of employees and officials of the municipality for the application of the new method of sustainable urban and spatial planning and management. Project ensured the introduction of geographic information system (GIS), development of strategy for the implementation of GIS and improvement of quality and efficiency of daily work of municipality and public utility enterprises by building capacities of both individuals and groups. The GIS Centre was established within the Department for Urbanism, Utility and Housing Affairs and Environmental Protection, GIS software was developed and IT equipment purchased, GIS Strategy prepared and GIS database created.

Project: "*Spatial and urban planning for the future in the City of Požarevac*" should encourage local sustainable development and creation of attractive and competitive sites for investments through responsible use of space, infrastructure equipping and by eliminating discrepancy in the land use between the City of Požarevac and municipalities of Petrovac na Mlavi, Velika Plana and Kučevo. The project ensured basic conditions for successful management of space by drafting and adopting significant legal documents and spatial planning documents and increased capacity of municipal administration to efficiently and effectively provide services related to management of space. There were developed spatial and urban plans providing basis for further local development of partner municipalities in the project.

(More information available at: http://www.skgo. org/publications/download/453)

## 6.3 Implementation and funding

Following the planning and integration of sustainable land management in strategic and planning documents, the next step is the implementation of sustainable land management system. This step implies drafting the action plan at the level of local self-government. An action plan is a very effective method of land management and decision making, designed to ensure improvement of local, social and environmental conditions.

Local communities and local authorities are very aware of all the problems, challenges and needs at the local level. It is the decentralisation of process of decision making that ensures that actions be adapted to real needs of a community.[71]

The action plan should be rational and transparent for wider public, and based on the main principles of sustainable land management. All stakeholders should take part in drafting action plan, which includes local self-governments, experts, higher education institutions, private companies, civil society organisations, users of ecosystem services from agriculture, forestry, energy and waters, and local population.

[71]Source: http://www.old.carecnet.org/programmes-and-activities/environmental-management-and-policy/local-environmental-action-plans-leap/?lang=en (accessed: 5.6.2017)

During the drafting process, it is necessary to obtain information about the current state, review relevant strategic and planning documents at the local level, and make sure to consult the community. Consultations may be organised in focus groups with population, representatives of private companies, non-governmental organisations and others, online surveys or discussions. Following the consultations and summary of collected data, the next step is setting the priorities for local community (e.g. biodiversity and forest management, increasing efficiency of agriculture, use of mountain pastures and increase of productivity of cattle breeding, reducing risk and vulnerability to natural disaster, etc.). Action plans are mainly based on results of consultations with stakeholders in the community, and therefore activities also result in line with needs of certain group of stakeholders and administrative level (PALM, 2011).

Action plans foresee participation of governmental and non-governmental structures, local community and international donor organisations in addressing poverty, land degradation, loss of biodiversity, sustainable production of energy and sustainable management of other natural resources. Action plans may be short-term (up to 2 years of implementation), mid-term (up to 5 years) and long-term (up to 10 years) (PALM, 2011).

*Civil society organisations have an increasing role in the field of environmental protection, while rather focused on social, environmental and gender-related problems concerning land management. The participation of civil society organisations can be very useful, given that they can contribute to information from the field, take part in drafting action plan and its implementation, and even be main drivers of reforms. Land management nowadays more than ever means investing joint efforts of public and private sectors and interaction with civil society organisations, in order to achieve one goal, which is sustainable development of the country in which they live and work.*[72]

Adoption of an action plan includes several phases. In the first phase already it is necessary to establish a Working group which will draft the Action plan and take active participation in the implementation of set goals. In this phase, potential partners are identified who can contribute to the implementation of activities, in particular in financial terms. The second phase is the analysis of the problem and current situation in the community, which may include review of relevant studies, focus groups, discussions, surveys, etc. In the third phase, strengths and weaknesses are analysed (political, legal, institutional, economical, financial, scientific, technological, social, cultural), as well as threats in the local community (e.g. excessive grazing, illegal logging, etc.) and opportunities – the most widespread method is SWOT (Strengths, Weaknesses, Opportunities, Threats).

[72]GIZ (2016)

After the first three phases, follows the fourth phase where priorities important for the community and goals (unless previously adopted in strategic and planning documents, see chapter 6.2 Planning and integration of sustainable land management) are set. In the fifth phase, specific activities are defined and responsibilities assigned. In the sixth phase, assessment of legal and institutional status and public policies is carried out in the field of land management, and proposal is designed for necessary changes important for the implementation of action plan, but also for the general progress in sustainable land management. Phase 7 is the summary of all collected information in one document, which should preferably contain financial details regarding the proposed activities.


**Figure 11**: Phases in the process of drafting Action plan

A good action plan contains clearly defined and specific goals, activities together with planned results which are measurable and traceable. Way of monitoring, its frequency and who is responsible for it are defined for each goal. In addition, document should also contain clearly indicated action plan implementation period (timeframe for each activity), and way and frequency of reporting.

Table 5 depicts an outline of action plan within certain sector of action (e.g. forestry, industry, mining, etc.).

| Problem | Priority activities | Goals | Expected result | Indicator | Timeframe | Unit cost | Stakeholders | Sources of funds |
|---|---|---|---|---|---|---|---|---|
| Sector xy | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Sector xy | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**Table 5**: Proposal of Action plan within certain sector of action

For the implementation of any action plan it is necessary to ensure funds through different financial instruments which may be: loans, guarantee fund in case of natural disasters, grants, credits, reinsurance and other structural financial instruments. There are several kinds of investments, which may be investments in development institutions, investment in specific measures and fixed assets, investment in building local capacities and technical support. Any kind of investment means different investment proposal and gives different results of the project, as depicted in Figure 12.

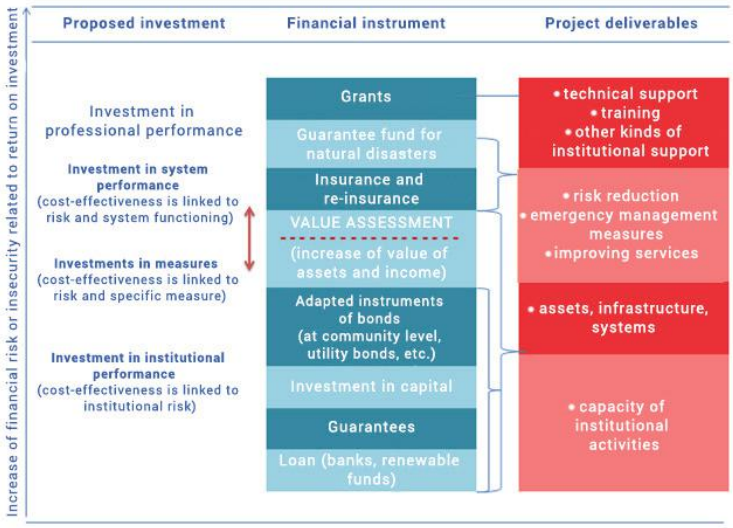



**Figure 12**: Proposal of structure of investment for sustainable land management[73]

[73]Adapted: ACT, 2013

In order to ensure funds, implementers of the action plan should prepare quality project proposals for potential financiers, in the form of a business plan, investment brochure, contract, terms of reference or project proposal. Different kinds of financial instruments are available or may be provided to ensure funds for different activities (ACT, 2013).

Recommendations for ensuring funds that the Government of the Republic of Serbia provided through the Law on Environmental Protection and Law on Soil Protection are to use (a) budgets of the Republic, autonomous provinces and local self-governments, (b) income from fees charged in line with the law. In addition, the following may be used for soil protection activities (c) funds obtained on the basis of international cooperation programmes and projects, (d) donations of national and foreign legal entities and physical persons and other sources in line with the law. In principle, there also exists a budgetary line for environmental protection at the level of local self-government. Additionally, it is recommended to use (e) donations, credits, international assistance funds, funds from instruments, programmes and funds of the EU and UN and international organisations.

**Table 6**: Overview of the most important donors and implementing agencies in the field of environmental protection in the Republic of Serbia

| No. | Organisation | Link for additional information |
|---|---|---|
| 1. | World Bank, Washington | http://www.worldbank. org/en/country/serbia/projects |
| 2. | Global Environment Fund, Washington | https://www.thegef. org/country/serbia |
| 3. | European Union, Brussels | http://ec. europa. eu/europeaid/about-funding_en |
| 4. | European Bank for Reconstruction and Development, London | http://www.ebrd. com/Search. html?srch-term-user=serbia&srch-term=serbia&srch-pg=srch&srch-type=all&p-g=1&sort=relevant |
| 5. | Embassy of the Kingdom of Sweden, Belgrade | http://www.swedenabroad. com/en-GB/Embassies/Belgrade/Development-Cooperation/Development-Cooperation-in-Serbia/Ongoing-projects-Security-Sector-Reform/ |
| 6. | Swedish Environmental Protection Agency, Stockholm | http://www.swedishepa. se/Environmental-objectives-and-cooperation/Cooperation-internationally-and-in-the-EU/International-cooperation/Bilateral-cooperation/Serbia/ |
| 7. | Swedish International Development Cooperation Agency | http://www.sida. se/english/where-we-work/europe/serbia-/ |
| 8. | Austrian Development Agency, Vienna | https://www.entwicklung.at/en/ada/funding/ |
| 9. | Embassy of the Kingdom of Norway, Belgrade | https://www.norway.no/en/serbia/values-priorities/climate-env/ |
| 10. | Embassy of the Czech Republic, Belgrade | https://www.mzv.cz/belgrade/sr/spoljna_razvojna_i_transformaciona/index.html |
| 11. | Czech Trust Fund | http://www.eurasia.undp.org/content/rbec/en/home/partnerships/aid-effectiveness-partnerships/czech-undp-partnership.html |
| 12. | Czech Development Agency in Serbia | http://www.czechaid.cz/en/zeme/serbia/ |

| No. | Organisation | Link for additional information |
|---|---|---|
| 13. | Italian Ministry of Environment, Land and Sees | http://www.minambiente.it/pagina/capacity-building-macedonia-bosnia-erzegovina-e-serbia |
| 14. | UN Environment Programme, Belgrade | http://www.unep. org/newscentre/unep-leads-first-ever-nationwide-diagnosis-contaminated-soil-republic-serbia |
| 15. | UN Development Programme, Belgrade | http://www.rs. undp. org/content/serbia/en/home/ourwork/environмentandenergy/environment. html |
| 16. | UN Office for Project Services, Copenhagen | https://www.unops. org/english/where-we-work/europe/Pages/Serbia. aspx |
| 17. | German Organisation for International Cooperation, Bonn | https://www.giz. de/en/worldwide/303. html |

When it comes to the EU funds, the Republic of Serbia has available Instrument for Pre-Accession Assistance. Currently, IPA II programme is ongoing (2014-2020). Environmental protection and climate change are certainly among the priority areas. The focus is on aligning current legislation with the EU legislation, as well as strengthening institutional framework at the national and local level, better treatment of waste and water and improvement of air quality. As part of the programme, the European Commission and national authorities will be focused only on strategically important and mature projects within a sector. The national authorities should make legal and institutional structures allowing efficient and effective obtaining of funds from the EU and other donors (including loans from international financial institutions).[74]

Implementation of the action plan is a continuous process, including monitoring and assessment of programme performance (more description in the following chapter: Monitoring and evaluation plan).

