Food and Agriculture Organization
of the United Nations

Decision support for mainstreaming and scaling up of sustainable land management

TECHNICAL REPORT | UZBEKISTAN

WOCAT
World Overview of Conservation Approaches and Technologies

Decision support for mainstreaming and scaling up of sustainable land management

GCP/GLO/337/GEF

TECHNICAL REPORT | UZBEKISTAN

by
Umid Abdullaev,
Design and Research UZGIP (Uzgipromeliovodkhoz) Institute
Ministry of Water Resources

Gulchekhra Khasankhanova,
Design and Research UZGIP (Uzgipromeliovodkhoz) Institute
Ministry of Water Resources

Tatyana Khamzina,
Design and Research UZGIP (Uzgipromeliovodkhoz) Institute
Ministry of Water Resources

Stefan Schlingloff,
Food and Agriculture Organization of the United Nations

Theodora Fetsi,
Food and Agriculture Organization of the United Nations

Soledad Bastidas,
Food and Agriculture Organization of the United Nations

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2024

Required citation:
Abdullaev, U., Khasankhanova, G., Khamzina, T., Schlingloff, S., Fetsi, T. & Bastidas, S. 2024. *Decision support for mainstreaming and scaling up of sustainable land management – Uzbekistan. Technical report*. Rome, FAO. https://doi.org/10.4060/cc7703en

ISBN 978-92-5-138164-9

Contents

Tables

Tables in Annex

Figures

Boxes

Foreword

Growing demand for food requires innovative ways to achieve the Sustainable Development Goals, under a changing climate and loss of biodiversity. The new FAO Strategic Framework 2022–2031 firmly commits the Organization to promoting the sustainable management of land and water ecosystems for better production, better nutrition, a better environment and a better life for all, leaving no one behind.

FAO's most recent assessment of the State of Land and Water (SOLAW, 2021) shows that one-third of global cropland and pastures are degraded. Climate change, unsustainable management practices and uncontrolled land-use changes are the main drivers of the land degradation process. Caring for land, especially agricultural land, is at the heart of the response to the challenges of addressing food security, poverty, adaptation to and mitigation of climate change, restoring ecosystems and nurturing biodiversity.

Land degradation and desertification affect almost 30 percent of Uzbekistan's total territory and pose a key limitation to achieving food security and combating rural poverty. Over the years, the Government of Uzbekistan has taken action to modernize the agriculture sector and support agricultural communities in mitigating the impacts of land degradation through sustainable soil, land and water management, crop diversification and support of local production by using salt-tolerant and drought-resistant crops. There is, however, a need to scale up sustainable land management (SLM) and strengthen informed decision-making processes.

Mainstreaming SLM into national and/or subnational agricultural plans, policies and programmes can be a challenge, as can supporting evidence-based strategy formulation at national level through the use of a decision-support system and appropriate tools. To address these challenges, in 2014 Uzbekistan joined the multi-country Global Environment Facility-funded project "Decision Support for Mainstreaming and Scaling up of Sustainable Land Management (DS-SLM)", in an effort to combat land degradation and to up- and out-scale SLM best practices through the adoption of a framework for decision support (DSF).

This report summarizes the main findings from the project implementation by applying DSF, which integrates land degradation assessments, SLM implementation, SLM mainstreaming and scaling-out, and knowledge management for informed decision-making at local, subnational and national levels. The results of the project, as well as the mainstreaming strategy developed, can serve as a guide for decision-makers in developing landscape interventions, as well as programmes on natural resource management that will build the resilience of communities.

Through this project, FAO has supported Uzbekistan in implementing SLM best practices in two demonstration areas, leading to the adoption of cost-effective SLM technologies, as well as strengthened capacities in the application of land degradation and SLM assessment tools. It is our hope that Uzbekistan and relevant stakeholders will benefit from the findings of this report and that awareness among policy-makers of the importance of mainstreaming SLM into key national policies, financing mechanisms and local-level decisions will be enhanced.

Lifeng Li,
Director
FAO Land and Water Division

Acknowledgements

Authors: Umid Abdullaev, Gulchekhra Khasankhanova, Tatyana Khamzina, Stefan Schlingloff, Theodora Fetsi and Soledad Bastidas

Contributors: Rustam Ibragimov, Salikh Khamzin, Tolib Mukimov, Abduvahob Ismonov, Abdumanop Tursunov, Anna Shkineva, Nicole Harari, Rima Mekdaschi Studer and Feras Ziadat

Preparation of maps: Rustam Ibragimov

Editors: Umid Abdullaev, Gulchekhra Khasankhanova, Tatyana Khamzina and Theodora Fetsi

Copy editor and proofreader: Clare Pedrick

Graphic designer: James Morgan

Abbreviations

CACILM	Central Asian Countries Initiative for Sustainable Land Management
DSF	Decision Support Framework
DLDD	desertification, land degradation and drought
DPSIR	Driving force–Pressure–State–Impact–Response
DS-SLM	Decision Support for Mainstreaming and Scaling-up of Sustainable Land Management
GEF	Global Environment Facility
ha	hectare
ICP/IWM	integrated crop planning/integrated water management
IFM	innovative financial mechanism
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
ISRIC	World Soil Information
LADA	Land Degradation Assessment in Drylands
LD	land degradation
LUS	land-use system
NGO	non-governmental organization
SLM	sustainable land management
SME	state monitoring of the environment
UNCCD	United Nations Convention to Combat Desertification
UNCCD PRAIS	United Nations Convention to Combat Desertification Performance Review and Assessment of Implementation System
UNDP	United Nations Development Programme
PLUD	Participatory Land Use Development
QT	questionnaire of technologies
QA	questionnaire of approaches
QM	questionnaire for mapping land degradation and sustainable land management
RAS	rural advisory services
SOC	soil organic carbon
SOM	soil organic matter
SRTM	Shuttle Radar Topography Mission
WB	World Bank
WOCAT	World Overview of Conservation Approaches and Technologies

©FAO/Rodger Bosch

1. Introduction

1.1. Background

Desertification, land degradation and drought (DLDD) are major environmental challenges, which threaten the status of the natural resources and the social and economic development of the Republic of Uzbekistan. Anthropogenic factors, together with the continuing risks of drought and climate change, have exacerbated land degradation in Central Asia and, more specifically in Uzbekistan, putting the country's sustainable development at serious risk. The most significant threats to natural resources in Uzbekistan include soil salinization, sand and dust storms, water erosion, biodiversity loss, deforestation, overgrazing and other unsustainable agricultural practices. The drying of the Aral Sea and of the Amudarya River Delta have become dramatic symbols of ecosystem damage and man-made disasters in the region.

Since land degradation problems are directly related to food insecurity and rural poverty, the Government of Uzbekistan has assigned mainstreaming and the scaling-up of sustainable land management (SLM) practices and approaches as a high priority, in order to overcome the above-mentioned challenges. Actions have focused on promoting initiatives for the sustainable development of the agriculture and water sectors until 2030. These have included a comprehensive modernization of the agriculture sector, strengthening the current financial status of farms, introducing advanced water-saving technologies and crop diversification, and the expansion of salt-tolerant and drought-resistant crops (see list of the Presidential Decrees of the RUz, 2015–2018. Table A3).

Uzbekistan became part of the Central Asian Initiative on Land Management (CACILM) in 2008. This seeks to assist countries in the region in implementing national-level programmatic frameworks for sustainable land management practices. In 2014, Uzbekistan joined the multicountry project "Decision Support for Mainstreaming and Scaling up of Sustainable Land Management (DS-SLM)", with the overall goal of increasing the provision of ecosystem services and enhancing food security by combating DLDD and scaling out SLM best practices, based on evidence-based decision-making. The national multidisciplinary group made efforts to adapt and demonstrate the most acceptable and cost-effective SLM practices, enhance the capacity building of target groups, and identify needs in terms of SLM measures to sustain the productive capacity of infertile soils.

1.2 Country context

Uzbekistan is located in the central part of the Eurasian continent in the Aral Sea basin. The landscape is extremely diverse and includes plateaus, lowlands and piedmont plains, spurs of mountains and mountain ranges. The population of Uzbekistan is 32.6 million, of which 49 percent is rural. Annual population growth is 2.3 percent and is considered to be the highest in Central Asia. This has resulted in a decline in arable land per capita from 0.195 to 0.129 hectares (ha) over the past 25 years. The rapidly growing population is posing challenges for the country's natural resources, due to pressure to meet increased demand for food (CACILM, 2009; UNDP, 2007).

According to the United Nations Environment Programme (UNEP) aridity index (Middleton and Thomas, 1992),[1] most of Uzbekistan's territory, except for the foothills and mountains, falls into arid zones, and it is highly susceptible to processes of land degradation, desertification and drought. Average rainfall varies from 100–200 mm/year (desert) to 200–800 mm/year (foothills and mountain areas). The main water resources of Uzbekistan are the transboundary Amudarya and Syrdarya Rivers, as well as the Kashkadarya and Zarafshan Rivers. The volumes of average multiyear river flows for the period of actual observations are 123 km^3/ year. (UNDP, 2007). The main flow of Amudarya and Syrdarya Rivers is formed in the territory of Tajikistan and Kyrgyzstan, respectively. The surface flow that is formed in the Uzbekistan area is 11,5 km^3/year, or around 18 percent of total water demand.

Total land area of the country is 44.4 million ha, of which 25.6 million ha are agricultural lands. Irrigated agriculture contributes to sustaining livelihoods, prosperity and employment of the rural population and occupies 3.5 million ha, whereas rainfed land covers 745 000 ha. Irrigated agriculture, which accounts for just 9 percent of total land area, consumes more than 91 percent of total water use (CACILM, 2006; CACILM 2009).

The estimated total area of the country's territory occupied by areas affected by land degradation and desertification is 127 117 km^2, or 28.6 percent of total territory (UNEP & Uzhydromet, 2016). In addition, about 4 percent of the area is located on the dried-up bottom of the Aral Sea – which is the main source of dust storms and salt transported to adjacent irrigated oases and the sandy landscapes of the Kyzylkum Desert. The dramatic desiccation of the Aral Sea has led to intensive desertification processes and

[1] According to the UNEP aridity index (correlation of precipitation rate to potential evapotranspiration), arid regions of the world are divided into three regions: arid 0.05-0.20, semi-arid 0.20-0.50, dry sub-humid 0.50-0.65.

the formation of a new desert, the Aralkum, on the dried sea bottom. In the past few decades, the exposed lakebed has become the new 'hotspot' of sand and dust storms in this region (FAO, 2013b).

Beyond the highly visible problems in the immediate surroundings of the Aral Sea, Uzbekistan is currently facing severe physical and chemical soil degradation. The total area of irrigated salt-affected soils is 2.1 million ha (Kuzyev *et al*., 2016). About 11 percent of irrigated lands suffer from water erosion to varying degrees. The most serious problems are identified in areas with the highest population density (such as the Fergana Valley) and the regions that rely most on irrigated agriculture (Bukhara, Khorezm and the Republic of Karakalpakstan) located in midstream and downstream Amudarya. About 90 to 94 percent of the irrigated land in Karakalpakstan, Khorezm and Bukhara provinces of Uzbekistan is salinized (Bucknall *et al.,* 2003; CACILM NPF, 2006).

