DOKSAY

Çok Nemli İklime Sahip Doğu Karadeniz Bölgesinde
Entegre Doğal Kaynak Yönetimi

Integrated Natural Resource Management in Very Humid
Climatic Regions of Eastern Black Sea Coastal Region in Türkiye

SUSTAINABLE LAND MANAGEMENT APPROACHES AND APPLICATIONS FOR LAND DEGRADATION NEUTRALITY

Local Solutions for a Climate-Resilient Future

Sustainable Land Management Approaches and Applications for Land Degradation Neutrality Booklet, 2025

Republic of Türkiye Ministry of Environment, Urbanization and Climate Change General Directorate of Combating Desertification and Erosion

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Baskı:

This publication has been prepared within the scope of the Integrated Natural Resource Management in Very Humid Climatic Regions of the Eastern Black Sea Coastal Region in Türkiye (DOKSAY) Project, using the Land Degradation Neutrality Decision Support System book, prepared by the Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, General Directorate of Combating Desertification and Erosion, as a source.

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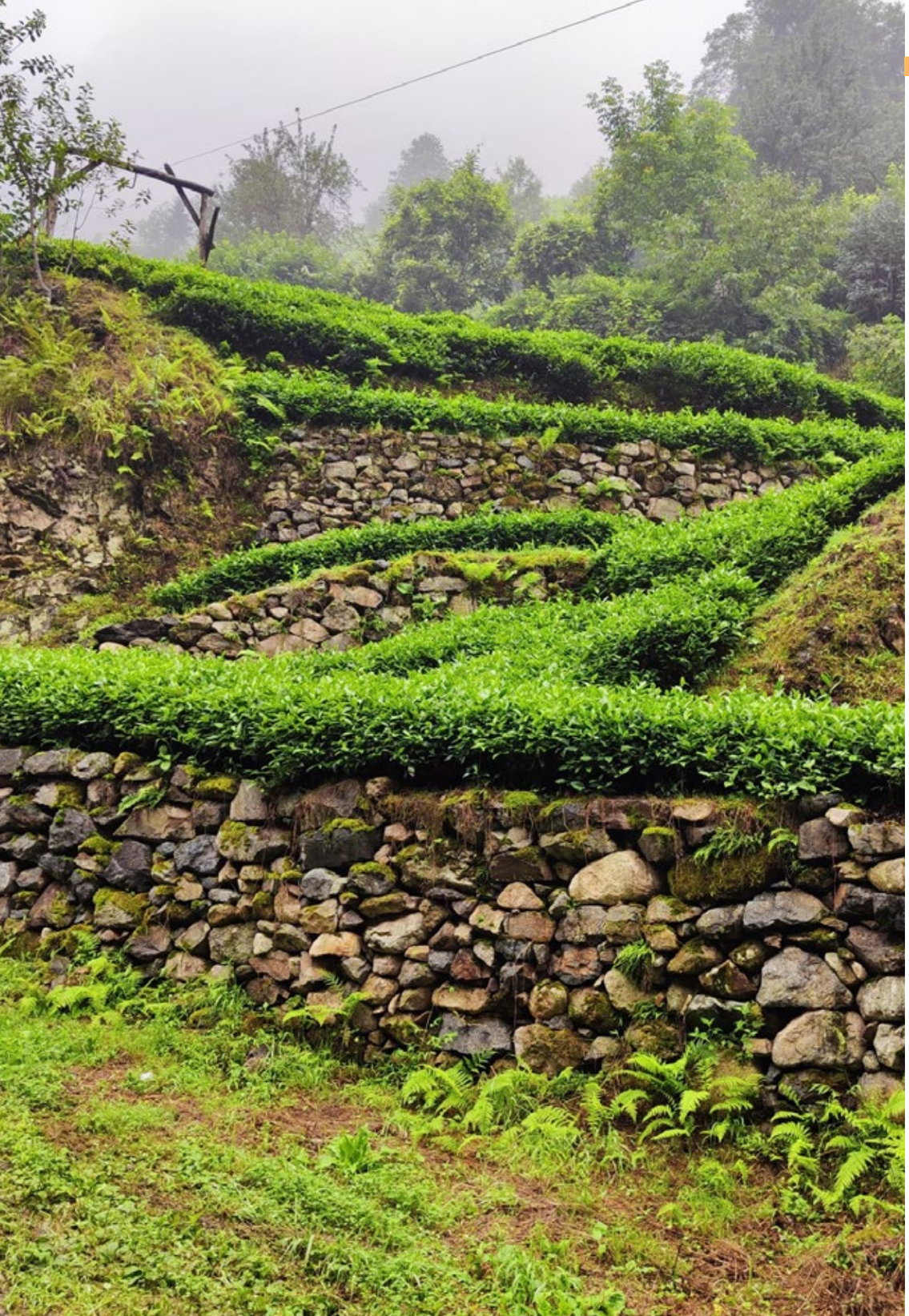