[74]Source: https://europa.rs/eu-assistance-to-serbia/?lang=en (accessed: 7.6.2017)

## 6.4 Monitoring and evaluation plan

When it comes to monitoring and evaluation, it is necessary to make distinction between two different processes, as follows:

- Monitoring the state of land resources and reporting on the state of land resources as defined under legal framework (from local to national level);
- Monitoring the implementation of strategic and planning documents and action plan.

Both processes should be accompanied by evaluation by national authorities and local self-governments in the process of adopting new or revising current strategic and planning documents.

The structure of management of land resources and reporting on the state of soil at the local level was adequately adapted through the overview of information pyramid (Figure 13 Structure of land management at the local level). The pyramid indicates the course of developing the soil protection policy, starting from **monitoring** the state, through collecting proper **parameters and data** for the purpose of elaborating **indicators** of the state, which are then used for **reporting** on the state of soil **to decision makers**. Such an approach is actually the basis for an integral system of monitoring the state of soil and its sustainable use (Figure 13).

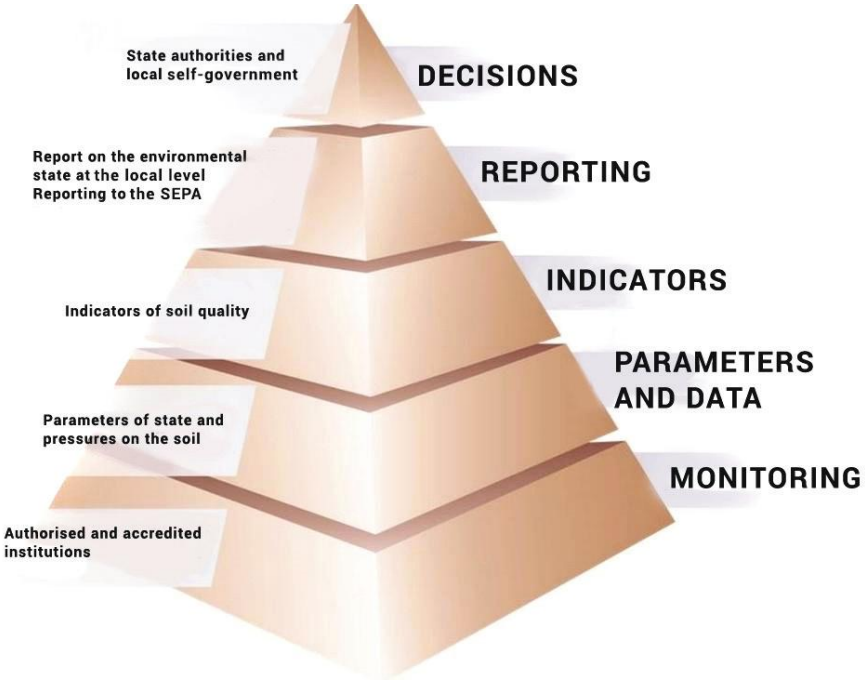



**Figure 13**: Structure of land management at the local level

*Source: http://www.sepa.gov.rs/download/Zemljiste_zakonskiOsnov.pdf*

**Monitoring the state of land resources and reporting thereof as defined under legal framework** means that the local self-government is responsible for data collection and preparation of databases used for reporting on the state of environment and soil at the local level, as well as for sending report to the SEPA and other competent institutions using legally prescribed form and within legally prescribed deadline. Reporting is the responsibility of services of administrative bodies responsible for environmental protection at the local level, as well as services pursuing agricultural, forest and water soils.

*Indicators for monitoring sustainable land use monitored at the local (and national) level are the basis for monitoring the process of land degradation and are guidelines for policies at the local and national level.*

Reporting on the state of land resources is carried out on the basis of developed indicators. In this sense, it is necessary to monitor the state of soil in an integrated manner and collect data from several competent institutions and expert services. Indicators are harmonised with the those of the National list of indicators and methodology for their development.[75] The overall set of indicators relevant for the state of land resources as well as for local self-government is attached hereto (Table 8).

Based on reports submitted by competent institutions, the Environmental Protection Agency, pursuant to the Law on Environmental Protection[76], prepares annual Report on the environmental state in the Republic of Serbia and submits it to the Government of the Republic of Serbia (Article 76). The report is based on indicators of environment and gives main overview of the environmental state in the country and recommendations for future steps aiming at general improvement in this field. Reports, as foreseen by the Aarhus Convention, are available to wider public on the website of the SEPA (http://www.sepa.gov.rs). In addition, the SEPA prepares a special *Report on the state of soil with basic information on land management in the Republic of Serbia*.

[75]*Official Gazette of the RS, no.* 37/2011
[76]*Official Gazette of the RS, no. 135/2004, 36/2009, 36/2009* — other law, *72/2009 — other law and 43/2011* — Constitutional Court decision, and *14/2016*

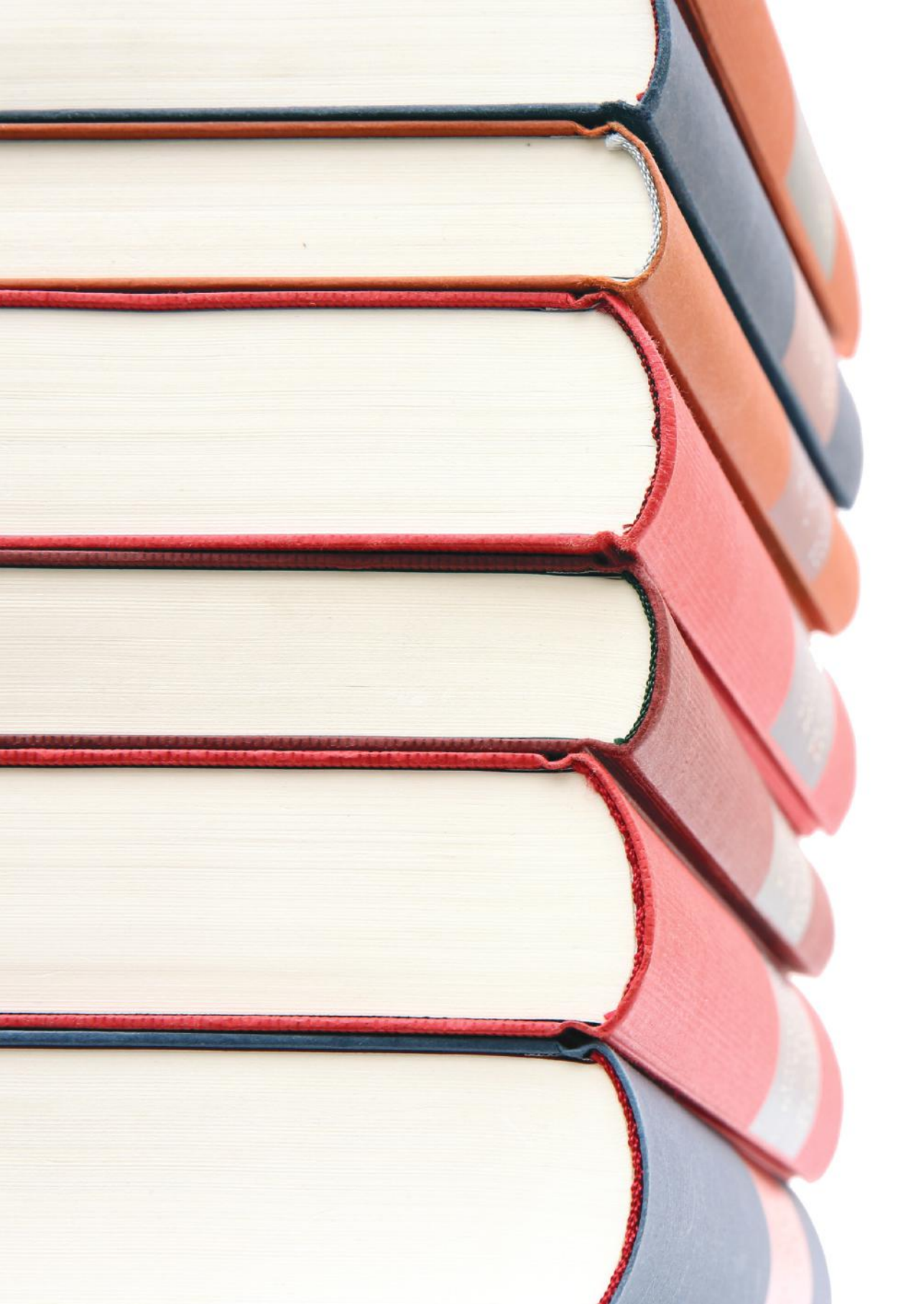
**Monitoring the implementation of strategic and planning documents and action plan:**

Beside monitoring the state of land resources according to national indicators, it is also necessary to monitor indicators prescribed under strategic and planning documents (especially action plan at the local level) for the implementation of certain goals and measures.

> *Indicators are quantitative and qualitative facts used for the assessment of progress in achieving a goal.*

This process should include all stakeholders, but the leading role should be on local administration. It is recommended that the working group established for drafting the action plan get active involvement in the implementation of action plan. Members of the working group should be representatives of local authorities, civil society organisations, private companies, scientific institutions and other stakeholders.

Action plan may be subject to changes, if the results of monitoring/evaluation prove it necessary, and it may also be changed in line with changes in the local community and advancing of technologies in the field of land management.



# 7.

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# 8.

# ANNEXES

## 8.1 Annex 1 — Competences and liabilities of local self-governments set by legislation

**Table 7**: Competences and liabilities of local self-governments set by legislation

| **LAW ON ENVIRONMENTAL PROTECTION**<br><br>*(Official Gazette of the RS, no. 135/2004, 36/2009, 36/2009 – other law, 72/2009 – other law, 43/2011 – Constitutional Court decision, and 14/2016)*<br><br>This Law governs the integral system of environmental protection which ensures human right to live and develop in healthy environment as well as balanced economy growth and protection of the environment in the Republic of Serbia. | |
|---|---|
| **Entities to the environmental protection system**<br>(Article 4) | The environmental protection system is carried out by local self-government within its competence. |
| **Entities' liabilities**<br>(Article 5) | In the implementation of the environmental protection system, a local self-government is responsible for every activity with which it changes or is likely to change environmental state and conditions, or for failing to implement environmental protection measures in compliance with the law. |
| **Principles of environmental protection**<br>(Article 9) | A local self-government provides mainstreaming of environmental protection and enhancement into all sector policies by implementing mutually harmonised plans and programs and by implementing regulations through licencing system, technical and other standards and norms, by financing, through a system of permits and other measures of environmental protection.<br><br>Local self-government takes the measures for the conservation and sustainable management of environmental capacities, particularly by reducing utilisation of resources and energy and preventing or reducing environmental pollution via economic instruments and other measures, applying the best available techniques, facilities and equipment not requiring excessive cost and through the selection of products and services. |
| **Plans and programs**<br>(Article 13) | Local self-governments, within their competencies spelled out in this and specific law, adopt their respective plans and programs of natural resources and property management in accordance with the strategic documents defined under this Law.<br><br>Two or more self-governments may promulgate joint programs of natural resources and property management. |