In Uzbekistan, the economic losses caused by salinity to wheat and cotton alone are USD 13.29 million per year (IMF, 2010). Annual losses of agricultural productivity are estimated at approximately USD 31 million, and economic losses due to land abandonment as a result of high salinity are estimated at USD 12 million (Gupta *et al.*, 2009; Aw-Hassan, *et al.,* 2016).

1.3 Definitions and methodology

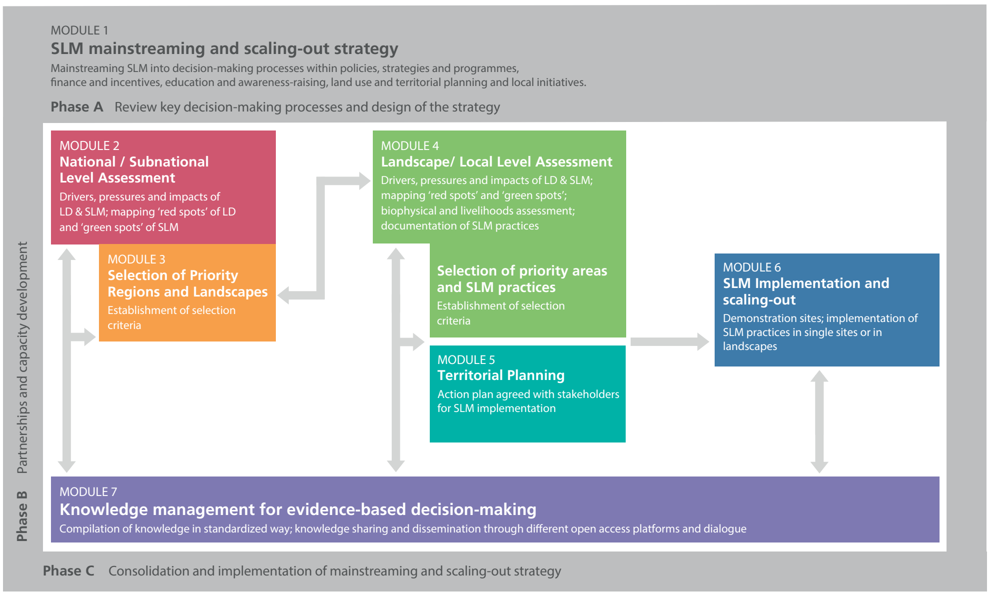
The Land Degradation Assessment in Drylands (LADA) project of the Food and Agriculture Organization of the United Nations (FAO) defines land degradation as "the reduction in the capacity of the land to provide ecosystem goods and services, over a period of time, for its beneficiaries" (FAO, 2013a). Degradation is the result of a complex interaction of factors that is developed under the combined influence of nature and man, and occurs in different forms on various land-use types:

- *On cropland*: chemical degradation – mainly fertility decline – due to nutrient mining and salinization; physical soil degradation due to compaction, sealing and crusting, water and wind soil erosion; biological degradation due to insufficient vegetation cover, decline of local crop varieties; and water degradation, mainly caused by polluting surface water and changing water availability, as well as high evaporation leading to aridity.
- *On grazing land*: biological degradation with loss of vegetation cover and valuable species; the increase of alien and 'undesirable' species. Low productivity and ecosystem services from degraded grazing lands are widespread and a major challenge to SLM.
- *On forestland*: biological degradation with deforestation and removal of valuable species.

The DS-SLM project envisaged the following outcomes: (i) SLM best practices mainstreamed into national and/or subnational agricultural and environmental plans and investment frameworks, policies and programmes to address DLDD; (ii) scaling-up of SLM best practices catalysed through targeted actions on the ground and strategic decision-making from local to national levels; and (iii) strengthening knowledge and decision support systems on DLDD and SLM.

The methodology followed for implementation of the project includes several steps and tools, which are outlined in the Decision Support Framework (DSF) and illustrated in Figure 1.1. The DSF was designed following a modular structure and serves as the overall framework for decision-making on land degradation assessment at national, subnational and local levels, as well as for supporting SLM implementation. Development of the DSF was an important step towards shaping a systemic way of working that can lead to informed decision-making. The DSF provides guidance to countries on how to link land degradation assessments and SLM practices to a strategy for SLM mainstreaming and scaling-out (Bastidas Fegan 2019; Liniger *et al*., 2019 and Harari *et al*., 2023).

Figure 1. 1 | The Decision Support Framework for SLM mainstreaming and scaling up



Source: Bastidas Fegan, S. 2019. *The Sustainable Land Management Mainstreaming Tool. Rome, FAO. 44 pp.* Licence: CC BY-NC-SA 3.0 IGO; Liniger *et al.* 2019. Achieving land degradation neutrality: The role of SLM knowledge in evidence-based decision-making. *Environmental science & policy,* 94, S. 123–134. http://www.sciencedirect.com/science/article/pii/S1462901118306403"www.sciencedirect.com/science/article/pii/S1462901118306403 and Harari *et al.* 2023. *Promoting sustainable land management through evidence-based decision support – A guide with country insights*. Rome, FAO.

The DSF integrates several planning and assessment tools for data provision, which are used to generate effective strategies and action plans for SLM integration into national policy, planning and financial decisions. Knowledge has been obtained through spatial and temporal assessment of DLDD, which was used as an input to select reliable SLM options that include soil conservation and restoration measures. More specifically, the LADA/World Overview of Conservation Approaches and Technologies (WOCAT) standardized tools have been used to collect data on land degradation and SLM at subnational and local level in Uzbekistan. At subnational level, the LADA-WOCAT Mapping Questionnaire (QM) provided a detailed assessment of the status, causes, trends and impacts of land degradation, as well as the SLM measures at (sub)national level to identify 'hotspots' of land degradation and 'green spots' of SLM per Land Use/ Land Management System (FAO, 2011). At landscape and local level, the LADA-local tool helped to identify promising SLM solutions, taking into consideration both biophysical and socioeconomic parameters.

For documentation of the SLM practices, the WOCAT Questionnaires on SLM Technologies and Approaches (QT-QA) provided a standardized methodology for data collection. The questionnaires sought experts' and land users' views on the main land degradation issues and ways to respond. In addition, several group discussions and field interviews were conducted, using locally adapted questionnaires on how to scale out SLM. Finally, an operational strategy has been developed to structure and monitor activities for integrating SLM into key national policy, planning and financial decisions and promote the wide adoption of SLM practices in Uzbekistan.

1.4 Study area

The project area covers the country's two highest priority agricultural landscapes – irrigated and rainfed arable land – located within two major economic regions: Djizak and Kashkadarya. These regions were selected on the basis of national priorities and the need to increase the productivity of agricultural land to improve the livelihood of the population. The landscapes are the most densely populated in Uzbekistan and play a dominant role in ensuring food security.

The selection criteria were based on biophysical, environmental and socioeconomic conditions at national and local levels. More specifically, the biophysical indicators included climate, soils, degree of susceptibility to erosion, salinization, drought and desertification. Socioeconomic indexes such as level of income, as well as institutional aspects and reforms in agricultural and water management, were used as a basis for the prioritization of landscapes. The study areas include two different types of landscape:

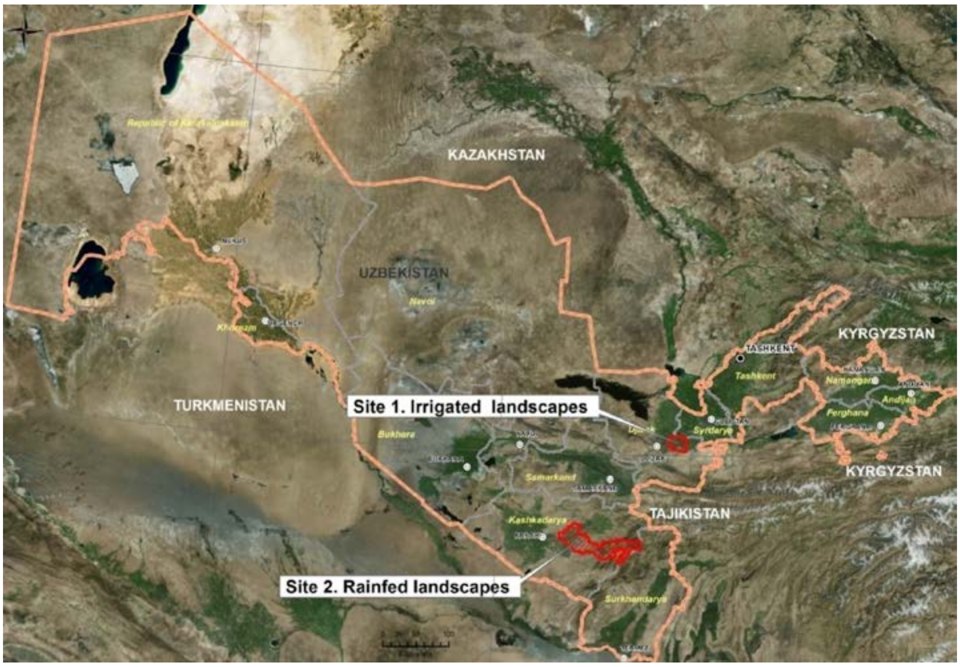
a) irrigated arable lands prone to salinization and drought in the Zarbdar district of Djizak region; and

b) rainfed arable lands suffering from lack of humidity, drought and soil erosion in the Kamashi district of Kashkadarya region (see Figure 1.2).

Djizak region is located in the centre of the country. The climate is extremely continental, with dry and hot summers and relatively mild winters. The total area of agricultural land is 1.249 million ha, including 0.477 million ha of arable land, of which 56 percent is irrigated and 44 percent is rainfed (State Committee of the Republic of Uzbekistan on Statistics. Agriculture, 2017). About 82 percent of irrigated lands are subject to soil salinization, 44 percent of which are classified as moderately and highly salinized, and are distributed in Arnasay, Dustlik, Mirzachul, Zarbdar and Farish districts. Rainfed croplands are subject to erosion and water scarcity. Between 40 and 70 percent of rainfed landscapes in Bakhmal, Gallyaaral, Djizak and Zaamin districts are characterized as moderately and highly eroded, and drought-prone lands.