ABBREVIATIONS

LDN	Land Degradation Neutrality
UN	United Nations
DLDD	Desertification, Land Degradation and Drought
DKM	Nature Conservation Centre
DOKSAY	The Integrated Natural Resource Management in the Very Humid Climatic Regions of the Eastern Black Sea Coastal Region in Türkiye Project
GEF	Global Environment Facility
ISFM	Integrated Soil Fertility Management
SLM	Sustainable Land Management
SDGs	Sustainable Development Goals
SFM	Sustainable Forest Management
SPI	Science-Policy Interface
SOC	Soil Organic Carbon
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme

SUSTAINABLE LAND MANAGEMENT

Sustainable Land Management (SLM) was defined at the 1992 Rio Earth Summit as “the use of land resources, including soils, water, animals, and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions.” The concept of SLM can be applied to any ecosystem and land use type.

SLM represents a holistic approach aimed at conserving all ecosystem services in productive ecosystems over the long term by integrating economic, sociocultural, and biophysical needs and values.

Land provides vital environmental functions and ecosystem services, including provisioning, regulating, supporting, and cultural services; it supports the production of food, feed, fuel, and fiber, regulates the severity of natural disaster risks, and provides cultural and spiritual services for human well-being. Currently, “Desertification, Land Degradation, and Drought” (DLDD) under the adverse effects of climate change negatively impacts the provision of ecosystem services that are essential for sustaining livelihoods and human well-being. In this context, SLM not only presents land-based solutions to mitigate the effects of these problems but also ensures the conservation of biodiversity and the safeguarding of soil and water resources in both quantity and quality.

SUSTAINABLE LAND MANAGEMENT APPROACHES AND APPLICATIONS FOR LAND DEGRADATION NEUTRALITY

The implementation of SLM approaches constitutes the necessary application phase to achieve the Land Degradation Neutrality (LDN) target. Through SLM practices, the goals of mitigating the effects of climate change and enhancing adaptation to climate change are pursued on one hand, while facilitating the fight against desertification, land degradation, and drought is aimed on the other. In short, SLM approaches represent a holistic approach that targets reaching long-term, productive ecosystems by considering biophysical, sociocultural, and economic needs and values together.

In Türkiye, administrative, cultural, vegetative, and engineering control measures have been taken and implemented for years by responsible public bodies and institutions within the framework of many projects and programs, depending on the severity and priority of desertification and erosion on managed agricultural, forest, and rangeland areas. Depending on institutional authority, duties, and responsibilities, the applications can vary over a wide spectrum according to land cover and soil and water management. In this document, the “Sustainable Land Management Approaches” prepared under the United Nations Convention to Combat Desertification Science-Policy Interface (UNCCD SPI) have been largely taken into account.

Sustainable land management approaches are grouped under 14 main headings. The descriptions and benefits of these approaches are briefly stated in Table 1.