| | |
|---|---|
| **Control over utilisation and protection**<br>(Article 14) | Control over the utilisation and protection of natural resources and property is ensured by local self-governments, in accordance with this and special laws. |
| **Protection of land and soil**<br>(Article 22) | Protection of land area (soil) and its sustainable use is achieved through the measures of systematic monitoring of soil quality, monitoring of indicators for the risk assessment of land degradation, and through the implementation of remediation programmes for removing consequences of soil contamination and land degradation, whether they occur naturally or are caused by human activities.<br><br>When changing the right-holder of land use, the user of the land, whose right to use is terminated and whose activity influenced or could have influenced natural soil functions or is disturbing them, is obliged to produce a report on the state of soil. |
| **Planning and construction**<br>(Article 33) | Local self-governments participate in the procedure of preparation and planning related to spatial planning, use of natural resources and goods. |
| **Spatial and urban planning**<br>(Article 34) | Local self-governments, at request of the authority in charge of plan preparation and adoption, and on the basis of conditions and opinion of competent authorities, ensure conditions for measures and conditions of environmental protection. |
| **Public alerts**<br>(Article 42) | Local self-governments stipulate the act introducing special measures in case of immediate threat or excess of prescribed threshold values of pollution, if the pollution has been limited to the territory of the local self-government and has no impact on the wider area. |
| **Status of threatened environment**<br>(Article 43) | Based on criteria determined by the Government, the status of threatened environment and the priorities for rehabilitation and remediation for the area of local relevance are determined by the local self-government.<br><br>Local self-governments are obliged to obtain prior consent by the Ministry competent for environmental protection (hereinafter: the Ministry) to proposed document determining the status of threatened environment and priorities for rehabilitation and remediation for areas of local relevance, and consent by competent authority of autonomous province for areas of local relevance in the territory of autonomous province. |
| **Proclamation of the state of threat**<br>(Article 62) | A local self-government, in the case of accident, depending of its scope, within or outside the plant, and estimated consequences which may cause direct or deferred threat towards human health and environment, proclaims the state of threat to environment and informs the public of the measures taken. |

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| **Programs and plans of local self-government**<br>(Article 68) | A local self-government promulgates the program for environmental protection on its territory, or local action and rehabilitation plans, in accordance with the National Programme, Action plan for the implementation of the National Programme and Rehabilitation plan, and its interest and specificities.<br><br>Two or more local self-governments enact joint program of environmental protection for reduction of negative effects on the environment and for cost-effective reasons (joint waste management, wastewater management, etc.).<br><br>Local self-governments are obliged to adopt environmental protection program, action and/or rehabilitation plans within one year of the day this Law enters into force. |
| **Provision of monitoring**<br>(Article 69) | Local self-governments within their respective competencies under the law provide continual control and monitoring of the state of the environment (monitoring) in compliance with this and special laws. Monitoring is an integral part of the uniform information system on environmental protection.<br><br>A local self-government adopts the monitoring programme on its own territory that must be in compliance with the programme adopted by the Government based on special laws.<br><br>A local self-government provides funds for monitoring. |
| **Contents and mode of monitoring**<br>(Article 70) | Monitoring is carried out by systematic measurement of indicators, or monitoring adverse impact on environment, environmental state, measures and activities undertaken for the purpose of reducing adverse impacts and raising level of quality of environment. |
| **Data submission**<br>(Article 73) | Local self-governments are obliged to submit the data on monitoring to the SEPA as prescribed. |
| **Register of sources of pollution**<br>(Article 75) | A local register of sources of pollution is maintained by the competent authority of the local self-government. |
| **Environmental state report**<br>(Article 76) | Competent authorities of the local self-governments report quarterly on the environmental state in their territory of the Republic of Serbia to the SEPA. |

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| **Access to information**<br>(Article 78) | Local self-governments are obliged to regularly, timely and objectively inform the public on the environmental state, namely phenomena monitored in keeping with the monitoring of level of pollutants and emission and warning measures or development of the pollution which may pose threat to human life and health, in compliance with this Law and other regulations. |
| **Dissemination of information about the environment**<br>(Article 80) | Public authorities are obliged to undertake necessary measures and ensure that information on environment they possess or are kept on their behalf be actively and systematically disseminated to the public, particularly through telecommunication and/or electronic technologies. Public authority is obliged to inform the public, without delay, via media or otherwise on the existence of threat to life and health of people, environment or material goods, whether caused by human activities or natural occurrences.<br><br>In case of failure to act or of inadequate and untimely action in relation to the obligation, public authorities are held liable according to general rules for damage compensation. |
| **Financing environmental protection**<br>(Article 83) | A local self-government, within its competences, provides funds and implementation of the environmental protection objectives, in compliance with this Law.<br><br>Funds for environmental protection may be ensured also through donations, credits, international assistance, foreign investments aimed at environmental protection, instruments, programmes and funds of the EU, UN and international organisations. |
| **Inspection**<br>(Article 109) | Local self-governments perform inspection of the implementation of the activities prescribed by this Law and regulations adopted thereon. |

**Regulations adopted on the basis of Law on Environmental Protection governing the soil protection:**

— **Regulation on the programme of systematic monitoring of soil quality via indicators for assessment of soil degradation risk and methodology for creation of remediation programmes** (*Official Gazette of the RS*, no. 88/2010). By adopting this Regulation, the basis was provided to adopt programmes of systematic monitoring of soil quality which will encompass establishment of national and local networks of sites for monitoring soil quality and excluding agricultural land. Local network is established for monitoring soil quality at the level of autonomous province and local self-government. Local network is composed of additional sites determined on the basis of measuring or assessment, for which there do not exist data on the level of pollutants, in line with their needs and possibilities.

– **Regulation on criteria for determining the status of threatened environment and priorities for rehabilitation and remediation** (*Official Gazette of the RS*, no. 22/2010).

— **Regulation on contents and methods of management of the environment protection information system, methodology, structure, common bases, categories and levels of data collection, as well as on data content about which the public is regularly and compulsory informed** (*Official Gazette of the RS*, no. 112/2009).

— **Rulebook on the National list of environmental protection indicators** (*Official Gazette of the RS*, no. 37/2011). National list of indicators contains the methodology of data collection, modes and deadlines od delivering data, information, indicators and reports to the information system. The National list of indicators contains the set of indicators for soil classifying information on the state of soil, conversion of land use and land degradation factors.

— **Rulebook on the methodology for the development of rehabilitation and remediation projects** (*Official Gazette of the RS*, no. 74/2015). The Rulebook prescribes methodology for developing rehabilitation and remediation projects, except for projects of exploitation of mineral resources, governed by special legislation. The Rulebook is not applied on projects of rehabilitation and re-cultivation of deserted mines and mining facilities.

| **LAW ON SOIL PROTECTION**<br><br>(*Official Gazette of the RS, no. 112/2015*)<br><br>This Law governs soil protection, systematic monitoring of state and quality of soil, measures of rehabilitation, remediation, re-cultivation, inspection and other issues of relevance for protection and conservation of land as natural resource of national interest. | |
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| **Principles of soil protection**<br>(Article 5) | Soil protection is based on applying the principle of "soil protection mainstreaming", which implies that local self-governments ensure integration of soil protection in all sectoral policies by implementing mutually agreed plans and programmes and implementing regulations through system of permits, standards and norms, by funding and other measures of soil protection. |
| **Soil protection entities**<br>(Article 6) | Soil protection is provided by local self-governments within their competences and liabilities.<br>In implementing the soil protection system subjects of soil protection are liable for any activity disturbing or which may disturb natural state and quality of soil and if protective measures are not taken pursuant to this and other laws. |
| **Spatial planning and land use**<br>(Article 9) | Prevention of land degradation is achieved through planning, spatial planning, use of natural resources and goods in line with spatial, urban and other planning documents, adopted in line with special laws. Measures and conditions of soil protection, for the purpose of sustainable land use, are integral part of planning documents. Local self-governments take part in the procedure of preparation and adoption of planning documents, as set forth under the law. |
| **Land conversion**<br>(Article 10) | Where planning document changes the purpose of the land, authority competent for adopting planning document is obliged in the decision-making procedure to have a consent by the Ministry competent for environmental protection (hereinafter: the Ministry). |

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| **Annual soil protection programme**<br>(Article 16) | A local self-government adopts annual soil protection programme, following previously obtained consent by the Ministry, or by the authority competent for environmental protection in the territory of autonomous province. The annual programme is submitted to the competent authority not later than 30 November of the current year for the next year.<br>The annual programme is made public. The annual programme contains protective measures and measures for the improvement of soil quality, activities and deadlines for their implementation, funds necessary for the implementation of the programme and manner of their providing and use, and other data and documents. The annual programme is conducted through legal entities and physical persons selected in line with the law. |
| **Reporting on the implementation of the Annual programme**<br>(Article 17) | Local self-governments are obliged to submit to the Ministry, and the authority competent for environmental protection in the territory of the autonomous province, the Report on conducting measures and activities defined in the Annual programme not later than 31 March of the current year for the previous year. |
| **Measures of soil protection**<br>(Article 18) | Measures of soil protection include a ban or limitation on performing activities of:<br><br>1) unplanned and/or uncontrolled conversion of agricultural land;<br>2) conversion of forest land to agricultural land;<br>3) discharge and disposal of hazardous and noxious matter and waste water to the soil surface and into the soil;<br>4) mode of tillage which is not in line with terrain configuration and relief;<br>5) negative changes in the structure of soil;<br>6) reduction of biological activities of soil;<br>7) compaction of soil;<br>8) exceeding optimal number of livestock in line with natural features of the site;<br>9) soil erosion;<br>10) depletion of organic matter in soil in relation to the level of natural content;<br>11) inadequate use of mineral and organic fertilisers;<br>12) inadequate application of plant protection products and other preparations;<br>13) inadequate use and arrangement of agricultural land;<br>14) unplanned and uncontrolled logging;<br>15) planting trees that do not correspond to the habitat;<br>16) uncontrolled and/or unplanned exploitation of mineral and organic resources;<br>17) unauthorised archaeological excavations and surveys;<br>18) unplanned and/or uncontrolled exploitation of gravel and sand from riverbeds, watercourses and their catchment areas. |

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| **Emergency measures**<br>(Article 21) | In case of incident where soil was polluted, the Ministry, through inspectors, orders emergency measures, as follows: obligation of emergency examination of polluting, hazardous and noxious matter in soil; bans activities which may cause further pollution or threatening danger from damage to the environment.<br><br>Persons, to whom the order or ban pertains, including local self-governments, are obliged to immediately act in line with the official document. Funds necessary for the implementation of emergency measures are provided by the person causing the pollution or damage to land. In case that the responsible person is unknown, unavailable or fails to act upon the order of inspector, emergency measures are applied by the local self-government (and/or autonomous province, or the Republic), in line with its respective budgets.<br><br>The person identified as responsible for the incident is obliged to pay the amount of costs spent for the implementation of emergency measures to the account of the budget of the local self-government (and/or autonomous province or Republic). |
| **Rehabilitation, remediation and re-cultivation**<br>(Article 25) | Funds necessary for the implementation of project of remediation and project of re-cultivation are provided by responsible person. In case that the responsible person is unknown, unavailable or fails to act upon the inspector's order, project is implemented by the local self-government and/or autonomous province, or the Republic in line with their respective budgets through an authorised legal entity which meets conditions for conducting remediation and re-cultivation.<br><br>Persons identified as responsible for the implementation of the project of remediation and project of re-cultivation are obliged to pay the amount of costs spent for the implementation of these measures to the account of the budget or the local self-government (and/or autonomous province or the Republic).<br><br>Article 26 provides for the report on remediation and re-cultivation of soil to be delivered by the investor to the Ministry not later than 30 days of the completion of the project. |
| **Rehabilitation plan**<br>(Article 27) | Rehabilitation plan is adopted when pollution, or land degradation on a site threatens the capacity of the environment and health of the population to a greater extent, or where there is a risk of permanent environmental degradation and health of the population, while regular and undertaken measures are insufficient. Local rehabilitation plan is adopted by competent authority of the local self-government in line with the Annual programme. |