Kashkadarya region is located in the southern part of Uzbekistan between the foothills of the Zarafshan and Gissar ranges in the Kashkadarya River basin, characterized by well-defined altitudes of vertical zonality. Most of the western part is occupied by extensive areas of plains, which gradually merge into the foothills and mountains to the east and northeast. The region's population is 3 088 800, with an annual growth rate of 2.5 percent, which is much higher than in other regions of the country. The total area of agricultural land is 2.194 million ha, including 0.422 million ha of irrigated lands and 0.257 million ha of rainfed (State Committee of the Republic of Uzbekistan on Statistics. Agriculture, 2017). The river flow probability is only 66 percent of water demand for irrigation. About 67 percent of the irrigated area is subject to soil salinization and soil pollution. These lands have also suffered from several consecutive years of drought, which has led to a dramatic decline in crop yields, coupled with accelerated soil degradation (Saliev and Fayzullaev, 2013).

Figure 1. 2 | The location of the selected study areas in Uzbekistan



Source: Contributor's own elaboration. Google Maps. (n.d.). [Uzbekistan]. Retrieved October 2018, from https://maps.app.goo.gl/HnTDmhmiFmYyw48PA. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Demonstration sites for the testing and distribution of best SLM practices were identified in both study areas, and field research was conducted to assess soil conditions. The pilot sites were selected based on multicriteria analysis.

The activities at the demonstration plots contributed to improvements in on-farm soil and water management, higher crop productivity and farm returns, and an increase of knowledge, skills and awareness on the part of land users regarding SLM-related challenges. In each district, SLM technologies were implemented as follows:

- Zarbdar district: (i) crop diversification with introduction of legumes (Green Gram) and green manure (Rye) on salt-affected soils; and (ii) introduction of new drought- and salt-tolerant cotton variety "Gulistan".
- Kamashi district: i) cultivation of desert drought-resistant crops (*Kochia prostrata*, *Halothamnus subaphilla*, *Ceratoides ewersman-niana*) on rainfed lands to reduce erosion and increase fodder production; and (ii) almond cultivation on small terraces to increase the efficiency of eroded soils in rainfed landscapes.

© FAO/Horst Wagner

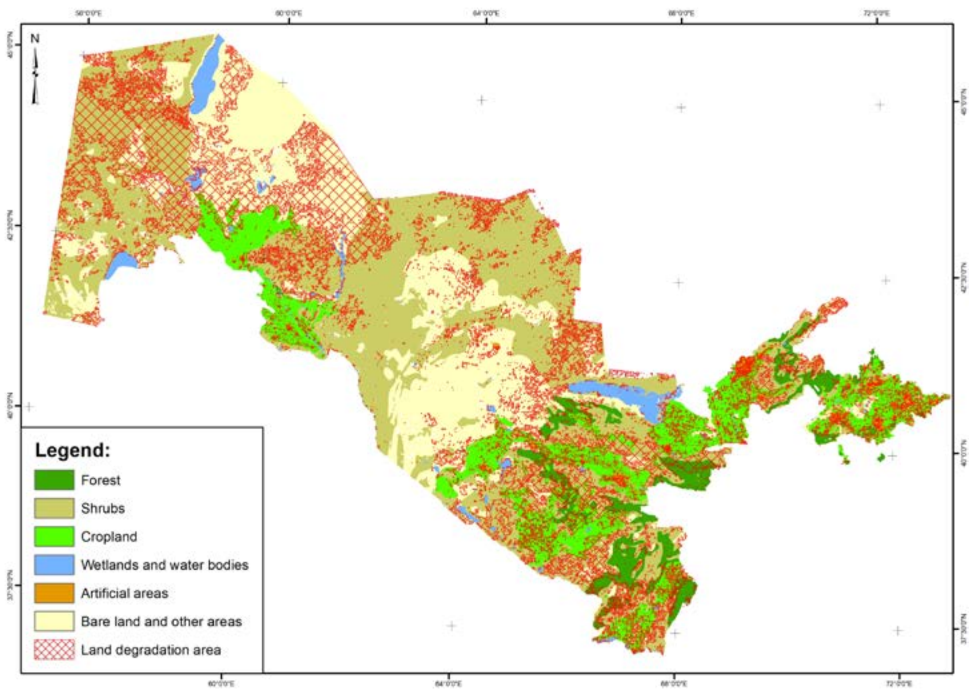
2. Key findings from the land degradation assessment

2.1 National-level assessment

2.1.1 Land Degradation Assessment

Land degradation and desertification are issues that are closely interconnected. The LADA-WOCAT Mapping Questionnaire (QM) for land degradation and Sustainable land management mapping was initially applied in Uzbekistan within the framework of CACILM-I (2008–2010). Defining and mapping different land-use systems are crucial activities for underpinning the assessment and its implementation. In accordance with the United Nations Convention to Combat Desertification Performance Review and Assessment of Implementation System (UNCCD PRAIS) Land Degradation Neutrality Target Setting Programme guidance (2018), the land cover map in Uzbekistan was developed based on the national database (see Figure 2.1). The assessment shows that the area of the country affected by DLDD is 127 117 km^2 or 28.6 percent of total territory, which includes 106 477 km^2 of drylands (issues related to overgrazing, deforestation) and 20 640 km^2 of irrigated land (salinization, erosion). In addition, about 4 percent of the area falls within the territory of the Aral Seabed, which with its drastic desiccation, has led to intensive desertification processes and the formation of the new Aralkum desert on the dried seabed (UNEP, 2016).

Figure 2. 1 | Land cover map with designated land degradation area in Uzbekistan



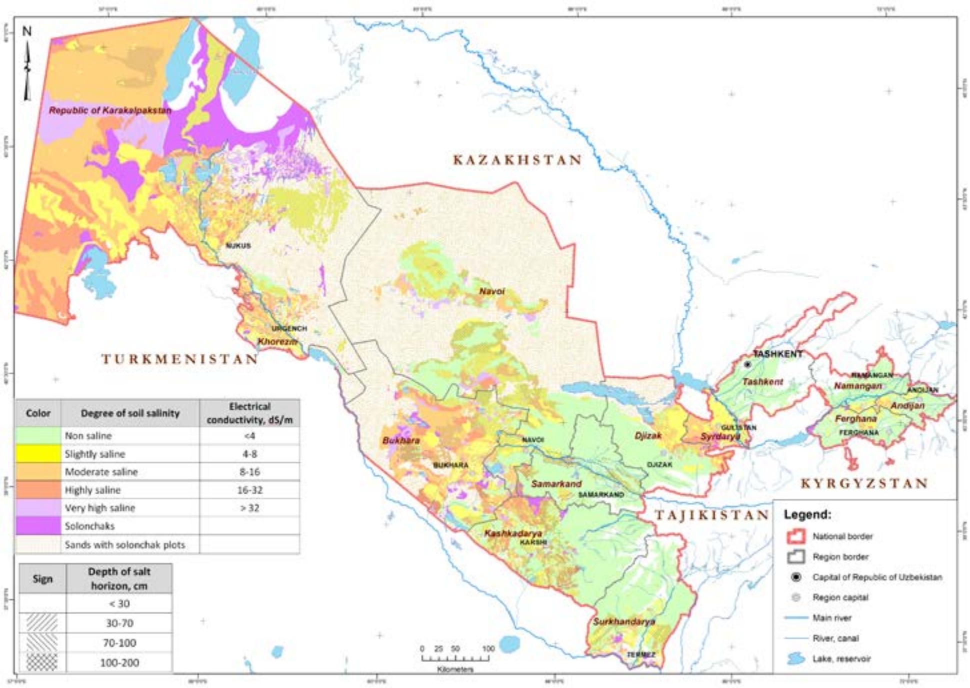
Source: UNEP. 2016. Third National Communication of Uzbekistan under the UNFCCC. https://unfccc.int/sites/default/files/resource/TNC%20of%20Uzbekistan%20under%20UNFCCC_english_n.pdf. Statistic State Committee of RUz. Agriculture in Uzbekistan, 2014–2017

2.1.2 Soil salinity

An arid climate, which defines characteristics of current bioclimatic conditions in the region, has conditioned the preservation of relict salt accumulation in eluvial and eluvial-accumulative landscapes, and current salt accumulation in hydromorphic conditions. The development of large-scale irrigation under conditions of low slopes and extremely difficult groundwater outflow led to the migration of soluble salts and their accumulation in the soil root zone (Pankova *et al.,* 1996). Within Uzbekistan, two landscape types are distinguished, based on manifestations of the salt process: i) landscapes with relict soil salinity; and ii) landscapes suffering from recent hydrogenic salt accumulation. (FAO, 2018b; Pankova *et al.,* 1996).

A vector soil salinity map has been developed on the basis of LADA methodology, using geographic information system/remote sensing and national monitoring data on the salinization of irrigated lands, regional natural and ameliorative maps, and a soil map of the Aral Sea coastal area. The map contains information on the degree and extent of salinization in the soil profile on layers of 0–30 cm, 30–100 cm and 100–200 cm, and the depth and thickness of the salt horizon (see Figure 2.2). The evaluation showed the total area of salt-affected soils in Uzbekistan to be 21.507 million ha. Of this total, around 10 million ha are characterized by a high degree of soil salinization of the 100–200 cm soil profile. These soils are mainly located in middle and downstream of the Amudarya and Syrdarya Rivers (FAO DS-SLM, 2018).

Figure 2. 2 | Soil salinity map of Uzbekistan



Source: FAO 2018. DS-SLM GCP/GLO/337 Project Implementation report, unpublished. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

2.1.3 Secondary salinization and waterlogging of irrigated lands

The most serious environmental threats in the country are secondary soil salinization and waterlogging of irrigated lands. The area of irrigated lands is concentrated mainly in desert and semi-desert zones. Secondary salinization occurs in conditions of a high groundwater table and poor drainage. Over-irrigation and high water loss from canals and irrigated fields produce a rapid rise of the groundwater table and salt accumulation in the rooting zone. The analysis shows that since the year 2000, there have been trends of reduced soil salinization and waterlogging processes in Uzbekistan.