Table 1. Sustainable Land Management Approaches

Approaches	Description	Benefits
1 Afforestation / Reforestation	The establishment of tree or forest cover on non-forest land. Reforestation is the establishment of tree or forest cover on land that was previously converted to another land use.	• Reversing land degradation and rehabilitating degraded land • An effective climate change mitigation strategy • High Soil Organic Carbon (SOC) accumulation • Increase in below- and above-ground biomass and biodiversity • Soil erosion control, soil and water conservation • Increase in aesthetic and cultural services due to improved ecosystem functions and services
2 Agroforestry	Agroforestry refers to production systems where trees are grown together with crops and/or animals on the same piece of land. This approach covers various land use models... with different densities and distributions of tree-crop-pasture components.	• Controlling soil erosion • Improving soil productivity, fertility, and structure • Forest cover improves water retention and reduces nutrient loss • Income generation opportunities • Socio-economic benefits • Increasing carbon sequestration to mitigate climate change effects and adapt to changes; increased resilience to climate change
3 Minimum Tillage	Actions that reduce the degree of tillage by applying low soil disturbance at shallow depths or in narrow strips.	• Conserving or increasing soil fertility/quality • Reducing soil erosion and soil compaction • Improving water availability and retention • Increasing SOC storage • Potential for climate change mitigation
4 Reducing Deforestation	Includes measures to prevent or reduce the removal or clearing of a forest or trees, or the conversion of forest land to non-forest land.	• Reducing greenhouse gas emissions and climate change impacts • Conserving soil quality, soil carbon stocks, and biodiversity • Enhancing the livelihoods and resilience of forest-dependent communities
5 Soil Erosion Control	The prevention or control of wind or water erosion that leads to the breakdown of soil aggregates, transport, redeposition, and loss of soil fertility.	• Controlling on-site soil erosion • Improving soil yield/productivity and water availability • Vegetative measures using perennial woody vegetation or grasses to increase SOC... • Increasing plant and terrestrial biodiversity
6 Sustainable Forest Management	Aims to manage natural and planted forests responsibly and implements management practices that combine both forest productivity and forest protection to sustainably increase the benefits derived from forests and forest ecosystems.	• Generating income and employment opportunities for forest-dependent communities • Providing socioeconomic goods and services such as food, timber, and non-wood products • Reducing forest vulnerability and conserving forest productivity... • Reducing land degradation and contributing to climate change mitigation
7 Vegetation Cover Management	Includes practices for managing vegetation cover to improve its quality, quantity, and diversity through the selection and management of appropriate species for different land use types. It also includes the management of invasive species...	• Improving soil structure • Increasing soil carbon • Controlling soil erosion
8 Water Management	The sustainable management of water resources, including groundwater, surface water, and rainwater, to promote efficient water use and protect them from pollution and overuse.	• Increasing the soil's capacity for water infiltration, retention, release, and transmission • Reducing soil erosion • Improving water quality and use efficiency • Adapting to climate change and drought • Water and financial savings
9 Integrated Crop-Livestock Systems	Refers to the combination of both crop and livestock production and is practiced among sedentary, nomadic, and transhumant communities.	• Mitigating climate change • Increasing land productivity • Reducing soil erosion, increasing nutrient and water use efficiency

Approaches	Description	Benefits
10 Livestock Waste Management	The proper collection, processing, storage, and use of solid manure and urea waste to recycle as much of the collected farm manure as possible.	• Increasing soil fertility and land productivity • Providing nutrient cycling and reducing losses
11 Pest, Fire and Disease Control	A set of measures that manage, prevent, or control fire, pests, and diseases to reduce their negative impacts on land, vegetation cover, and ecosystems.	• Controlling pests and diseases • Reducing crop/vegetation losses and the spread of outbreaks • Conserving biodiversity • Reducing forest degradation • Mitigating climate change
12 Forest Restoration	A technology that serves to recover degraded forest ecosystems to re-establish their structure, ecological functioning, biodiversity, and productivity levels.	• Restoration or rehabilitation of degraded land • Climate change mitigation • Increased forest productivity • Biodiversity and carbon sequestration • Improving the livelihoods and resilience of forest-dependent communities • Aesthetic and sociocultural benefits
13 Grazing Pressure Management	A series of measures that prevent the damage, degradation, or depletion of natural resources such as vegetation, soil, and water by assessing the carrying capacity at which grazing ecosystems can be managed on a sustainable basis.	• Preventing soil erosion and degradation • Regulating soil carbon dynamics
14 Integrated Soil Fertility Management	A series of practices aimed at optimizing nutrient cycling and use efficiency in the soil and increasing crop productivity.	• Improving soil quality • Controlling soil erosion • Water retention and SOC accumulation in soil • Reducing nitrogen (N) losses and greenhouse gas (GHG) emissions • Conserving and maintaining soil biodiversity • Ensuring the efficient functioning of ecosystem services in terms of nutrient cycling

Source: United Nations Convention to Combat Desertification Science-Policy Interface

In terms of land cover management, primary practices for both increasing land productivity and controlling soil erosion involve establishing or enhancing vegetation cover. This is achieved through methods such as afforestation, cover improvement, seeding for pasture, rangeland rehabilitation, the rehabilitation of dry stream beds, and afforestation as needed.