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| **Programme of systematic monitoring of condition and quality of soil**<br>(Article 28) | Local self-governments, within their competences provided for by the law, ensure systematic monitoring of the state and quality of soil (soil monitoring) and maintaining a corresponding database, in line with the Programme of soil monitoring. |
| **Local monitoring network**<br>(Article 29) | Competent authority of the local self-government adopts Programme of soil monitoring at the local level, and it has to be harmonised with the Programme of soil monitoring at the national level. The ministry gives consent to the Programme of monitoring establishing the local network. Funds for the implementation of the Programme of soil monitoring at the local level are provided from the budget of local self-government. |
| **Report on soil monitoring**<br>(Article 33) | Competent authority of the local self-government submits report of local network monitoring to the Ministry and SEPA not later than 31 March of the current year for the previous year. |
| **Information system, cadastre of contaminated sites**<br>(Article 34) | Local self-governments and polluters who, in line with this and other laws, have available data on the state and quality of soil as well as on polluters are obliged to provide data thereon to the Ministry and SEPA for the purpose of developing soil information system, timely and free of charge. |
| **Public information**<br>(Article 35) | Local self-governments and other authorised organisations are obliged to inform the public fully and objectively about the quality and state of soil and changes that may pose threat to life and health of people, flora and fauna in line with this law and other legislation. The public has the right to access prescribed registers or records containing information and data in line with the law. |
| **Soil protection funding**<br>(Article 36) | Funds for the protection and improvement of quality of land are provided from:<br><br>1) budgets of the Republic, autonomous province and local self-government;<br>2) revenues from fees in line with the law;<br>3) funds acquired on the basis of international cooperation programmes and projects;<br>4) donations from domestic and foreign legal entities and physical persons;<br>5) other sources in line with the law.<br><br>The utilisation of funds is defined in Article 37. |

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| **Supervision of work**<br>(Article 38) | The Ministry supervises the work of competent authority of local self-government in pursuing matters in line with this Law. |
| **Inspection**<br>(Article 39) | Inspection of the application of provisions of this Law and legislation passed on the basis of this Law is carried out by the Ministry through inspectors, within the scope of work defined under this Law. |
| **Transitional and final provisions**<br>(Article 50)<br><br>(Article 51) | Local self-governments are obliged to adopt annual soil protection programmes within one year of the day the Soil protection plan was adopted.<br><br>Competent authority of autonomous province and local self-government will submit the Programme of soil monitoring at the local level to the Ministry for their consent within six months of the day the Programme of soil monitoring at the national level was adopted. |
| **Regulations to be passed on the basis of authorisation of this law have not yet been adopted.** | |

**LAW ON AGRICULTURAL LAND**

(*Official Gazette of the RS, no. 62/2006, 65/2008 – other law, 41/2009 and 112/2015*)

This Law governs planning, protection, development and use of agricultural land, supervision over the implementation of this Law and other issues of relevance for the protection, development and use of agricultural land as goods of general interest.

Agricultural land is a good of general interest for the Republic of Serbia, used for agricultural production and may not be used for other purposes, except in cases and under the conditions set forth under this Law.
This Law is the basis for the establishment and governs the scope of the Administration for Agricultural Land, as an administrative authority within the ministry competent for agriculture.

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| **Land purpose**<br>(Article 15) | Agricultural land is used for agricultural production and may not be used for other purposes, except in cases and under the conditions set forth under this Law. |
| **Ban on releasing and disposing hazardous and noxious substances**<br>(Article 16) | It is prohibited to release and dispose hazardous and noxious substances on agricultural land and in irrigation and drainage channels. |
| **Soil testing**<br>(Article 17) | Testing agricultural land and water for irrigation to determine quantity of hazardous and noxious substances is conducted by the programme adopted by minister competent for agriculture. |
| **Anti-erosion measures**<br>(Article 18) | In order to protect agricultural land from noxious activity of erosion and torrents, anti-erosion measure are undertaken on erosion-prone areas. Anti-erosion measures are:<br><br>1) temporary or permanent ban on ploughing meadows and pastures and other surfaces for the purpose of converting them to arable land with annual crops;<br>2) introducing crop rotation;<br>3) cultivation of perennial crops;<br>4) construction of specific construction facilities;<br>5) manner of cultivation of agricultural land;<br>6) raising and cultivation of shelterbelts or planting of perennial woody plants;<br>7) ban on grazing for a certain period or limiting the number of cattle grazing in certain areas;<br>8) ban on cutting forests and forest plantations above threatened plots;<br>9) other measures.<br><br>Users of agricultural land are obliged to apply measures defined under this Law on erosion-prone area. |

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| **Competence for conducting anti-erosion measures**<br>(Article 19) | Conducting of anti-erosion measures is controlled by competent authority of local self-government. When identifying anti-erosion measures and their conducting, the competent authority of the local self-government will provide:<br><br>1) that terrains with slope exceeding 10% are cultivated in parallel to contour lines, that the structure of harvest ensures that such terrains and basins of certain torrents be sown or planted by perennial plantations at minimum one third of the total surface, and that terrains with slope exceeding 25% are not used as arable land;<br>2) that each local self-government establishes, for areas subject to, affected or threatened by wind erosion and depending on the specific characteristics of areas and degree of threat, in line with agricultural master plan, the soil protection programme from wind erosion by raising shelterbelts, perennial crops and plantations or by applying other forms of protection, to foresee schedule as per years for the implementation of the programme;<br>3) that anti-erosion biological measures are undertaken every year at minimum 4% of new areas from the total areas affected, subject to or threatened by erosion. |
| **Costs of conducting anti-erosion measures**<br>(Article 20) | Costs of conducting anti-erosion measures are borne by legal entities and physical persons whose agricultural land is protected under the measures, unless otherwise set by the law. |
| **Control of fertility of arable agricultural land and quantities of mineral fertilisers and pesticides introduced in arable agricultural land**<br>(Article 21) | In order to protect and conserve chemical and biological properties of agricultural land from cadastre class one to class five and ensure proper use of mineral and organic fertilisers and pesticides, the owner or the user of the arable agricultural land will control fertility of arable agricultural land and keep records of introduced mineral fertilisers and pesticides.<br><br>Control of fertility of arable agricultural land and quantity of introduced mineral fertilisers and pesticides is done where appropriate, every five years as a minimum.<br><br>Testing fertility of arable agricultural land and determining quantities of introduced mineral fertilisers and pesticides may be done by a company, enterprise or other legal entity registered for adequate activity, having available technical and expert capacities and authorised by the Ministry competent for agriculture (hereinafter: the Ministry). |

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| **Ban on use**<br>(Article 22) | It is prohibited to use arable agricultural land of cadastre class one, two, three, four and five for non-agricultural purposes. |
| **Exceptions to the ban on use**<br>(Article 23) | Arable agricultural land may be used for non-agricultural purposes in the following cases:<br><br>1) for installing artificial meadows and pastures in arable agricultural land of cadastre class four and five, as well as installing forests regardless of land class, following prior consent by the Ministry;<br><br>2) for exploitation of mineral resources (clay, gravel, sand, peat, stone, etc.), or works of disposing tailings, ashes, slag and other hazardous and noxious substances on arable agricultural land for a certain period following prior consent by the Ministry and enclosing proof of paid fee for conversion of arable agricultural land, which was determined by municipal or city administration in a decision;<br><br>3) in other cases if general interest is established based on the law, along with paying fee for conversion. |
| **Conversion fee**<br>(Article 25) | Fee is to be paid for the conversion of arable agricultural land.<br><br>The obligation to pay and the amount of conversion fee are determined by municipal or city administration in a decision at request of interested party or by order of agricultural inspector.<br><br>Revenue obtained from conversion in the amount of 60% is the revenue for the budget of the Republic of Serbia, and in the amount of 40% the revenue for the budget of local self-government on whose territory the converted arable agricultural land is located. The revenue is used for the implementation of the annual programme of protection, development and use of agricultural land adopted by competent authority of the local self-government. |
| **Fragmentation of cadastre plots**<br>(Article 27) | Arable agricultural land may not be fragmented to plots of surface less than half a hectare.<br><br>Arable agricultural land regulated by land consolidation may not be fragmented to plots of surface less than one hectare. |

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| **Agricultural damage**<br>(Article 28) | It is prohibited to destroy and damage crops, seedlings, trees and agricultural machinery on fields, make damage that leads to reduction of productivity, structure and layers of agricultural land, as well as any other damage to agricultural land (agricultural damage).<br><br>It is forbidden to burn the organic residues after the harvest on agricultural land.<br>Grazing is forbidden on arable agricultural land, except on own land.<br><br>A local self-government prescribes measures for the protection from agricultural damage and measures for the protection from burning organic residues on agricultural land. |
| **Protection of agricultural land from frost, hail, fire**<br>(Article 29) | A local self-government prescribes measures for the protection of agricultural land from frost, hail, fire and other natural disasters. |
| **Land consolidation**<br>(Article 32) | Assembly of local self-government determines the territory of cadastre municipality or parts thereof to be consolidated.<br><br>Development by land consolidation is carried out on the basis of consolidation programmes adopted by the assembly of the local self-government, with the consent of the Ministry. |
| **Decision on land consolidation**<br>(Article 34) | Decision on land consolidation is adopted by the assembly of the local self-government based on land consolidation programme.<br><br>Decision is published in the official gazette of the local self-government. |
| **Land consolidation committee and sub-committee**<br>(Article 35) | While adopting the decision on land consolidation, the assembly of the local self-government establishes a land consolidation committee. The Committee carries out the land consolidation procedure. |
| **Voluntary land grouping**<br>(Article 48) | Assembly of the local self-government issues decision on initiating procedure for voluntary grouping of land at the proposal of minimum ten land owners or, in case of state-owned agricultural land, at the proposal of minimum one land owner or if it is established as justified. |
| **Agricultural land re-cultivation project**<br>(Article 55) | Agricultural land used for exploitation of mineral resources or for other purposes which are not permanent is brought to adequate purpose, or recovered for agricultural production as per agricultural land re-cultivation programme. This article also defines content and developers of the re-cultivation projects. |