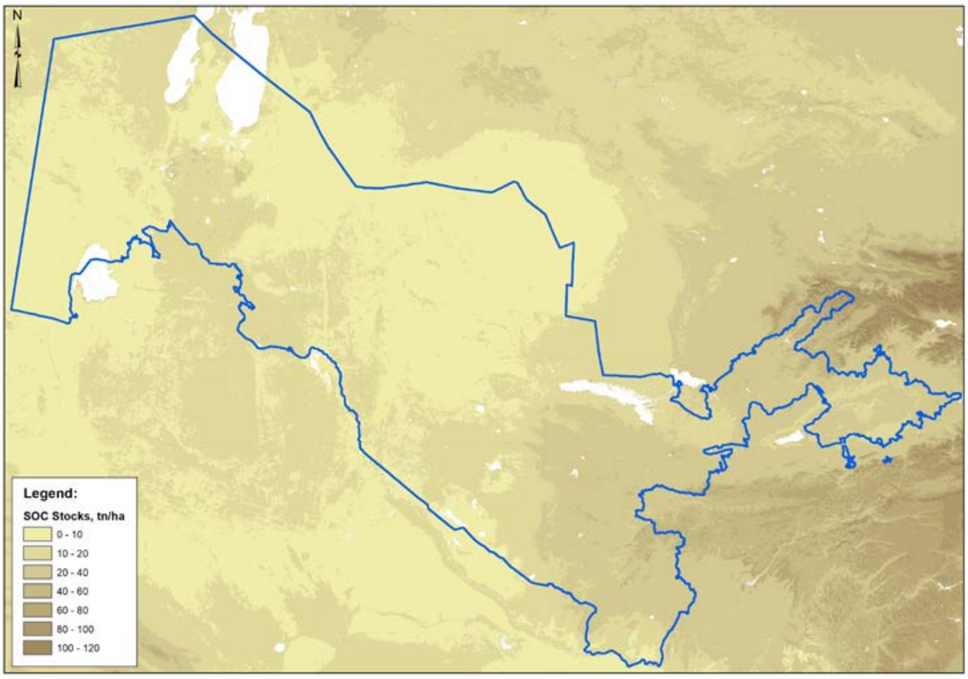
2.1.4 Soil organic matter and soil organic carbon

Soil organic matter (SOM) is key to soil fertility: through the binding of soil particles, it is it is fundamental for good soil structure and water-holding capacity, and it provides a habitat for soil organisms. SOM is a revolving nutrient fund; it contains all the essential plant nutrients, and it helps to absorb and hold nutrients in an available form for plants (Bot and Benites, 2005).

The dominant soil types in Uzbekistan are desert and semi-desert soils formed in very dry conditions, which are characterized by poor soil organic matter content (<1 percent). At present, humus content in the upper layer (0–60 cm) varies from 0.5–0.8 percent on light and typical serozems, to 0.65–0.95 percent on old irrigated land, and 1.25–1.60 percent on meadow soils. That is 1.3–1.5 times less compared with 1980 (FAO DS-SLM, 2018, CACILM NPF, 2006;). A reduction of humus in the soil is caused by the intensive monocrop cultivation of cotton over a long period of time, as well as by a small share of alfalfa and herbs in crop rotation, and scant use of manure.

In the framework of the development of the global FAO GSP SOC Map jointly prepared with the World Soil Information Center (ISRIC), the country-specific maps of Soil Organic Carbon in GRID 1 km were developed to evaluate soil carbon in Uzbekistan (see Figure 2.3).The National Soil Organic Carbon Map of Uzbekistan, at a scale of 1: 100 000, was used as a main source of information and characteristics of soil for digital SOC mapping, such as: content of soil organic matter as a percentage for 30 cm soil depth and soil bulk density in g/cm^3 for the same depth. These soil maps were scanned, georeferenced and digitized into polygonal shapes and attributed with corresponding soil characteristics. For the purpose of simulation of soil carbon stock, a digital point dataset was created from the above-mentioned polygons using ArcGIS software. In total, roughly 5 000 points were derived from the soil polygons, covering the entire territory of Uzbekistan. Each point in the dataset includes spatial information (x and y coordinates in the Universal Transverse Mercator (UTM) coordinate system), soil organic matter and bulk density for the 30 cm depth. The map was developed through the following steps: (i) soil inventory databases and mapping (digital and analogue); (ii) collecting and compiling soil data (soil profiles, humus horizon, soil types); and (iii) digitizing the necessary covariate data (agroclimate, geology, hydrogeology and land use etc.).

Figure 2. 3 | The National Soil Organic Carbon Map (GRID 1 km)



Source: Contributor's own compilation, 2017. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

2.1.5 Land productivity dynamics

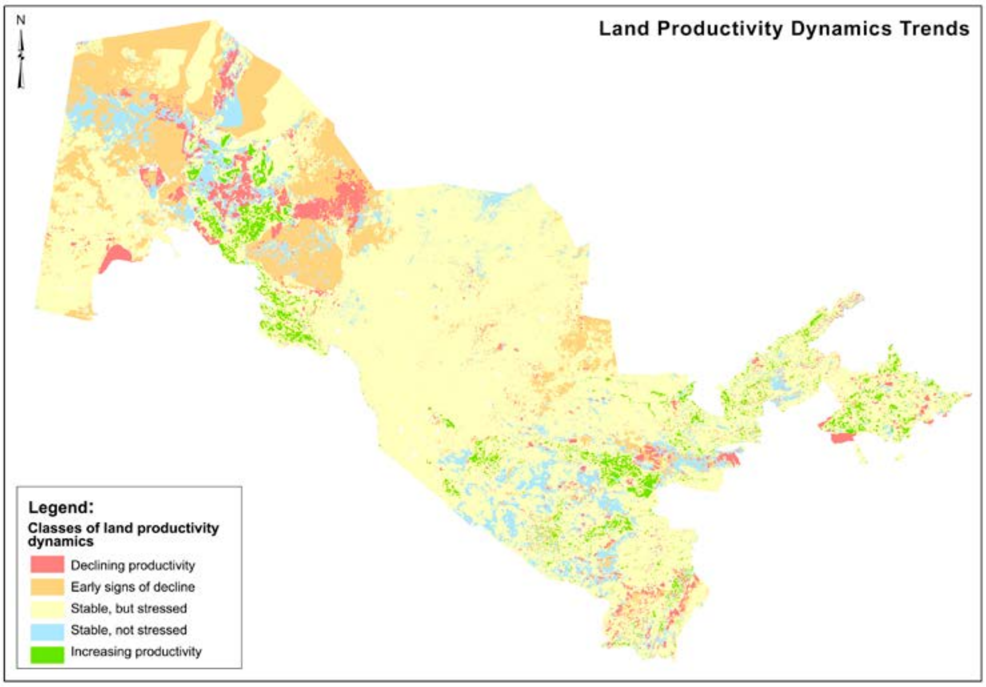
In accordance with the UNCCD PRAIS LDN Guidance, Net land productivity dynamics and their spatial distribution by land-use/cover categories for the period 2000–2013 are prepared and presented in Table 2.1 and Figure 2.4. An analysis of land productivity dynamics shows that for the period 2000–2013 all land-use/cover categories have stable land productivity dynamics (67 percent), but these are under stress. About 21 percent of the area is characterized by a decline in productivity and early signs of productivity decline.

Table 2. 1 | Net land productivity dynamics (2000–2013), km^2

Productivity	Forest	Shrubs, grasslands areas	Cropland	Wetlands and water bodies	Artificial areas	Bare land and other areas
Decline in productivity	4 408	4 800	1 086	1 103	475	8 377
Early signs of productivity decline	977	43 581	1 243	195	141	21 439
Stable but stressed	15 163	149 241	139 066	9 572	3 724	81 176
Stable not stressed	2 239	20 437	3 598	377	491	10 706
Increasing productivity	584	1 193	10 945	740	583	1 447
No data	110	2 017	216	495	29	2 126

Source: UNCCD PRAIS Report-Uzbekistan based on LDN guidance. 2018. Unpublished.

Figure 2. 4 | Net land productivity dynamics (2000–2013)



Source: UNEP, 2016. Third National Communication of Uzbekistan under the UNFCCC; Decision Support for Mainstreaming and Scaling up of Sustainable Land Management (DS-SLM), 2018. NPCU project implementation report (Unpublished).

2.2 Subnational-level assessment

2.2.1 DPSIR analysis

Driving force–Pressure–State–Impact–Response (DPSIR) analysis was conducted to assess land-use pressure, impacts and potential solutions in selected rainfed and irrigated landscapes in the project areas:

Irrigated lands (Djizak region)

Drivers: Population is 1 725 000. Area of irrigated lands – 260 000 ha. Annual requirement of agricultural production (per capita) – meat 40 kg, milk 140 kg, vegetables 113 kg, fruits 56 kg.

Pressure: Drought (400 mm/year of precipitation), deficiency of surface water resources for irrigation, improper use of land (imperfect irrigation, soil cultivation, poor crop rotation, unbalanced plant nutrition regime, low rates of organic fertilizer, low efficiency of irrigation water use).

State: Medium and high salinization is prevalent on 44 percent of the irrigated lands, humus content in soil arable layer is 0.7–1.2 percent, and 60 percent of lands are compacted.

Impact: Decrease in soil productivity: fertility of lands is characterized as low, crop yield is low (cotton 1.7 tonnes/ha, winter wheat 2.0 tonnes/ha).

Responses: Republican Fund for Ameliorative Improvement of Irrigated Lands and rational use of water resources in the regions of Uzbekistan for the periods 2008–2012, 2013–2017, 2018–2019, Environmental Protection Action Program for Uzbekistan for 1999–2005, 2008–2012, 2013–2017, as well as national and regional CACILM SLM projects under support of the ADB, GEF, UNDP, FAO SLM activities and technical projects of the ADB, GIZ, ICARDA for improving water use efficiency, and increasing agricultural production rural livelihoods and environmental safety.

Rainfed (Kashkadarya region)

Drivers: Population is 3 088 800. Rainfed areas – 257 000 ha.

Pressure: Low amount of precipitation (300–400 mm/year), high evapotranspiration (1 300 mm/year), inadequate application of agro-technologies for moisture saving, prevention of erosion, and use of manure and fertilizers.

State: Some 94 percent of rainfed lands are subject to erosion (76 percent of are moderately and highly eroded), content of humus in soil arable layer is low (0.5–1.5 percent).

Impact: Low and unstable productivity of grain crops – 0.7–1.4 tonnes/ha.

Response: State scientific programmes and projects for increased productivity of rainfed arable land, and SLM projects under support of the FAO ICARDA and other international partners.

2.2.2 Land-use systems and land cover

The dominant land cover class in both regions is grasslands, followed by cropland (see Figures 2.5 and 2.9).