For the sustainable use of soil and water resources, the management of vegetation cover, in addition to the implementation of soil and water conservation measures, plays a crucial role in combating desertification and erosion. Examples of these include engineering measures such as dry stone check dams, wattle fences, and rehabilitation terraces, which are implemented alongside land preparation measures like afforestation terraces and surface runoff diversion ditches constructed in upper watersheds.

SLM approaches on agricultural lands differ to a certain degree from those in upper watershed forests and rangelands, depending on the cropping system and the crop variety being cultivated, and the applied methods vary accordingly. For example, many infrastructural engineering methods that complement cultural practices (e.g., land parcelling, irrigation, and drainage systems) may become more prominent. In this context, numerous studies are directly related to climate change adaptation, combating desertification and erosion, and conserving biodiversity and ecosystem services. These include agricultural crop pattern management, soil management, reduced tillage, water management, and integrated pest management. Various agricultural research and application programs, such as land consolidation, irrigation and drainage projects, good agricultural practices, and organic farming—all within the scope of land use and management plans—can be cited as examples.

Since biomass and vegetation cover management in different agricultural, forest, and rangeland areas directly affects soil fertility, SLM approaches must be addressed in conjunction with “Sustainable Soil Management” indicators. Although SLM approaches are classified under 14 headings, it is important to consider the relationships and mutual interactions between these approaches when solving land degradation problems during the implementation phase. In this context, a strategic action plan—designed at the provincial level in coordination with land users, especially farmers and local communities, and in harmony with incentive policies—is an important step in planning for land degradation neutrality measures.

SLM APPROACHES IN AGRICULTURAL ECOSYSTEMS

Integrated Soil Fertility Management

1.Organic fertilization

2. Biochar applications

3. Use of humus-containing fertilizers from biological and sustainable sources

4. Planting pits for fertilization and moisture conservation

5. Fertilization rates based on production system and variety

6. Mulching in rice paddies.

7. Composting with natural microorganisms

8. Micro-fertilization and seedbed preparation

Water Management

Sustainable irrigation systems

1. Stepped stone irrigation channel

2. Flood irrigation

3. Spiral water pump irrigation

4. Micro-irrigation systems

Water Harvesting

1. Water harvesting from heavy surface runoff for irrigation 2. Water harvesting

3. Groundwater recharge

Drainage

1. Subsurface drainage

2. Mid-season drainage in rice paddies

Vegetation Cover Management

1.Seed preparation

2. Selection of plant species and varieties

3. Traditional soil fallowing

4. Long-term fallow and transition to non-agricultural natural vegetation

5. Multi-cropping and intercropping systems

6. Maintenance of green cover with perennial woody plants 7. Perennial crop systems

8. Crop rotation

Minimum Tillage

1. Strip tillage (in-row planting)

2. Maintenance of permanent vegetative cover on the soil surface

3. No-till technologies (zero-tillage farming systems)

4. Direct seeding into stubble

5. Mulching

Pest and Disease Control

1. Integrated production and pest management

2. Application of biological agents to increase crop resistance

3. Use of plant-derived insecticides (phyto-pesticides)

4. Biological pest control

5. Identification of buffer tree strips

Soil Erosion Control

Structural (Engineering) Measures

1. Contour tillage and bund formation

2. Vegetated terraces

3. Soil/stone bunds

4. Soil ridges

5. Stone check dams or walls

6. Stone wall terraces

7. Traditional soil or stone-lined diversion channels

8. Watershed terracing

9. Semicircular soil or stone bunds

10. Bench terracing

Vegetative Measures

1. Windbreaks, shelterbelts, and live fences

2. Vegetative strips

3. Tree rows and grass strips to trap sediment

4. Stone-lined and vegetated waterways

5. Live barriers and windbreaks

Combined Measures

1. Riverbank stabilization

2. Water distribution weirs or dams

3. Gully control and watershed protection

4. Integrated surface runoff management

1. Assisted regeneration

Forest Restoration

1. Establishing protected forest areas
2. Reducing the conversion of forest land to agriculture through cutting and burning