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| **Reclamation of meadows and pastures**<br>(Article 56) | Reclamation of meadows and pastures includes a set of measures for the improvement of quality of grass for grazing and hay production. This article also defines content and developers of reclamation of meadows and pastures projects. |
| **Improving quality of arable agricultural land**<br>(Article 58) | Improving quality of arable agricultural land includes measures enhancing physical, chemical and biological properties of soil (soil claying and sanding, reducing acidity, reducing alkalinity, ameliorative fertilising of soil and other measures). This article also defines content and developers of improving quality arable agricultural land projects. |
| **Obligations of owners, or users of agricultural land**<br>(Article 59) | Owner, or user of agricultural land is obliged to:<br><br>1) regularly cultivate arable agricultural land applying measures prescribed under this Law and other legislation;<br><br>2) act as a good host and follow rules of good agricultural practice.<br><br>The Ministry may lease arable agricultural land not cultivated in the previous vegetation period to a physical person or a legal entity for a period of up to three years, while paying land rent to the land owner, and deducting costs of procedure. |
| **Disposal and management of state-owned agricultural land**<br>(Article 60) | Articles 60–61 define the use of state-owned agricultural land. State-owned agricultural land is used in line with the annual programme of protection, development and use of agricultural land adopted by competent authority of local self-government.<br><br>Competent authority of local self-government adopts the programme following prior opinion obtained from the commission established by the mayor, which is composed of minimum half of the members who are physical persons – farmers entered in the Register of agricultural holdings in line with regulation governing entry in the Register of agricultural holdings, as well as a BSc in agriculture. The programme is adopted until 31 March of the current year at the latest, with the consent of the Ministry.<br><br>Article 64 defines procedures of lease of state-owned agricultural land. |
| **Obligations of the lessee of state-owned agricultural land**<br>(Article 67) | Lessee may not carry out activities contrary to regulations on environmental protection or actions with adverse effect on natural wealth or state of natural areas. |

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| **Rent**<br>(Article 71) | Revenue obtained from lease of state-owned agricultural land or agricultural facility in the amount of 60% is the revenue of the budget of the Republic of Serbia, and in the amount of 40% the revenue of the budget of the local self-government on whose territory the state-owned agricultural land is located. The revenue is used for the implementation of the annual programme of protection, development and use of agricultural land adopted by the competent authority of the local self-government. |
| **Use of pastures**<br>(Article 75) | Pasture may be used for other purposes, provided that it encourages a more rational and economic use of land. |
| **Competence for supervision**<br>(Article 81) | Supervision over the implementation of this law and regulations adopted thereon, except geodetic and technical works in the procedure of land consolidation, is carried out by the Ministry. |
| (Article 82) | Inspection is carried out by the Ministry through agricultural inspector of the Republic. |
| **Deadline for adopting agricultural master plan**<br>(Article 91) | Agricultural master plan of the local self-government will be adopted within five years of the day of adopting Agricultural Master Plan of the Republic. |
| Regulations adopted based on the Law on Agricultural Land governing the soil protection:<br><br>**The Regulation on establishing Programme of works on the protection, development and use of agricultural land for 2017** (*Official Gazette of the RS, no. 39/2017*); **The Rulebook on allowable quantities of hazardous and noxious substances in soil and irrigation water and methods for their testing** (*Official Gazette of the RS, no. 23/1994*); **The Rulebook on type and content of measures that user of arable agricultural land is obliged to apply during the use** (*Official Gazette of the RS, no. 33/1993*). | |

**LAW ON PLANNING AND CONSTRUCTION**

(*Official Gazette of the RS, no. 72/2009, 81/2009 — correction, 64/2010 — Constitutional Court decision, 24/2011, 121/2012, 42/2013 — Constitutional Court decision, 50/2013 — Constitutional Court decision, 98/2013 — Constitutional Court decision, 132/2014 and 145/2014*)

This Law governs: conditions and manner of spatial planning, development and use of construction land and construction of facilities; supervision over applying provisions of the Law and inspection; other matters of relevance for spatial planning, development and use of construction land and construction of facilities.

Provisions of this Law do not pertain to spatial planning and development, construction and removal of facilities which are considered military compounds or military facilities within the meaning of the law governing defence matters, or construction of facilities considered mining facilities, plants and devices within the meaning of the law governing mining.

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| **Principles for development and use**<br>(Article 3) | Vertical coordination (as part of planning, development and use of space) means establishing connections of all levels of spatial and urban planning and development of space, from national to regional level and down to local level, as well as informing, cooperation and coordination between local initiatives, plans and projects with regional and national plans and actions. |
| **Consolidated procedure for issuing documents**<br>(Article 8) | Competent authority of local self-government is obliged to identify own organisational unit to conduct consolidated procedure for: issuing location approval; issuing construction permit; reporting works; issuing use permit; obtaining approval for design, or connecting facilities to infrastructure network; obtaining papers and other documents issued by holders of public functions, which are the requirement for construction of facilities, or for issuing location approval, construction permit and use permit from their respective competences, as well as provide conditions to connect to infrastructure network and registration of property rights on constructed building (consolidated procedure).<br><br>Actions by holders of public functions and conducting of consolidated procedure are further defined in Article 8. |
| **Planning documents**<br>(Article 11) | Planning documents include spatial plan of a local self-government. |
| **Content of spatial plan**<br>(Article 20) | Spatial plan of a local self-government contains (inter alia):<br><br>– planned use of space;<br>– planned protection, planning, use and development of natural and cultural goods and environment;<br>– measures for balanced territorial development of the local self-government. |
| **Integral parts of planning documents**<br>(Article 29) | Integral parts of spatial plan of the local self-government are rules of planning, rules of construction and graphical part. Their content is provided in Articles 30, 31 and 32. |

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| **Conformity of planning documents**<br>(Article 33) | Documents of spatial and urban planning must be harmonised so that a document of narrower scope must be in line with a document of broader scope. Planning documents must be in line with Spatial Plan of the Republic of Serbia.<br><br>The spatial plan of a local self-government, following public insight, must get consent by the minister competent for spatial planning and urbanism, regarding conformity of those plans with planning documents of broader scope, this Law and regulations adopted thereon, within maximum of 30 days of the day of receiving application for consent.<br><br>The spatial plan of a local self-government, following public insight, must obtain the consent of competent authority of the autonomous province, regarding conformity of that plan with planning documents of wider relevance, this Law and regulations adopted thereon, within maximum of 30 days from the day of receiving application for consent.<br><br>Control of conformity of spatial plan of the local self-government is carried out, within 15 days of the day the application for control of conformity of planning document, by a commission established by the minister competent for spatial planning and urbanism. As regards planning documents in the territory of autonomous province the control is carried out by a commission established by competent authority of autonomous province. |
| **Competence for adopting planning documents**<br>(Article 35) | Spatial plan of a local self-government is adopted by the assembly of the local self-government. |
| **Developing planning documents**<br>(Article 36) | Planning documents as required under this Law, can be developed by a public enterprise, or another organisation established by the local self-government for spatial and urban planning, as well as companies, or other legal entities entered in proper register for carrying out activities related to spatial and urban planning and developing planning documents. |
| **Publishing planning documents**<br>(Article 42) | Upon the adoption of the planning documents, the narrative part of all planning documents is published in the official gazette of authorities adopting the planning documents, or official gazette of the local self-government, except the special annex related to special measures of development and preparation of territory for the purpose of defending the country. |

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| **Monitoring the spatial situation**<br>(Article 45) | For the purpose of monitoring the spatial situation, competent authority of the local self-government develops a local information system of planning documents and spatial situation, in line with principles of INSPIRE Directive.<br><br>Deadline for the establishment of local information system is one year from the day this Law enters into force.<br><br>All planning documents recorded in the local information system are available to interested parties in electronic form online, except the special annex pertaining to special measures of development and preparation of territory for the purpose of defending the country. Procedure for adopting planning documents is further defined in Articles 45–52. |
| **Conversion of agricultural to construction land**<br>(Article 88) | When agricultural land is converted to construction land through a planning document, the authority competent for adopting the planning document is obliged to submit, within 15 days of the day the document enters into force, an official document containing a list of converted cadastre plots to the authority competent for national survey and cadastre.<br><br>The owner of the cadastre plot converted from agricultural to construction land is obliged to pay conversion fee prior to the issuing of a construction permit, in line with the Law governing agricultural land. |
| **Conversion of forest land to construction land**<br>(Article 89) | When forest land is converted to construction land through a planning document, the authority competent for adopting the planning document is obliged to submit, within 15 days from the date the planning document enters into force, an official document containing a list of converted cadastre plots to the ministry competent for forestry and authority competent for national survey and cadastre.<br><br>The owner of the cadastre plot converted from forest to construction land is obliged to pay conversion fee prior to the issuing of location conditions, i.e. construction permit, in line with the Law governing forests. |
| **Construction land development**<br>(Article 94) | Construction land development is carried out in line with applicable planning document according to mid-term and annual development programmes adopted by local self-government, while taking care of the protection and rational and sustainable use of land.<br><br>In order to ensure conditions for development, use, improvement and protection of construction land, a local self-government can establish a company, public enterprise or other organisation or to ensure such matters otherwise, in line with the law or statute. |

| | |
|---|---|
| **Urban land consolidation**<br>(Article 107-108) | Urban land consolidation is the procedure whereby existing cadastre plots, in the territory for which the plan of general or detailed regulation was adopted, are converted to construction plots, in line with the valid planning document, for the purpose of rational use and development of construction land, with simultaneous resolving of property issues that occur in the procedure. Urban land consolidation is further governed by Articles 107–108. |

Regulation adopted on the basis of the Law on Planning and Construction pertaining to local information system of planning documents and spatial situation:

— **Rulebook on the content and keeping of Central register of planning documents, information system on the spatial situation and local information system in digital form of submission of planning documents** (*Official Gazette of the RS, no. 33/2015*). This Rulebook further governs the content and keeping of Central register of planning documents, information system on spatial situation and local information system of planning documents as well as digital form of submission of planning documents. For the purpose of monitoring the spatial situation, the competent authority of the local self-government develops a local information system of planning documents and spatial situation.

| **LAW ON FORESTS**<br><br>*(Official Gazette of the RS, no. 30/2010, 93/2012 and 89/2015)*<br><br>This Law governs silviculture, conservation, protection, planning, utilisation and management of forests and forest lands, the supervision of the implementation of this Law, as well as other issues significant for forests and forest lands. This Law ensures the conditions for sustainable management of forests and forest lands as a good of public interest, in a manner and to an extent to conserve and enhance their productivity, biodiversity, ability to regenerate and vitality, and increase their potential for the mitigation of climate change and their economic, ecologic and social functions, without inflicting damage to the surrounding ecosystems. | |
|---|---|
| **Forest and forest lands**<br>(Article 5) | Forest land is the land on which a forest is cultivated, the land on which it is more rational to grow forest, because of its natural characteristics, as well as the land with facilities intended for forest and game management and for multiple-use forest functions, and which cannot be used for other purposes, except in cases and under the conditions laid down by this Law. |
| **Obligations and limitations of forest owners and users**<br>(Article 7) | Forest owner, or forest user, is obliged to protect forests and forest lands against degradation and erosion, to execute forest management plans, and to perform other measures stipulated by this Law and regulations adopted thereon. Article 10 defines conditions for conversion of forests and forest lands. |

| **LAW ON WATERS**<br><br>(*Official Gazette of the RS, no. 30/2010, 93/2012 and 101/2016)*<br><br>This Law governs legal status of waters, integrated water management, management of water facilities and water land, sources and manner of funding water activities, supervision over the implementation of this Law as well as other issues relevant to water management. | |
|---|---|
| **Determining erosion-prone areas**<br><br>(Article 61) | Borders of erosion-prone areas are entered in the water management plan, flood risk management plan, forest development programme, forest land development plan, agricultural master plan, in spatial plans (spatial plan of the local self-government, spatial plan for areas of special purpose and regional spatial plan) and urban plans (master regulation plan, master urban plan and detailed regulation plan).<br><br>A local self-government is obliged, for the purpose of revision of water management plan, to record all occurrences and works that may affect the change of the state of erosion and torrents and submit data thereon to public water management enterprise once a year. |
| **Damage restoration**<br><br>(Article 139) | The legal entity or physical person deteriorating water regime, or the state of erosion on erosion-prone area, is obliged, within the deadline set by the inspector for water management, to carry out actions of restoring the situation to that prior to incurrence of damage.<br><br>If the mentioned person fails to carry out actions within the set deadline, those actions will be carried out by the public water management enterprise or competent authority of the local self-government in the case of erosion-prone area, at the expense of the person inflicting the damage. |

*Text in the table for some mentioned articles of the Law is not an extract from the Law, but rather a copy of some paragraphs of articles of the Law or their description.