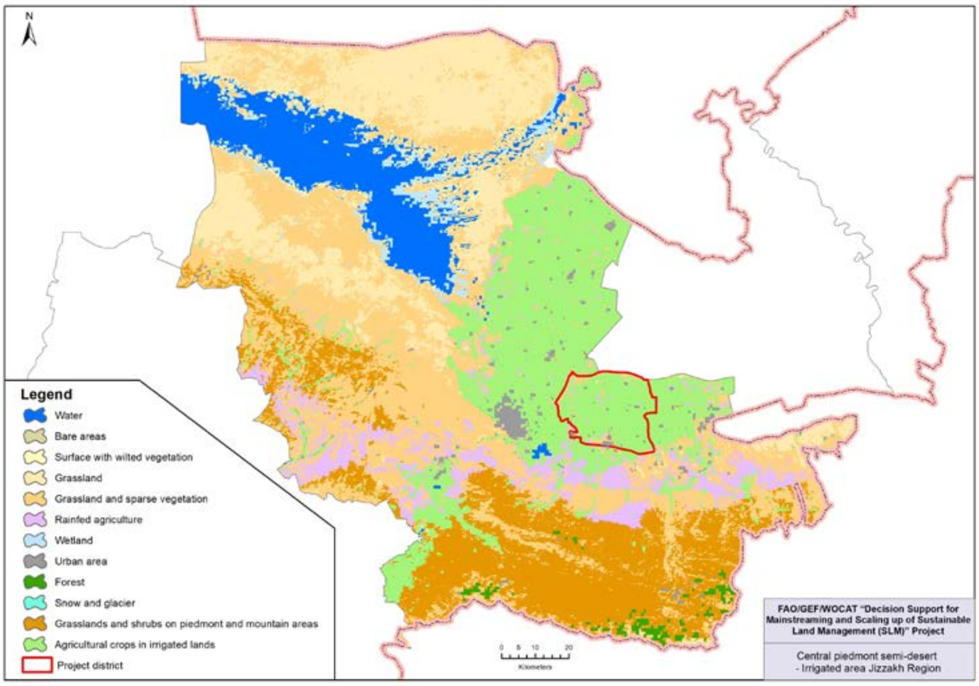
The FAO Land Degradation Assessment in Drylands (FAO LADA), as well as data from global products – Global Land Cover 2000, AgroMaps and SRTM (Shuttle Radar Topography

Mission), served as a methodological basis for creating land-use system maps at national level (CACILM, 2009). Mapping of land-use system (LUS) at subnational level for Djizak and Kashkadarya regions was developed by updating and verifying the national FAO LUS map, using SRTM data and global products, and monitoring data provided by regional hydrogeological expeditions within the project area (FAO, 2018a). For the delineation of LUS, the following criteria and attributes were used:

- *Land-use attributes:* dominant crop type/group, livestock type, small-scale irrigation, input level;
- *Biophysical attributes:* slope, soil type, precipitation availability (infiltration, runoff), altitude, temperature regime, highland and mountain ecosystems and climatically determined ecosystems;
- *Socioeconomic attributes:* population density, poverty indicator.

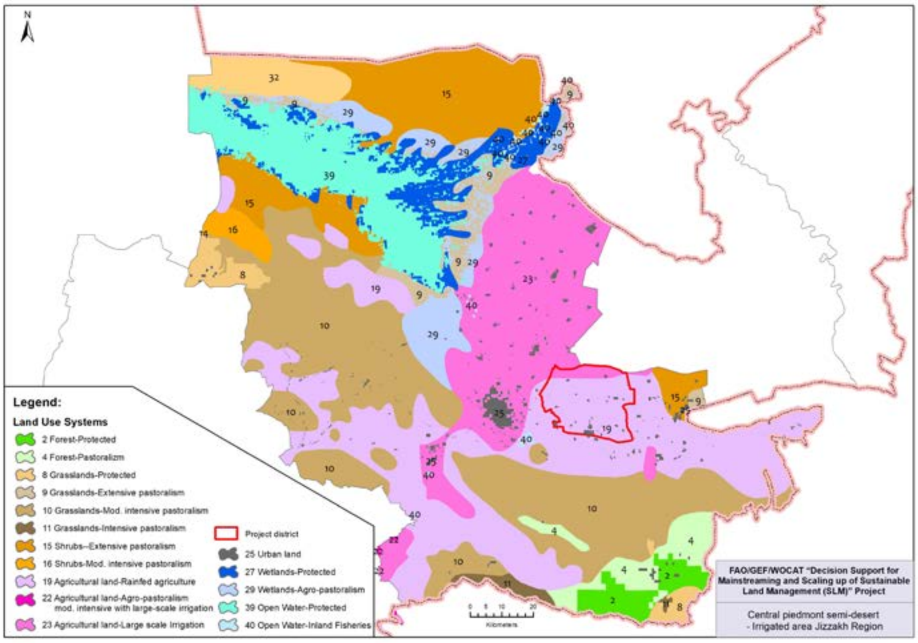
The LUS Map of Djizak region (see Figure 2.6) includes 16 land-use types. Three types of land use prevail: (i) Grasslands-moderate intensive pastoralism in non-irrigated semi-desert landscapes (23 percent); (ii) Agricultural land-rainfed agriculture in piedmonts and mountain areas (21 percent); and (iii) Agricultural land-large-scale irrigation (15 percent).

Figure 2.5 | Map of land cover in Djizak region



Source: Contributor's own compilation, 2018. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

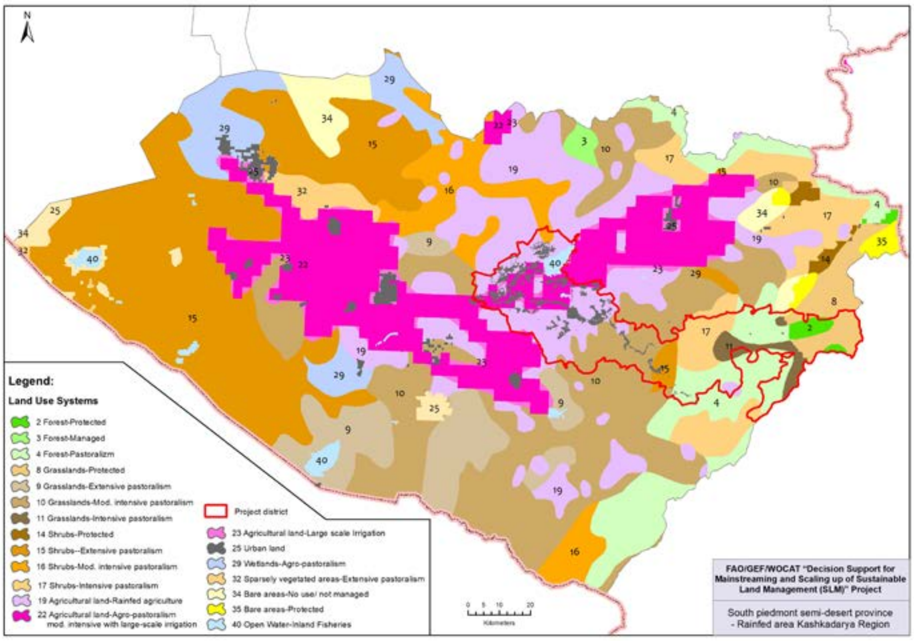
Figure 2.6 | Land-use system map of Djizak region



Source: geoBoundaries, 2020, https://www.geoboundaries.org. Modified by the contributor. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

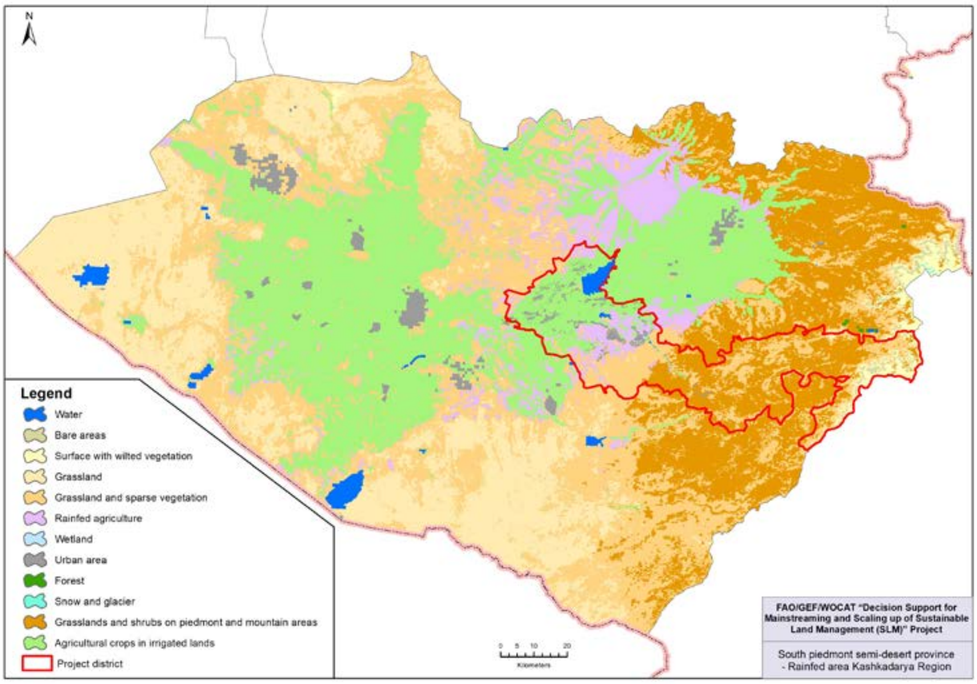
The LUS map of Kashkadarya region (see Figure 2.7) includes 20 land-use classes. The largest area is occupied by 4 land-use classes: (i) Shrubs – extensive pastoralism in semi-desert (21 percent); (ii) Grasslands – moderate intensive pastoralism in semi-desert (17 percent); (iii) Agricultural land-agropastoralism–moderately intensive with large-scale irrigation (14 percent); and (iv) Agricultural land-rainfed agriculture in piedmonts and mountain areas (13 percent).

Figure 2.7 | Land-use system map of Kashkadarya region



Source: Contributor's own compilation, 2017. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Figure 2.8 | Map of land cover in Kashkadarya region



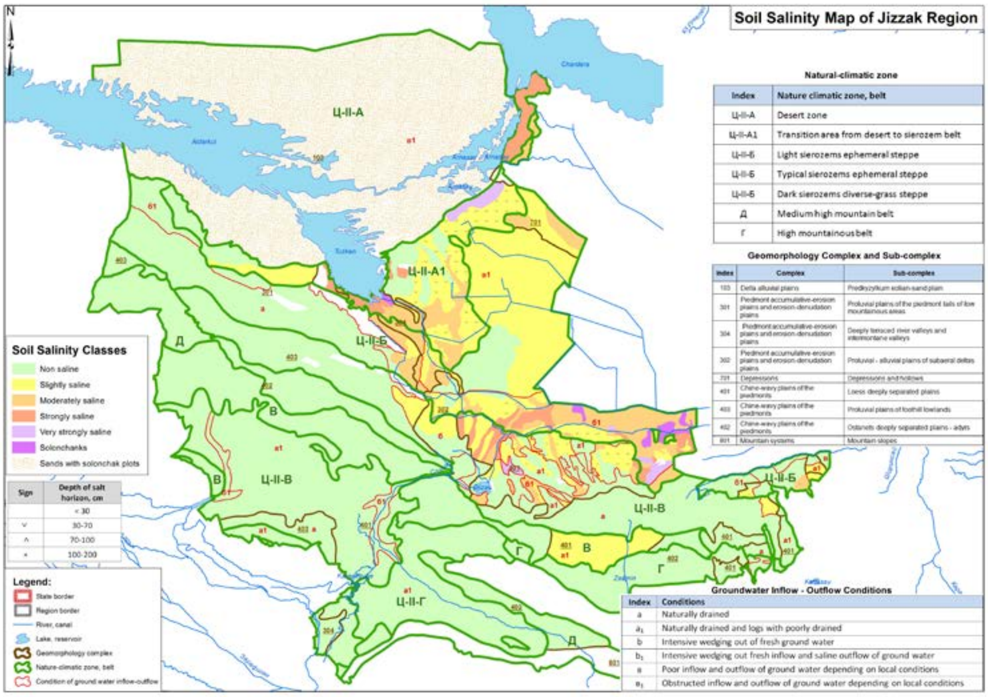
Source: Contributor's own compilation, 2018. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

2.2.3 Land Degradation Assessment

About 82 percent of irrigated lands in Djizak region are subject to soil salinization, of which 44 percent are classified as moderately and highly salinized. The saline-prone soils are distributed in Arnasay, Dustlik, Mirzachul, Zarbdar and Farish districts (see Figure 2.9).