Reducing Deforestation

SLM APPROACHES IN FOREST ECOSYSTEMS

Afforestation/Reforestation

1. Afforestation with mixed species at different scales
2. Land reclamation with native forest tree species
3. Reforestation on former forest lands
4. Re-establishment of forest cover after forest fires
5. Forest establishment in semi-arid areas

Water Management: Drainage

1. Use of biological drainage trees

Fire, Pest and Disease Control

1. Management of fire prevention measures in forests
2. Control of human-induced damages such as fires and pest outbreaks
3. Prevention of peatland fires

Soil Erosion Control

1. Afforestation activities for watershed management
2. Afforestation and terracing on hill slopes
3. Wet mulching
4. Preventing landslides with fast-growing trees compatible with drainage ditches
5. Mulching following forest fires
6. Afforestation with water-collecting or storing ditches on mountainous slopes

Sustainable Forest Management

1. Selective logging (for timber)
2. Adjusting rotation periods in forest plantations
3. Establishing woodlands for biomass production
4. Reducing timber waste
5. Firewood production
6. Forest irrigation and fertilization
7. Biomass production with short-rotation coppice in forests

SLM APPROACHES IN RANGELAND ECOSYSTEMS

Livestock Waste Management

1. Advanced low-emission barns equipped with special flooring, drainage, and collection systems

Water Management / Grazing Pressure Management

1. Stocking density (carrying capacity)
2. Rotational (controlled) grazing
3. Ecological grazing
4. Pasture resting
5. Closure of rangeland to grazing
6. Common (public) rangeland management

Integrated Soil Fertility Management

1. Organik maddeyi daha iyi dağıtmak için katı hayvan gübresinin üreden ayrılması
2. Besin elementi yönetimi

Vegetation Cover Management

1. Creation of small shallow pits in rangeland and reseeding
2. Irrigation of rangelands and meadows outside the grazing season
3. Fodder production on degraded rangelands
4. Rangeland rehabilitation through shrub plantation
5. Cut-and-carry fodder production
6. Establishment of perennial grass seed plots
7. Improved fire stacking for sustainable rangeland management

SLM APPROACHES IN MIXED ECOSYSTEMS

Agroforestry (Agri-Forestry Mixed Production Systems)

1. No-till farming with draft animals (zero tillage)
2. Home gardens
3. Integrated grazing and fodder production with orchard management (Forest-Grazing Production Systems)
4. Crop mixtures and plantation of multipurpose trees on agricultural land

Integrated Crop-Livestock Production Systems (Agro-pastoralism)

1. Inclusion of small ruminant fattening in dryland cereal production systems

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The Integrated Natural Resource Management in Very Humid Climatic Regions of the Eastern Black Sea Coastal Region in Türkiye (DOKSAY) Project is a project supported through GEF-7 cycle carried out in partnership with the General Directorate of Combating Desertification and Erosion Control (ÇEM) under the Ministry of Environment, Urbanization and Climate Change (MoEUCC), relevant governmental institutions, and with financial support from the Global Environment Facility (GEF). The project is being implemented by the Nature Conservation Centre (DKM) with the support from the United Nations Development Programme (UNDP).

The DOKSAY Project is a multi-faceted project that aims to provide significant environmental, social, and economic contributions to Türkiye. It aims to develop low-cost and nature-based solutions to problems related to land management. This project, which blends traditional knowledge with innovative practices, plays an important role in the areas of environmental sustainability, rural development, and combating climate change. It particularly supports the transition to a sustainable development model with more resilient and compatible land use in the Eastern Black Sea Region.

The project directly contributes to the Land Degradation Neutrality (LDN) targets set by Türkiye within the scope of the United Nations Convention to Combat Desertification (UNCCD), the United Nations Sustainable Development Goals (SDGs), the Paris Agreement, and Türkiye's mitigation and adaptation strategies for combating climate change.