## 8.2 Annex 2 — Indicators for monitoring the process of sustainable land use at the local level

**Table 8**: Indicators for monitoring the process of sustainable land use at the local level[77]

| **Indicator:** | **CHANGE OF LAND USE** |
|---|---|
| **Indicator definition and description** | Indicator shows trends in the conversion of agricultural, forest and other semi-natural and natural land into urban land and other artificial areas. It indicates areas occupied by construction and urban infrastructure, as well as urban green, sport and recreational areas. Indicator shows changes in the use of agricultural land, occupation of land by various types of human activities, origin of urban land shown through the percentage of various converted categories. |
| **Methodology of data calculation and collection** | Indicator is calculated by analysing maps developed on the basis of interpretation of satellite images. Depending on the area where analysis is carried out, Corine Land Cover database of European Environment Agency is used, as well as maps of greater scales. Indicator is calculated on the basis of growth trend of areas converted over a certain period of time (5–10 years) and on the basis of CLC databases of changes; indicator is shown numerically, in tables and charts in hectares of converted land, by type of conversion and as a percentage (%) of converted land annually in relation to the entire land.<br><br>Conversion of agricultural, forest and semi-natural/natural land (CLC2 to CLC5) into urban lands (CLC1) is grouped depending on the methodology for calculation of land cover. |
| **Unit of measure** | ha or $km^2$ |
| **Competent institution to which data are submitted** | Data are submitted on special requests, there is no specially regulated obligation of data submission. Local self-government calculates the indicator for the purpose of monitoring the implementation of spatial plans and monitoring the implementation of goals from strategic documents. |

[77]Rulebook on national list of indicators of environmental protection (*Official Gazette of the RS, no. 37/2011*)

| Indicator: | LAND EROSION |
|---|---|
| **Indicator definition and description** | Indicator shows areas and intensity of erosion processes, as well as representation of classes of real and potential risk from land erosion. Erosion processes represent changes to the surface layer of soil relief occurring due to leaching and removal of the tiniest and most fertile particles from loose surface. |
| **Methodology of data calculation and collection** | Indicator is calculated by determining the degree of threat to land from erosion expressed in t/ha per year. To calculate the indicator, modelling is applied using data on the manner of land-use, topography and climate. Recommended methodologies are the Pan-European Soil Erosion Risk Assessment model (PESERA model), as well as (USLE model) for soil loss. A list of other accepted models for the assessment of soil loss is available in the Technical guidelines for the collection of soil erosion and soil organic carbon data for Europe through Eionet (2010, European Commission, Directorate General JRC).[78]<br><br>Data necessary for assessing risk from land degradation by erosion are:<br><br>1. Soil type;<br>2. Soil texture;<br>3. Bulk density and water and air properties of soil, hydraulic properties of soil;<br>4. Topography, including slope gradients and slope length;<br>5. Land coverage;<br>6. Manner of use of land and land area (including land management, agricultural systems and forestry);<br>7. Climate (including distribution of precipitation and characteristics of wind);<br>8. Hydrology conditions;<br>9. Dominant factors of erosive processes;<br>10. Quantitative indicator of the degree of threat - erosion coefficient Z (according to Erosion Potential Method).<br><br>It is necessary to apply satellite images, in combination with information technologies – GIS, digital terrain model and elevation models combined with field recognition of terrain, where appropriate.<br><br>An erosion map must be in digital and interactive form, with wide and diverse possibilities of use. |

[78]Current methodology is likely to change as follows: for the calculation of indicators, data obtained through field research and modelling are used and supported by data on the land use, topography and climate. Primarily, national methodology is used (EPT – Erosion Potential Method), which may be aligned to reporting requirements of the European Commission and European Soil Data Centre JRC (Technical guidelines for the collection of soil erosion and soil organic carbon data for Europe through EIONET, 2010, European Commission, Directorate General JRC), where appropriate. Recommended methodologies are the Pan-European Soil Erosion Risk Assessment model (PESERA model), as well as Revised Universal Soil Loss Equation (RUSLE model).

| | |
|---|---|
| **Unit of measure** | t/ha per year of eroded soil |
| **Competent institution to which data are submitted** | Ministry of Agriculture, Forestry and Water Management, Ministry of Environmental Protection, Serbian Environmental Protection Agency, Directorate for Waters of the Republic of Serbia. |

| Indicator: | CONTENT OF SOIL ORGANIC CARBON |
|---|---|
| **Indicator definition and description** | Indicator monitors the content of organic carbon in certain layers of soil to determine the degree of land degradation. Determining the content of organic carbon in soil represents the basis for calculating the accumulation of organic matter in the layer down to one metre deep in soil. Development of the indicator ensured the assessment of organic matter stocks in soil depending on the type of land and its use, all aimed at determining areas at risk for sustainable land use. |
| **Methodology of data calculation and collection** | Indicator is calculated on the basis of data on the content of organic carbon in soil and is expressed in t/ha in the soil layer of 0–30 cm and in layer of 0–100 cm, as well as in percentage of organic carbon in the soil layer of 0–30 cm and in layer of 0–100 cm.<br><br>A list of accepted pedotransfer functions for determining bulk density necessary for determining the content of organic carbon in soil is available in the Technical guidelines for the collection of soil erosion and soil organic carbon data for Europe through Eionet (2010, European Commission, Directorate General JRC).<br><br>The set of data necessary for assessing risk of land degradation by reducing organic matter includes the soil type and texture, manner of land use, topography, as well as variation of climate factors.<br><br>Data are collected within the Programme of systematic control of soil fertility, Programme of systematic monitoring of soil quality, as part of soil research and soil mapping, as well as other projects determining quality and degradation of land.<br><br>Data obtained on the content of organic carbon in soil are shown on maps and in numbers in determined grid. |
| **Unit of measure** | t/ha and % |
| **Competent institution to which data are submitted** | Ministry of Environmental Protection, Serbian Environmental Protection Agency |

| Indicator: | CONTAMINATED SITE MANAGEMENT |
|---|---|
| **Indicator definition and description** | Indicator shows the manner of managing sites where presence of localised soil pollution was confirmed. It monitors progress in managing such sites by following the main pollutants affecting the quality of soil and groundwater, as well as the implementation of rehabilitation and remediation. Localised pollution is linked to the areas of intensified industrial activities, inadequately regulated waste dumps, sites of mineral resources excavation, military storages and areas where incidents and soil pollution occurred. |
| **Methodology of data calculation and collection** | Indicator is developed by analysing progress in managing contaminated sites which is expressed through:<br><br>1. Total number of potentially contaminated sites;<br>2. Number of sites where preliminary research was carried out (in % and in numbers);<br>3. Number of sites where detailed research was carried out (in % and in numbers);<br>4. Number of sites where rehabilitation and remediation measures are undertaken (in % and in numbers);<br>5. Number of sites where remediation was carried out (in % and in numbers);<br>6. Costs and estimated costs of rehabilitation (in RSD);<br>7. Share of main types of localised sources of soil pollution in the total number of identified sites (in %);<br>8. Share of industries in localised soil pollution (in %);<br>9. Main pollutants affecting pollution of soil and surface waters. |
| **Unit of measure** | Number of sites is indicated numerically and in percentage, share is indicated in percentage, costs of rehabilitation and remediation are expressed in local currency (RSD) |
| **Competent institution to which data are submitted** | Ministry of Environmental Protection, Serbian Environmental Protection Agency |

| **Indicator:** | **AREAS OF DEGRADED LAND** |
|---|---|
| **Indicator definition and description** | Indicator shows area of degraded land resulting from erosion, loss of organic matter, soil compaction, salinization and/or alkalisation, landslides, acidification and chemical pollution. |
| **Methodology of data calculation and collection** | Indicator includes several sub-indicators related to the degree of soil vulnerability from:<br><br>1. Erosion, expressed in t/ha per year and in percentage of degraded area;<br>2. Loss of organic matter, and expressed in the loss of soil organic carbon in t/ha and in percentage per unit of time and in hectares of degraded land;<br>3. Risk from soil compaction expressed in percentage of degraded land and hectares;<br>4. Vulnerability of soil to salinization and/or alkalisation expressed in percentage of vulnerable land and hectares;<br>5. Vulnerability of soil to landslides expressed in percentage of vulnerable land and hectares;<br>6. Vulnerability of soil to acidification expressed in percentage of vulnerable land and hectares;<br>7. Vulnerability of soil to chemical pollution (% of vulnerable land and level of pollution).<br><br>Sub-indicators are assessed on the basis of general elements for risk assessment for land degradation provided in the Regulation on the programme of systematic monitoring of soil quality via indicators for assessment of soil degradation risk and methodology for creation of remediation programmes (*Official Gazette of the RS, no. 88/2010*).<br><br>Methodology for calculating degree of vulnerability of soil is based on empirical data or modelling. If modelling is used, then models need to be confirmed by comparing results on the basis of empirical data not used for the development of the models. Measurement, or mathematical methods and engineer assessment must be in line with relevant national, European and/or international instructions and standards.<br><br>Degree of vulnerability of soil from chemical pollution is determined on the basis of values of pollutants in groundwater and value of concentration of hazardous and noxious substances and values that may indicate considerable soil contamination.<br><br>Obtained data are indicated on maps, in numbers and descriptive in established grid. |

| | |
|---|---|
| **Unit of measure** | Percentage of degraded/vulnerable soil in relation to the total surface and surface of degraded land expressed in hectares. |
| **Competent institution to which data are submitted** | Ministry of Environmental Protection, Serbian Environmental Protection Agency |

## 8.3 Annex 3 — Measures of good agricultural practice

Sustainable land management means a whole set of measures in the **Good agricultural practices** system. The main goal is to prevent any process of land degradation and maintain and improve current soil fertility in a holding.

Good Agricultural Practice (GAP) has been prescribed by international institutions, such as UN Food and Agriculture Organisation – FAO. Good agricultural practice is based on control of critical points (HACCP) and quality of products provided within regulation of World Health Organisation - Codex Alimentarius. FAO good agricultural practice initiative ensures a mechanism for implementing specific activities ensuring sustainable agriculture and rural development. In the Republic of Serbia, good agricultural practice is not isolated as a separate document, but is found within the laws and rulebooks on agricultural production. Since 2005, the application of GAP is a legal obligation and a requirement to access markets of the European Union and global markets.

Suggestion is that different levels of administration (from local level to the ministry) should help agricultural producers with subsidy measures.

Table 9 shows specific measures which should be applied.