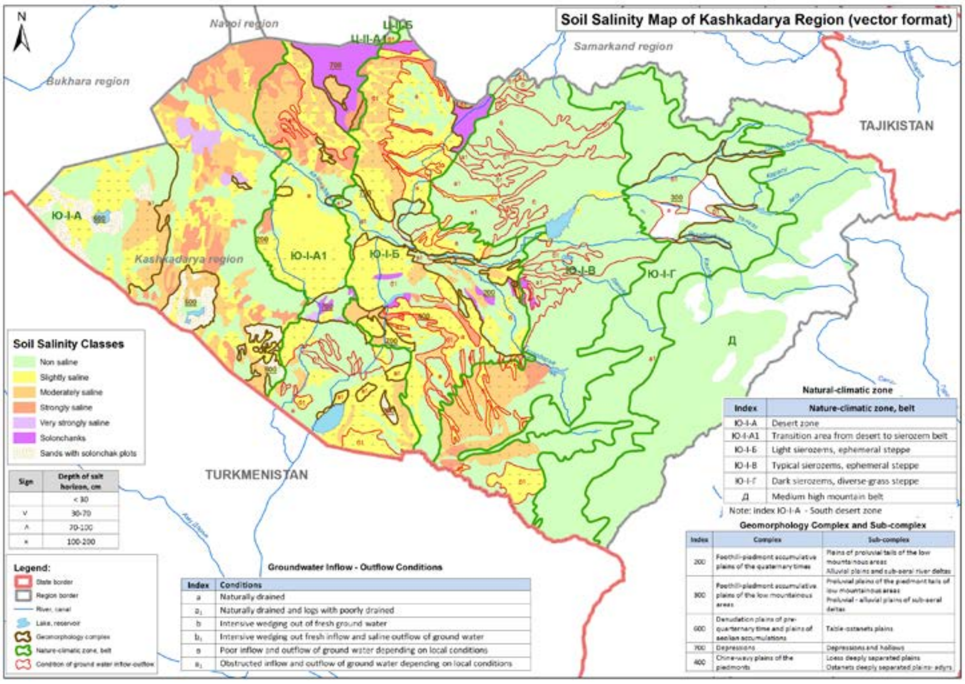
In Kashkadarya region, more than 67 percent of the irrigated area is subject to soil salinization and soil pollution, and about 67 percent of the rainfed lands are subject to soil erosion (see Figure 2.10). The degree of erosion increases from small slope surface to big slope. Lands with low vegetation and light soil texture are most susceptible to wind erosion (see Figure 2.11).

Figure 2. 9 | Soil salinity map of Djizak region



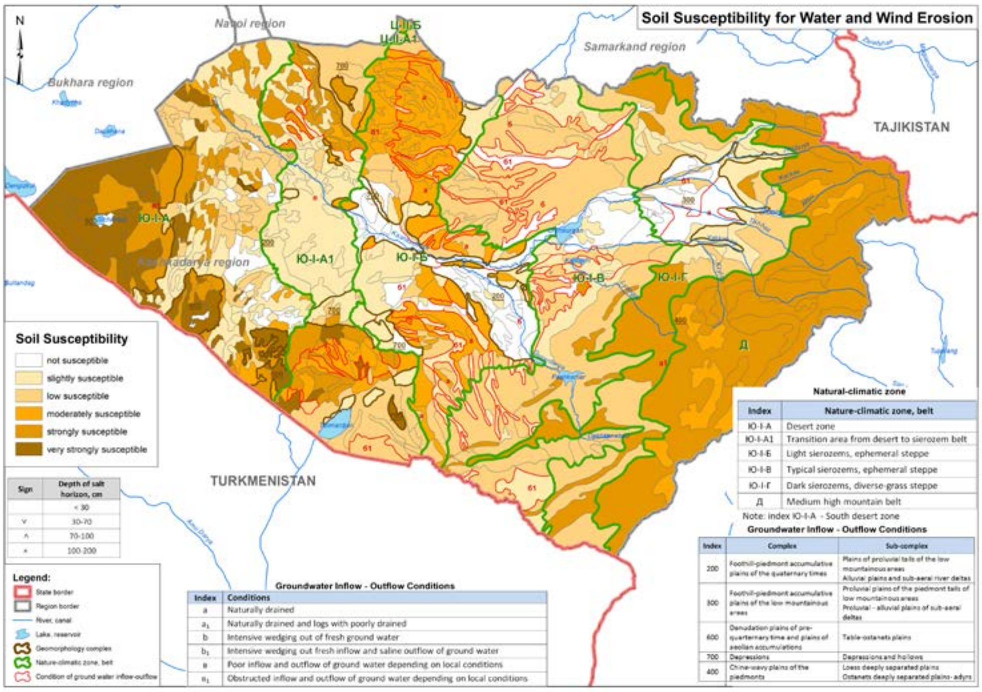
Source: Contributor's own compilation, 2018. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Figure 2. 10 | Soil salinity map of Kashkadarya region



Source: Contributor's own compilation, 2018. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Figure 2. 11 | Map of soil erosion susceptibility of Kashkadarya region



Source: Contributor's own compilation, 2018. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

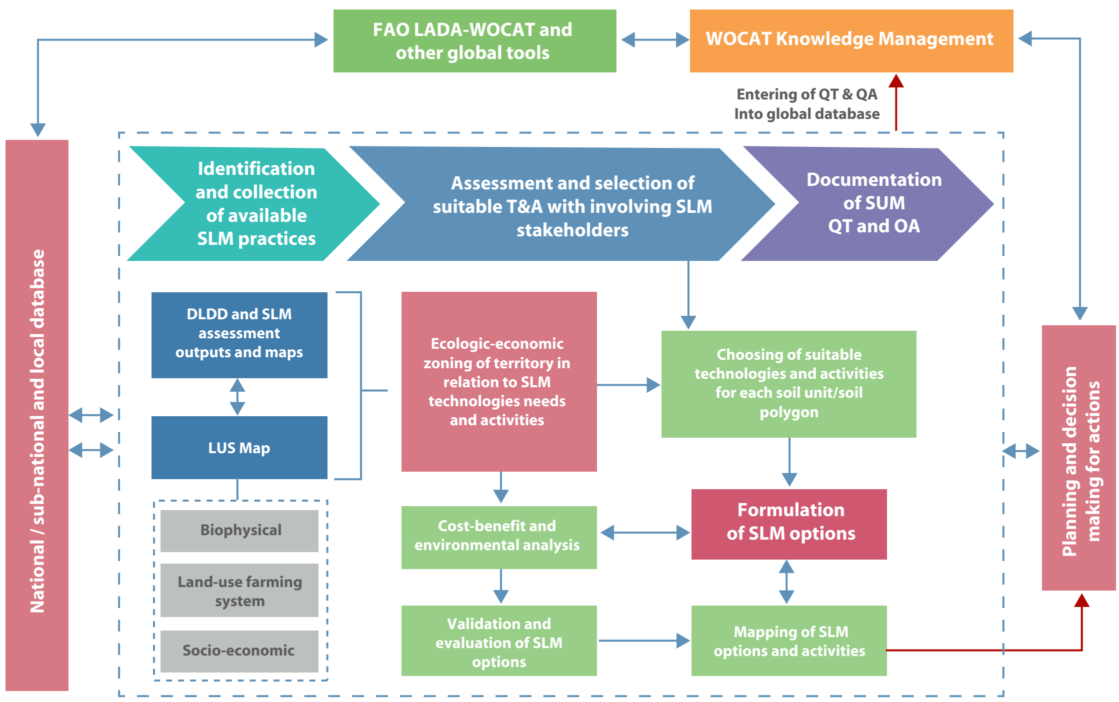
3. Sustainable land management assessment

Uzbekistan has gained extensive experience in the field of sustainable land management. Government policy is aimed at expanding innovative approaches and technologies, investment flow and institutional transformations to create an enabling environment for the scaling-out of SLM practices related to water conservation, drought mitigation and climate-smart solutions in different agroclimatic regions of the country (UNDP and CER, 2015). There are a number of case studies, projects and training initiatives for the mainstreaming and scaling-out of SLM and climate-smart agricultural approaches and technologies in salt-affected degraded and drought-prone landscapes in Central Asia, South Asia, Africa and other regions. (Dalal-Clayton *et al.*, 2009; FAO, 2017a; FAO, 2017b; Aw-Hassan *et al.,* 2016; Gupta *et al.*, 2009).

3.1 Review, selection and documentation of SLM practices

The sustainable land management process – from the identification and selection of SLM options to their implementation – requires a number of steps, starting with an assessment of land degradation and SLM. As a result of the findings from those exercises, suitable SLM technologies were identified, followed by a cost-benefit and environmental analysis to provide a detailed perspective of the existing benefits and implementation costs. The final step is the mapping of the SLM options, which will feed into the decision-making processes for action. Throughout this process, consultations with local authorities, dialogue and interviews with farmers, decision-makers and local communities – using questionnaires – were conducted to enhance the adoption of suitable SLM options for scaling-out in the project regions (see Box 3.1). The development process of SLM options for planning and decision-making is illustrated in Figure 3.1.

Figure 3. 1 | The development of SLM options



Source: FAO, 2017c. Decision support for mainstreaming and scaling up of SLM. Project Implementation report (Unpublished)

In order to identify and list best practices, a large number of various technologies to address major land degradation and SLM issues were analysed, and the most suitable practices were selected based on multicriteria analysis. These criteria are the following: measurable outputs and impact, environmental sustainability, economic and financial viability, technical appropriateness, social and cultural acceptance, institutional viability, compliance with national strategies and priorities, applicability, efficiency, and community involvement. The general list of SLM practices that was selected and prioritized on the regional FAO/WOCAT National SLM Implementation Workshop (Box 3.2) included 65 SLM technologies and approaches for 4 target areas: (i) integrated soil, nutrient and crop management; (ii) agroforestry; (iii) management of irrigation/ water saving; and (iv) pasture management. From a screening of these 65 technologies and approaches, 29 were identified for discussion with target groups. The discussions resulted in identification of the 11 most reliable SLM practices (Table 3.1), which were documented using the WOCAT methodology through stakeholder workshops, expert meetings and consultations at local, national and regional levels (FAO, 2018a).

Box 3. 1 | Definitions of SLM technologies and approaches

An SLM technology is a physical practice on the land that controls land degradation, enhances productivity, and/or other ecosystem services. A technology consists of one or several measures, such as agronomic, vegetative, structural and management measures.