**Table 9**: Measures of good agricultural practice

| General measures | Specific measures |
|---|---|
| **1. crop rotation principles** | 1.1. permanent soil coverage, thus reducing effects of wind and water erosion<br><br>1.2. shifting cultivation of plant species according to the rules of practice |
| **2. tillage** | 2.1. reduce intensive tillage where climate and soil conditions, as well as requirements of cultivated plant species so allow<br><br>2.2. plough along contour lines in order to prevent water erosion on sloping fields<br><br>2.3. avoid unnecessary passing over by heavy machinery, selection of time of tillage depending on the soil moisture, tillage at various depth to avoid plough pan – prevention of surface and subsurface compaction |
| **3. fertilising** | 3.1. strict application of regular control of soil fertility and recommended quantities of organic and mineral fertilisers – profitability of agricultural production, avoiding pollution of water ecosystems<br><br>3.2. apply proper cultivation measures, or preparation of manure – conservation of nutritive value of manure and elimination of weeds<br><br>3.3. compost all organic refuse, not only from holdings but also organic municipal waste and organic side products from food industry<br><br>3.4. plough under, and do not burn crop residues<br><br>3.5. apply green manure or cultivation of plants for the purpose of their ploughing under to increase content of organic matter in soil |
| **4. irrigation** | 4.1. analysis of water and physical properties before designing irrigation system<br><br>4.2. analysis of irrigation water to eliminate secondary salinization, alkalisation and pollution<br><br>4.3. compulsory regular organic fertilising of the soil under irrigation system |
| **5. protection** | 5.1. apply preventive measures<br><br>5.2. apply appropriate quantities of pesticides – education, proper use of technique, proper time of applying pesticides |

| General measures | Specific measures |
|---|---|
| **6. reclamation measures** | 6.1. humification – application of increased quantities of organic fertilisers to increase the content of organic matter<br><br>6.2. reduce the level of salinized groundwater by constructing and maintaining drainage channels<br><br>6.3. regulation of water courses in order to prevent floods<br><br>6.4. calcification – introduction of a lime material in acid soil to raise pH value<br><br>6.5. adequate use of crop residues as conditionally renewable source of energy – with more frequent control of soil fertility and ensuring sufficient quantity of organic fertilisers<br><br>6.6. re-cultivation of soils damaged by excavating opencast mines, disposing industrial waste, etc.<br><br>6.7. sanding – adding big quantities of sand fraction on clay soil (with ploughing under), to improve soil texture; rather rare measure on agricultural land due to big transport costs, perhaps on the land area foreseen for recreation (sport playgrounds) |

Regulation of agricultural land by reclamation, which, inter alia, includes construction and maintenance of the irrigation and drainage systems, is crucial for the state of land resources and is one of preconditions for the development of agricultural production in an area, which was recognised in the 2014 – 2024 Agriculture and Rural Development Strategy of the Republic of Serbia. One of priority areas in the document is efficient land management and increase of accessibility of land resources, while one of the goals is to increase reclaimed areas and improve soil fertility. Principles and mechanisms of action indicate that special attention will be given to the improvement of soil quality and its production capacities, and to the support and funding of projects of reclamation and improvement of land infrastructure.

The Republic of Serbia is located in a specific area where droughts and surplus water periodically occur, which all has a negative effect on plant production. Excessive soil moisture is mainly present in lowlands in all basins in the Republic of Serbia, not only on the surfaces without drainage system but also on surfaces where system functionality is reduced due to insufficient conservation. On higher grounds, surplus water comes usually from precipitation or as external water from higher fields. Degree of soil vulnerability to surface water is described through drainage classes containing information on the state of natural drainage of soil and influence of water of different origin in the process.

They are used for assessing needs for drainage: soils can be very much vulnerable due to the surplus water (I), strongly vulnerable due to the surplus water (II), less vulnerable (III) and partly and occasionally vulnerable due to the surplus water (IV). Approximately 2.6 million hectares of agricultural land is within I – IV drainage class. Approximately 955,000 ha is within the first two drainage classes, which may not be used without applying drainage system. It is estimated that in the Republic of Serbia there exist approximately 400 drainage systems, with 210 pumping stations of 543 m3/s capacity. In the development period by 2021, drainage should include approximately 1,127,000 ha of land (Regulation on determining Water Management Master Plan of the Republic of Serbia).

Drainage in wider sense means all measures and works on regulating soil moisture, draining surplus water in soil and implementing procedures of eliminating negative impacts of surface and groundwater (Belanović S., 2012). It is a set of measures for collection and draining of surplus water from soil or soil surface (Rudić et al, 2006). Draining measures can be divided into: (a) measures of surface draining and (b) measures of subsurface draining. Scope and methods of drainage are determined by the complex of natural and economic and social conditions of individual areas. Drainage is closely linked with climatology, pedology, geology, hydrology and other scientific disciplines, and other hydro-reclamation measures, primarily irrigation. Analysis of long-term water balance in the Republic of Serbia indicates that it is poor in own waters, while spatial and time-related uneven distribution of water resources is the main characteristic of hydrology situation in the Republic of Serbia. Time-related uneven distribution is reflected in occurrences of surplus water in winter/spring and lack of water in summer. Surplus internal waters are most often the consequence of high precipitation, and to a larger extent they are the consequence of subsequent rainy years leading to aggregating of water mass on flat terrains with rather shallow level of first groundwater, so that processes of excessive soil moisture are mainly expressed in spring.

Considerable part of land area of the Republic of Serbia is hydromorphic soils, which are permanently or occasionally exposed to excessive moisture in the whole profile or part thereof. Given their high potential fertility and the fact that they appear in predominantly flat land, suitable for mechanised tillage, these soils require reclamation interventions. Activation of potentials of hydromorphic soils and changes in the soundness of land cover will be possible by applying drainage measures.

## 8.4 Annex 4 – Results of research within the Project from the viewpoint of impact on health of local population

One of the main goals of the project "*Enhanced Cross-Sectoral Land Management through Land Use Pressure Reduction and Planning*" was to define possible impacts and hazards (direct and indirect) to the health of, primarily local population, resulting from degraded and polluted soil. So far, a preliminary analysis of risk – threat to human health – was drafted based on interpretation of previous research (environmental impact assessment study, peer reviews, plans and laboratory analyses to classify hazardous and non-hazardous waste, inspection reports and other documents) and results of laboratory analyses of soil, hazardous and non-hazardous waste, groundwater and surface waters, sediment of standing and flowing water from the environment and the locations themselves – hot spots.

Based on conducted analysis, the presence or suspected soil contamination was determined due to the following pollutants: (a) oil and derivatives, (b) polycyclic aromatic hydrocarbons (aliphatic and highly volatile), (c) polychlorinated biphenyls (PCB), dioxins and furans, (d) pesticides and residues, (e) artificial fertilisers and related compounds, (f) some heavy and toxic metals, (g) fluorides, cyanides and asbestos. Sources of soil pollution originating from anthropogenic activities result from contamination from the air – atmosphere (emissions from technological processes, combustion of fossil fuels in industry, energy, individual and central fire bed), from motor vehicles, via emission of gases and particles in waste combustion, biomass, forest fires, from waste waters, mine tailings, resulting from agricultural activities (artificial fertilisers, pesticides, organic waste) and waste (hazardous waste) from industry, households and other activities.

Having studied technology and production processes of the former economic operators, having classified residual industrial hazardous waste on compounds and having conducted field visits, the presence of large quantities of residual "historical" waste was determined, which mainly represents **hazardous waste** with the potential of polluting the environment and threatening human health. Inadequate storage of hazardous waste (used oil, residual contaminated fuels, fuel oils and other mineral substances, metal dust, solvents, waste catalysts, pyralene capacitors and sub-stations), acids, bases, alcohol and other raw material that expired, as well as other hazardous waste mostly stored in inadequate containers, outdoors under the influence of wind, rainfall, floods and other extraordinary circumstances, can contaminate atmosphere of neighbouring residential settlements, and also penetrate into soil and contaminate surface and groundwater. Potential threat to water supply was registered at several locations (Sombor, Prokuplje, Veliki Crljeni, thermal power plant "A" and "B" in Obrenovac, etc.)

and it requires timely reaction of professional services and competent national and local authorities. Some sites are characterised by risk of contamination by heavy and toxic metals (Pb, Hg, Cd, As, Ni, etc.), some pesticides (DDT, organochlorine), PCB, polycyclic aromatic hydrocarbons and other substances of mineral origin, all characterised by bioaccumulation, entry into the food chain, mutagenicity,[79] teratogenicity,[80] while some are medically proved to be carcinogenic. PCB and similar compounds are registered at micro-locations also as constituent of waste in various media at several locations (Kolubara, Lazarevac, Veliki Crljeni, thermal power plants, Zrenjanin), and in case of inhaling, they may have temporary mutagenic and teratogenic features.

It is worth mentioning the share of soil pollution originating from residual unsecured mine tailings. Often in emergency situations, (floods) the flood wave contaminates downstream settlements, in particular riversides, by tailings containing mainly heavy and toxic metals (Pb, Hg, As, Cd, An, Ni). Such circumstances are registered in the territory of the following local self-governments: Kruševac, Čačak, Loznica, Šabac and Negotin – Prahovo. Similar situation is in some municipalities with presence of lead in environment (Sombor), resulting from the activity of accumulator industry over many years.

Table 10 provides a full overview of polluters, their eco-toxicological properties and sites where they were identified, and provides information to decision makers at the local level about which sites or hot spots should be carefully considered in the process of planning sustainable land management and health protection of local population.

[79]Mutagenicity is a mutation of genes as a consequence of malign transformation of a cell under the effect of some noxious and hazardous substance in human organism.

[80]Teratogenicity is damage to foetus in mother's womb under the effect of gene mutation resulting from penetration of noxious and hazardous substances from a group of carcinogenic substances to organism. Under the influence of pyralene and similar compounds (dioxins and furans), in case they penetrate into human organism by inhaling large concentrations over a long period of time, it is possible that in human organism there occurs gene mutation with temporary character and spontaneously disappear after one or two years, but provided that there is no further exposure. Gene mutation leads to damage to foetus in mother's body so that children can be born with minor or major damage to tissue and organs (teratogenic effect).