An SLM approach defines the ways and means used to implement one or several SLM technologies. It includes technical and material support, the involvement and roles of different stakeholders, etc. An approach can refer to a project/ programme or to activities initiated by land users themselves.

Source: WOCAT. Global SLM Database. Available online at: https://www.wocat.net/en/global-slm-database/

Table 3. 1 | List of documented technologies in SLM database of WOCAT

WOCAT Index	Technology
3632	Crop diversification with introduction of legumes and green manure on irrigated salt-affected soils
3634	Laser land levelling to increase on-farm water-use efficiency
3645	Use of biogas production waste to improve soil fertility
3646	Watering every second furrow with alternating dry and watered furrows
3650	Cultivation of desert drought-resistant crops on rainfed lands to increase fodder production and prevent erosion
3654	Planting of almonds on small terraces to increase efficiency of eroded soils in rainfed landscapes
4010	Waterproofing of channel with polyethylene film
4035	Cultivation of *Indigofera tinctoria* to restore marginal lands and improve incomes of local communities
4037	Shelterbelts to protect pastures in the Central Kyzylkum Desert
4040	Creating autumn-winter pastures in the foothill zone of Uzbekistan
4042	Counter furrow irrigation

Source: WOCAT, 2018. Global SLM Database. Available online at: https://www.wocat.net/en/global-slm-database/

Box 3. 2 | Analysis of SLM technologies using the FAO PLUD tool

Local Participatory Land Use Planning Workshops were organized to apply the FAO Participatory Land Use Development (PLUD) approach, in order to select the most acceptable and reliable SLM practices for outscaling. A total of 151 participants, including 39 women from local communities in Kamashi and Zarbdar districts, were involved in consultative meetings. Focus group discussions and field interviews were conducted using locally adapted questionnaires that included general and more specific questions (farmer/ stakeholder profile, land use, current practices of farmers, innovative technologies and SLM practices, needs and problems at local level) in support of mainstreaming and outscaling of SLM.

Box 3. 2 (continued)

The results of the group discussions and interviews included the following limiting factors for SLM implementation: (i) a lack of knowledge, experience and information; (ii) financial obstacles (costly machinery, plant protection issues, unavailability of organic fertilizers and seeds); (iii) deterioration of on-farm infrastructure (canalettes, drainage); and iv) lack of incentives to adopt SLM practices. To respond to those challenges, participants offered four options: (i) raising awareness and knowledge sharing through Farmer Field School (FFS) training programmes, as well as the establishment of a consultation office; ii) development of local action plan and microcredit schemes for farmers and other land users to apply and scale out SLM best practices; (iii) establishment of informal cooperation and community work days for repair of on-farm networks and roads, and organization of discussions/meetings with local administration and decision-makers; and (iv) improvement of technical services for agricultural machinery and equipment units and drawing up schedule for sharing agricultural machines and equipment between farmers, water user associations and agro firms.

Box 3. 3 | FAO Farmer Field Schools

The FAO Farmer Field Schools (FFS) approach has had a significant impact on enhancing farmers' capacity and knowledge sharing, aimed at achieving SLM scale-up in the project areas. In accordance with the FAO guidelines, curricula and training modules, and in collaboration with the relevant ministerial departments, local communities, administrations, education and science institutions, the following training initiatives took place.

Training of trainers (TOT) workshop:

The TOT workshop programme consisted of six technical sessions, where lectures on six modules and field case studies were presented by the FFS facilitators and national experts. The modules included: (i) land reclamation techniques; (ii) best practices and soil improvement technologies; (iii) agro-mechanization and soil conservation technologies; (iv) water management and water-saving technologies; (v) crop protection; and (vi) achievements of selection and seed farming, as well as an institutional legal framework for substantial SLM scale-up. Ten farmers and agricultural specialists from Zarbdar and Kamashi districts were trained as FFS facilitators.

Training of FFS target groups for wider SLM adoption:

In Zarbdar and Kamashi districts, training of FFS target groups (farmers and *dekhkan*; local authorities, entrepreneurs and teachers of local agricultural colleges) was conducted for 760 people, including 58 women. About 34 people, including 26 gender specialists, participated in regional and interregional workshops, and more than 17 specialists strengthened their capacity to assess DLDD and SLM practices (i.e. LADA/WOCAT tools). The objective was to provide knowledge of the most effective technologies for achieving an increase in the productivity of food crops, fodder herbs and an improvement of soil fertility in rainfed and irrigated croplands, as well as the approaches and tools for SLM scale-up.

Box 3. 4 | Dynamics of development of desert fodder species at the demonstration site in Kamashi


Kochia prostrata/Izen. 2017


Kochia prostrata/Izen. 2019


Halothamnus subaphilla/ Chogon. 2018


Halothamnus subaphilla/ Chogon. 2019


Ceratoides ewersman-niana/ Teresken 2018


Ceratoides ewersmanniana/ Teresken 2019


Participatory planting of trees at the demonstration site in Kamashi project area (2017)


Distribution of seedlings, (March, 2017)


General view of the rainfed pastures adjacent to the project demo site of Kamashi (2019)

Photos: Tolib Mukimov, Sherzod Oltinbaev

3.2 Selected SLM options for management and decision support

The selection of SLM options that can be used in the planning and management of investments and decision support is essential to enhance soil health and sustainable land management at local and subnational levels. Participatory selection and assessment of SLM options was conducted through the following steps:

- technology needs assessment, and zoning of project areas in relation to SLM;
- cost estimation of selected SLM options; and
- GIS mapping of suitable SLM options for each soil unit/soil polygon for planning of interventions and investment flow at local and subnational level.

Implementation of SLM technologies covers a set of inputs, investments, actions and activities, combining agronomic options with agricultural equipment, machinery, technical interventions and preventive measures to minimize soil impact, conserve and increase water-use efficiency and maximize soil cover, soil biodiversity and crop root system improvement.

These SLM technologies were prioritized as a result of discussions with stakeholders, taking into account the existing problems and needs of the project areas. As a result, 14 technologies were chosen, but these can be expanded, depending on specific conditions and needs (see Table 3.2).

The costs were calculated based on a cost-benefit analysis. Various sources were used: methodological approaches and guidelines, analytical review of the economics of land degradation, WOCAT databases and regional/multicounty SLM projects of CACILM Phase I (2007–2010).

Table 3. 2 | List of selected SLM technologies and their expected outputs for planning

	Land-use system	SLM technology	Expected outputs/ benefits	Estimated finance requirement, USD/ha
Project site: Zarbdar, Djizak region				
1	Agricultural large-scale irrigation	Crop diversification on salt-affected and gypsiferous soils with introduction of legumes and green manures	Increasing soil organic matter and soil health	250
		Deep ripping (ploughing)		150
		Adaptation of innovative drought-prone and salt-tolerant crop varieties ('Gulistan' cotton variety, grains etc.)	Reducing the effects of salinization and drought	100
		Planting trees for biodrainage	Reduction of groundwater level and salt mobilization	700
		Laser land levelling *	Water-saving and efficient irrigation	350
		Improvement of surface irrigation method by application of irrigation equipment		200
		Cotton irrigation on lands subject to water erosion, with straw mulching of the end furrows		20
2	Agricultural land-agropastoralism moderate intensive with large-scale irrigation	1) Crop diversification on salt-affected and gypsiferous soils with introduction of legumes and green manures	Increasing soil fertility	250
		2) Deep ripping (ploughing)		150
		Adaptation of innovative drought-prone and salt-tolerant varieties of crops ('Gulistan' cotton variety, grains etc.)	Reducing the impact of soil salinity and drought	100
		Planting trees for biodrainage	Reduction of groundwater level	700
		Laser land levelling *	Water-saving and efficient irrigation	350
		Improvement of surface irrigation method by application of irrigation equipment		200
		Cotton irrigation on lands subject to water erosion, with straw mulching of end furrows		20

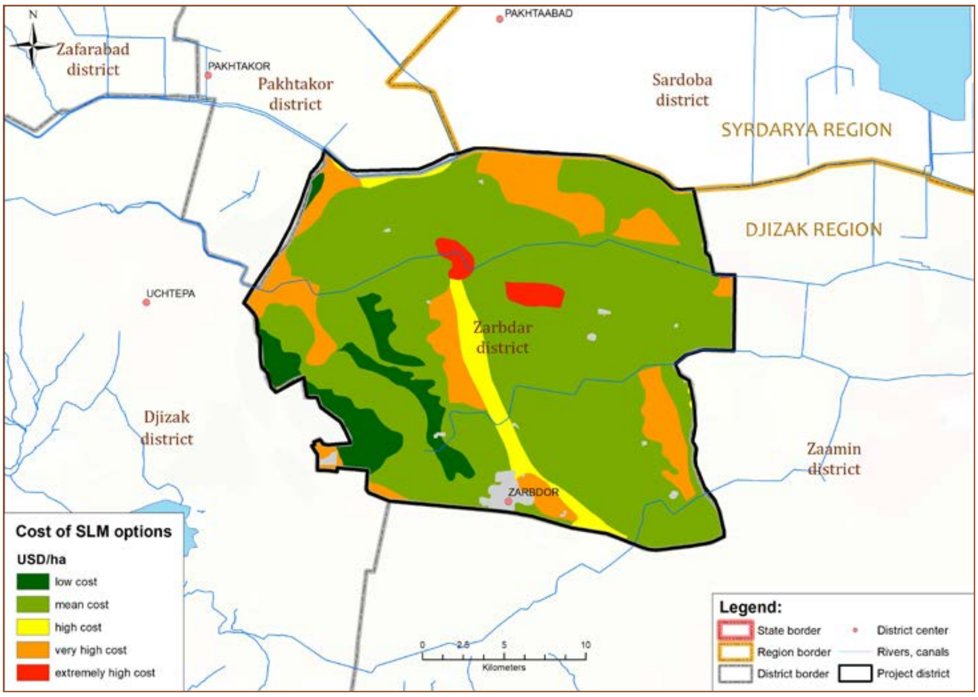
	Land-use system	SLM technology	Expected outputs/ benefits	Estimated finance requirement, USD/ha
Project site: Kamashi, Kashkadarya region				
8		Improvement of lands in arid conditions through creation of pistachio varietal plantations		1 230
9	Agricultural land-rainfed Agricultural	Increase in forage production by sowing desert drought-resistant herbs on rainfed lands	Improving productivity of rainfed lands and preventing soil erosion	100
10		Planting almonds on small terraces for increase in efficiency of rainfed lands and prevention of erosion		311

*Note: * 'Laser land levelling' is given without the cost of equipment*

Table 3. 3 | SLM technology groupings for SLM option mapping

N	Cost rate, USD/ha	SLM option	Area, ha
1	100–300	low cost	3 914.0
2	300–500	mean cost	39 780.1
3	500–800	high cost	2 311.0
4	800–2 000	very high cost	7 867.9
5	>2,000	extremely high cost	854.7
Total			54 727.5

Figure 3. 2 | Cost of SLM options in Zarbdar district



Source: Contributor's own compilation, 2019. Basemap source: geoBoundaries, 2020, https://www.geoboundaries.org. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

3.3 Demonstrated SLM technologies for planning and scaling-out at pilot sites

Four technologies selected for demonstration at pilot sites of the DS-SLM project are illustrated in Figure 3.3. Consultation meetings, field interviews with local stakeholders, awareness-raising campaigns and community-based learning initiatives were regularly conducted at these project sites.