**Table 10**: Pollutants, eco-toxicological properties and sites where they were identified

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Antimony**<br><br>Light silver-coloured metal, of 3-valent or 5-valent electric charge. It burns and releases the fragrance typical of garlic. It is used in the metal industry for making alloys and other products. | Hazardous to plants and animals, bioaccumulative, penetrates into the human body by inhalation of dust, ingestion and through the skin. It reaches the lungs, it is toxic to the heart muscle and especially to the renal function. Suspected of causing cancer. | It was noted as **antimony slag originating from the Zajača tailing, the municipality of Krupanj**, which flooded in the 2014 floods. Flotation tailings of the antimony have contaminated the rivers of Korenita and Jadar, specifically sediment and riverside soil. Tailing, beside antimony, contains also high concentrations of As, Pb, Hg, Cd and Ni and other metals. |
| **Arsenic**<br><br>It belongs to both metals and non-metals. In some areas in the nature there are increased concentrations of arsenic. It is present in the ores of lead, copper, gold, antimony, often in pesticides, paints, wood preservatives, leather tanning agents, paper making, etc. | Arsenic is bioaccumulative and therefore enters in food chains. If aquatic organisms (fish, crabs, shells, etc.) have been exposed to arsenic for a long time, it can be deposited in their tissues. In the human organism, it binds to serum proteins in haemoglobin. Certain arsenic compounds, especially organic, are very toxic.<br><br>Arsenic belongs to the first group of carcinogens according to IARC. It causes lung cancer (after exposure of 30 years), skin, bladder, kidneys, liver and prostate. As for non-carcinogenic toxic effects, there stand out disturbances of renal and hepatic functions, hypertension, diabetes (exposure to contaminated water), changes in the skin. | It can be mainly found on ash dumps of thermal power plants, whereas by rinsing due to rainfalls and floods it reaches surface waters (**thermal power plant "Nikola Tesla", "A" and "B", Thermal power plant "Morava" - Svilajnac, Thermal power plant and ash dumps in Veliki Crljeni, Kostolac and Obrenovac**). |

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Cadmium**<br><br>Soft, silvery metal, present in ores of lead, zinc, copper. It is used in the production of nickel-cadmium batteries, paints, plastics, rubber, glass alloys, etc. It is used in the production of fungicides, and it is often found in phosphorus fertilisers. | Diseases related to intake of cadmium are bone diseases (in which it is deposited as other heavy metals: Hg, Pb) and it causes osteomalacia. It damages the liver and kidneys, blood enzymes. It is deposited in the liver (biological time of degradation is 20-30 years).<br>Fungicides also contain Cd, which is resorbed in plants and thus enters the food chain and then the human organism.<br>Humans are exposed to cadmium also when inhaling tobacco smoke because the tobacco plant accumulates this element. It is easily absorbed (40-60%) by inhaling the cigarette smoke, and can be absorbed also over the skin. After exposure, cadmium binds to erythrocytes and is transported through the body, where it is deposited in the liver, kidneys, testicles, pancreas and spleen. The elimination of cadmium occurs slowly and it can remain in the body for 20-30 years. Target organs of the toxicity of this element are kidneys (causing histopathological changes), bone system (osteoporosis, osteomalacia), lungs (lung carcinoma, exposure through tobacco smoke). Cadmium does not pass through the placenta but is deposited on it, thus preventing the normal transport of the necessary bioelements (Zn and Mg). | It can be found at several examined locations: **the antimony tailing in Loznica, the thermal power plant "Nikola Tesla" "A" and "B", Prahovo, Šabac, Kragujevac - wherever there is metalworking industry**. It follows other heavy metals in the tailings of ores of zinc, copper, lead, gold, antimony, etc. It is often found at the recycling and collection complexes of wasted Ni-Cd batteries, rubber as well as dirt in phosphate fertilisers. |
| **Nickel**<br><br>Solid, grey-coloured metal found in iron and copper ores. It is used for production of alloys and especially as a catalyst for chemical processes. Nickel is often present in coal and oil whose combustion releases it into the atmosphere. Nickel-carbonyl is a particularly toxic compound that may also be found in cigarette smoke. | It is associated with nasal and lung cancer (when inhaling nickel and nickel carbonyl). It inhibits blood serum enzymes. It damages the alveoli of the lungs, and is associated with the development of lung cancer in smokers. | It can be often found at various locations in Serbia (**metalworking industry - Kraljevo, Niš**), somewhere even at very high concentrations. It is present in copper and iron ores. Coal contains a certain amount of nickel that is registered as a significant polluter from the atmosphere, especially near coal mines and ash depots of thermal power plants, heating plants, etc. The problem is to determine whether it originates from the parent substrate, or it has emerged as a product of some industrial activity. |

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Lead**<br><br>Grey, soft heavy metal, known to humans from the beginning of civilisation. It is used for glazing of pottery and casting of water pipes. It is widespread in industrial production. It is used in fuel production to increase octane value. | Lead can be introduced into the body by inhalation, digestion and through the skin, it enters the blood and thus into organs and tissues. It accumulates in bones and hair. It inhibits enzymes in the blood and blocks the synthesis of haemoglobin, shortens the life span of erythrocytes, impairs renal function, and often the central nervous system (encephalopathy).<br><br>99% of the absorbed lead is transported through the bloodstream (erythrocytes) to soft tissues (liver, kidneys, brain), where 90% is deposited in bones. The biological half-life of degradation is 10-20 years.<br><br>One of the ways of exposure to lead is also through the protective clothing of the workers, thereby endangering the health of the members of their households.<br><br>Lead penetrates the placenta, and the lead content in the blood of the foetus is correlated with the content of lead in the mother's blood. | It can be frequently found in metallic dust from the processing of materials in galvanizing sludge at the tailing sites and drifts of river, streams. It is deposited in the riverside and is often found in individual water facilities-wells in the riversides. Very high concentrations were registered in earlier laboratory soil testing **in Sombor (near the accumulator factory) and at storage sites of waste accumulators, tailings, hazardous metal waste, pyrite burner (Prahovo, Šabac), etc**. |
| **Mercury**<br><br>The only elementary metal in liquid aggregate state. It evaporates in an enclosed and heated room. It often accompanies other ore tailings. | Mercury enters the food chain because it is bio-accumulative, and most algae and microorganisms from the soil are not sensitive to its presence, but it accumulates in them. Mercury vapours are well absorbed in the lungs, reaching the brain and kidneys through the blood and causing the most degenerative changes, blocking enzymatic activity and cell division. It is especially dangerous for pregnant women and their foetuses due to accumulation in the placenta. It causes acute and chronic diseases of people depending on the length of exposure and dosage. It accumulates in bones, hair and certain human tissues, especially the kidneys. | It is used in the production of chlorine preparations (chloralkali), for the production of pesticides, especially fungicides, and is included in ash composition after coal combustion. Organic and inorganic compounds of mercury are toxic.<br><br>Mercury compounds are very often in practice found on **ash depots - landfills from coal combustion in thermal power plants and heating plants. Examples are ash depots of TPP "Nikola Tesla" "A" and "B" in Obrenovac, TPP "Morava" in Svilajnac and TPP in Kostolac**. |

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Chromium**<br><br>Its compounds are used for chrome plating of metals, tanning of leather, as photo material, and for chemical syntheses (chromic acid, chromates, bromates). In nature, it is found to be trivalent (less toxic) and hexavalent. | In its trivalent form it is a necessary microelement in human organism which, together with insulin, affects the utilisation of glucose. It is used in leather, textile industry, for chrome plating of metals, etc. Compounds of hexavalent chromium are extremely toxic and directly connected with the development of lung cancer. It damages the skin, and when inhaled and ingested it causes gastric ulcer. It damages blood and blood cells and causes chromosomal aberrations and is associated with lung cancer. | In the previous research activities analysed in this Project, the presence of significant quantities of chromium was registered in hazardous metal waste **on ash depots of thermal power plants, in the sediments of the rivers of Južna and Velika Morava, Toplica and in the drifts from mine tailings**. |
| **Asbestos**<br><br>Mineral, very widespread in the Earth's crust, 90% present in the form of chrysolite (hydrated magnesium silicate). It is used for the production of heat-resistant objects, insulating materials, building materials, pipes, etc. In the air, asbestos is found in the form of microscopic fibres in the concentration of 0.01-0.1 μg, where 0.1 μg contains about 100 million fibres. | The fibres are inhaled or penetrate through the skin into the human body and form "asbestos corpuscles", and the disease is called asbestosis. The lymphoma is transported to the liver, intestines and elsewhere, where a specific tumour mesothelioma can occur. | It is present in ash and coal depots, residue depots from oil refining, soil contaminated by oil and derivatives. **Locations of ash depots of TPP "Nikola Tesla" "A" and "B", "Kostolac", "Morava" - Svilajnac**. As construction material, asbestos is present at the **complexes of "Goša", "Župa", El Niš, "Fiat" Kragujevac** and many other industrial complexes. In a number of towns and industrial complexes there are data about the presence of asbestos waste which is macroscopically noticeable (corrugated cover, construction material, brake linings and belts). |

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Cyanides**<br><br>Compounds containing cyanic radical and used in many technological processes, in the composition of rodenticides and other insecticides for extermination of rodents. They often accompany waste water from the paper and cardboard industry, recycling plants, etc. Used as nerve agents in World War II. | Strong poisons binding to iron from haemoglobin and preventing the cell in the use of oxygen. Symptoms of poisoning of the nervous system may be paresis, paralysis, breathing block, etc. | Cyanide waste is registered **in several locations: factory "21 October" in Kragujevac, Industry for the production of chlorine preparations "Župa" in Kruševac, "Prva Petoletka" from Trstenik, Factory of wagons in Kraljevo, "Papirpak" in Čačak, "Toza Marković" in Kikinda.** |
| **Phosphates**<br><br>They are used as artificial fertilisers in fruit growing, in particular raspberry growing for mosquito control, but also in the production of detergents. | They are very toxic to the nervous, blood and bone system of humans. | The presence of phosphates was registered in the soil **in Prahovo and Šabac**, in relation to the production of phosphoric acid. |
| **Oil, derivatives, polycyclic hydrocarbons of aliphatic and aromatic type and PCB**<br><br>They belong to similar compounds of various toxicity. | What they have in common are bioaccumulation and dissolving in the lipids of cells. The fractions of these high boiling point compounds (aromatic compounds) are very toxic and have a carcinogenic effect on humans after many years of exposure (20-30 years).<br><br>Many microorganisms participate in the oil degradation in the aquatic environment and soil. Lipophilicity of derivatives and oil, but also DDT and PCBs, allow penetration and accumulation in the wildlife and human body. | **At all locations where oil is processed - refineries, coal mines, thermal power plants, wherever there is heating oil, fuel storage, petrochemicals.** |

| Noxious and hazardous substance | Significant eco-toxicological properties | Sites where presence in soil was identified |
|---|---|---|
| **Pesticides**<br><br>Chlorinated hydrocarbons (DDT, dieldrin, landan, aldrin, endrin, chlordane, toxaphene), organophosphorus pesticides, carbamates, fungicides (Bordeaux soup) and many other compounds make up a range of thousands of compounds that pollute the environment with heavy and toxic metals, hydrocarbons and various impurities. | They are toxic to humans, wildlife and microorganisms in soil. In humans, they cause damage to the blood, liver, spleen, kidneys and central nervous system.<br><br>Pesticides are a huge group of compounds and are all toxic. The period of decomposition under the influence of pesticides is very important because the residues can be even more toxic. Through anthropogenic action they get to water and soil as a significant source of contamination of soil, food, groundwater, sources of water. | No specific location. |

*Locations that may have significant negative impact on human health include complex of industry for production of chlorine preparations "Župa" from Kruševac where, as early as fifteen years ago, macroscopically visible mercury was registered in waste water drainage channels and inside the complex. Besides mercury, which is a systemic poison for human organisms, as well as for animals and microorganisms, waste carbon - disulphide (raw material for the production of artificial silk fibres) was registered on several locations. This substance is flammable, explosive and very toxic to human health, terrestrial and aquatic flora and fauna, and at the stated site it is not safely stored and protected from penetration into the soil and water (surface and groundwater). The registered presence of mercury (macroscopically visible) in the form of mercury drops was revealed in the report of the Mobile Eco-toxicological Unit for chemical incidents of the Public Health Institute of the City of Belgrade in 2009 at the Župa industry complex in Kruševac, which used to produced chlorine and other chemical preparations, using mercury in the production process. Mercury was detected by instrumental techniques and laboratory analyses in the sediment of a nearby stream outside the complex (waste water drainage channel) and within the complex (in containments). Even though noxious effects on human health have not been established, it is recommended that specific epidemiological studies should be conducted in the workplace, and in the environment.*

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