Figure 3. 3 | SLM technologies demonstrated at the pilot sites of the DS-SLM project

Salt-affected irrigated lands (Zarbdar site)		Drought-prone rainfed lands (Kamashi site)	

SLM technologies			
QT-1	QT-2	QT-3	QT-4
Crop diversification with introduction of legumes and green manure on salt-affected soils	Introduction of new salt-tolerant and drought-resistant 'Gulistan' cotton variety	Planting of almonds on small terraces to increase efficiency in eroded soils of rainfed landscapes	Cultivation of desert drought-resistant crops on rainfed lands to reduce erosion and increase fodder production

Source: FAO 2018a. DS-SLM Project GCP/GLO/337. Implementation report (PIR) for 2016–2017 (Unpublished).

At the Zarbdar pilot site, the following SLM technologies were demonstrated: integrated soil management through double-cropping (wheat-legume rotation) and drought-resistant and salt-tolerant cotton variety 'Gulistan'. Crop diversification improves the existing crop rotation of wheat-cotton-wheat by reseeding after winter wheat legumes and crops as a green manure/fertilizer. The improved crop rotation includes the following steps: winter wheat – legumes (mash, beans) – green manure (rye) – cotton. This leguminous crop was used to enrich soil with nitrogen and improve its structure. The estimated productivity of the cotton variety was 3.15 tonnes/ha for the period 2016–2018, while the yield at the control site (farmers' field) was 1.8 tonnes/ha (see Table 3.2).

At the Kamashi pilot site, almond plantations were established to prevent soil degradation on the slopes and provide local land users with additional income. An almond harvest of about 1.1 tonnes/ha was obtained after 2 years of project completion.

The second selected SLM technology was the cultivation of desert drought-resistant crops to ensure feed reserves for livestock and prevent water erosion. An analysis showed that all fodder plant species that were demonstrated at the Kamashi site entered the fruiting phase. Growth trends in the dry mass of forage species on the experimental plot at the Kamashi site during the project life (2016–2019) are summarized in Table 3.5 and illustrated in Box 3.4.

Table 3. 4 | Assessment of productivity results of SLM technologies, demonstrated at the pilot sites compared with farm practices (control), 2016–2018

Demonstrated technologies/practices	Yield, t/ha		Income, USD/ha	
	Farmer field	Project site	Farmer field	Project site
Salt-affected irrigated lands at Zarbdar site				
Technology 1. Crop diversification with introduction of legumes and green manure	0.30 winter wheat without secondary crops	0.75	57.6	144
Technology 2. Introduction of new salt-tolerant and drought-resistant 'Gulistan' cotton variety	1.8	3.15	33	217
Drought-prone rainfed lands at Kamashi site				
Technology 3. Planting of almonds on small terraces to increase efficiency of eroded soils on rainfed landscapes	NONE	1.10	NONE	3 000
Technology 4. Cultivation of desert drought-resistant crops on rainfed lands	NONE	2.20	NONE	3 700

Source: FAO DS-SLM 2018. Decision support for mainstreaming and scaling up of SLM. Project Implementation report (Unpublished)

Table 3. 5 | Growth trends of the forage dry mass/seed per hectare for 2016–2019

№	Plant species	Increase in the dry mass/seed dynamics of forage species, centre/ha			
		2016	2017	2018	2019
		Dry masses/ seeds	Dry masses/ seeds	Dry masses/ seeds	Dry masses/ seeds
1	Kochia prostrata	25 /0.1	6.5 /0.6	12.0 /0.8/	18 /1.2
2	Ceratoides Ewersmanniana	1.8 /0.5	5.1/0.5	10.5 /0.6	14 /1.1
3	Halothamus subaphylla	3.3 /0.2	8.0 /0.6	18.5 /1.0	20 /1.4
4	Atriplex undulata	3.0 /0.2	6.5 /0.6	16.5 /1.1	18 /1.4
5	Onobrychis horossanica	0.6 /0.1	3.5 /0.4	5.5 /0.6	6.5 /0.8
6	Haloxylon aphyllum	0.8/-	1.5/-	3.5/-	3.8 /-
7	Artemisia diffusa	-	-	0.5/-	0.8 /0.1
8	Astragalus	4.0/0.1	4.02/0.1	1.6/-	4.5 /0.2

Source: FAO DS-SLM 2018. Decision support for mainstreaming and scaling up of SLM. Project Implementation report (Unpublished)

3.3.1 Socioeconomic and environmental benefits

The socioeconomic and environmental benefits were multiple, as shown in greater detail in Table 3.6.

Table 3. 6 | SLM practices and their economic and environmental benefits

№	SLM practices	Measures/actions	Economic benefits	Environmental benefits
Irrigated salt-affected croplands (Zarbdar site)				
	Improvement of existing crop rotations:			
1	Diversification of food crops	1. Introduction of legume crops (mung bean) after harvesting of winter wheat 2. Sowing of green manure (winter rye) as green fertilizer	Increased yields and incomes for rural communities Support to food security Increase in biological control of diseases Reduced costs for pesticides, herbicides and fertilizers	Enrichment of soil by nitrogen, humus, improvement of soil structure Improvement of soil health and soil micro flora and soil organisms Decrease of soil salinization, salt accumulations in root zone, and unproductive evaporation Increased vegetation cover and improvement of land use Increased soil fertility Reduced plant diseases
	Introduction of drought-prone and salt-tolerant cotton variety			
2	New drought-prone and salt-tolerant variety of cotton	Introduction of drought- prone and salt-tolerant cotton variety 'Gulistan'	Increased farmer incomes Saving of cultivation costs and watering	Saving of irrigation water - 2 irrigation events (approximately 1 600–2 000 m^3/ha) Preventing soil compaction
Rainfed croplands (Kamashi site)				
1	Agroforestry (almond planting)	Almond planting on small terraces	Increased yields and farmer incomes	Rainwater harvesting (accumulation of atmospheric precipitation) Prevention of water and wind erosion Increased soil fertility Increase in biodiversity of rainfed agricultural lands and of forage production Aesthetic improvement of the agro landscape Carbon sequestration in biomass and soils
2	Cultivation of drought-resistant fodder desert plants	Sowing of fodder desert plants in row-spacing with almonds	Providing livestock with fodder Reduced pressure on pastures and reduced cost of restoring pastures	

- The area under SLM during two crop seasons was increased from 2 347 ha (2017) to 4 729 ha (2018).
- More than 760 people from the target stakeholder groups participated in workshops and training in land degradation assessment, water-saving techniques, and mainstreaming and scaling-out of SLM, including by 58 women.
- Farmers at the project sites saw a significant increase in their income.
- Farmers experienced an increase in crop yields.
- Water-saving during crop vegetation period was up to 1 600–2 000 m^3/ha, which is equal to 2 crop irrigation requirements.
- There was a 10–20 percent increase in vegetation cover and biodiversity.
- Soil erosion in rainfed areas declined due to the cultivation of desert perennial species and almonds.

Box 3. 5 | Useful definitions

Mainstreaming SLM is the informed inclusion of relevant land management concerns into the decisions and institutions that drive national, sectoral and local development policy, rules, plans, investment and action.

Scaling-out SLM focuses on the dissemination, spread and wide replication on a large scale (adapted from Dalal-Clayton and Bass, 2009).

Scaling-up SLM is used to refer to both mainstreaming and scaling-out of SLM.

Source: Bastidas Fegan, S. 2019. The Sustainable Land Management Mainstreaming Tool. Rome, FAO. 44 pp. Licence: CC BY-NC-SA 3.0 IGO; Dalal-Clayton, B. & Bass, S. 2009. The challenges of environmental mainstreaming: Experience of integrating environment into development institutions and decisions. Environmental Governance No. 3. London, International Institute for Environment and Development.

© FAO/Lazizkhon Tashbekov

4. The mainstreaming strategy

4.1 Introduction

The mainstreaming strategy is intended as a pathway for integrating SLM into key decision-making processes and resource mobilization, to facilitate SLM implementation and scaling-out, in close coordination with the relevant institutions. The mainstreaming strategy is directly aimed at building partnerships and enhancing knowledge management and capacity-building on SLM, supported by DLDD/SLM-related information. Mainstreaming of SLM integrates issues of natural resource management, climate change and disaster risk reduction into sectoral, institutional and political processes.

The strategy is designed to serve as a guide for decision-makers in developing programmes, management plans and the use of water and land resources. The target objectives of the strategy are based on government SLM policy programmatic documents adopted in 2017–2019, which determined implementation of the key objectives of the "Strategy for action in the five priority areas for development of Uzbekistan in 2017–2021" (DP-4947 dated 7 February 2017), as well as "The State Program for the implementation of the Strategy of Action in the Year of Dialogue with the People and the Interests of the People" and others.

The strategy aims to support implementation of Uzbekistan's national priorities for achieving the Sustainable Development Goals and the UNCCD land degradation neutrality targets. It promotes a multidimensional and holistic approach to the mainstreaming and scaling-out of SLM technologies required to maintain and generate valuable agroecosystem services and improve rural livelihoods, with a focus on strengthening collaboration and capacity building, knowledge management and resource diversification, in harmony with the above legal provisions and in line with recommendations of the 13th UNCCD Conference of the Parties and the Rio Conventions targets.

The strategy is also contributing to the regional GEF/FAO CACILM Phase II "Integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey" project, which seeks to increase the productivity of agroecosystems and the scaling-out of SLM practices in wider landscapes.

4.2 Methodology

The mainstreaming strategy was developed based on several FAO methodological guidelines and tools, and more specifically on the Sustainable Land Management Mainstreaming Tool, which provides a step-by-step methodology for the design of operational strategies and action plans. Development of the mainstreaming strategy included the following steps: *(i) assessment of the main barriers hindering the implementation of SLM; (ii) assessment of opportunities and decision-making processes relevant for SLM; (iii) formulation of mainstreaming objectives and target activities; and (iv) identification and roles of responsible institutions and target groups.*

The baseline information for formulating the mainstreaming strategy was compiled by the team experts. The activities included fieldwork at local level at the project demonstration sites, coordination meetings with local decision-makers, rural citizens' assemblies, training sessions and interviews with farmers and households in the framework of FFS, national SLM delivery workshops, stakeholder consultations and other related actions. The project outputs and draft mainstreaming strategy were discussed during the National Coordination Committee meeting, involving the main target groups and local partners from the project areas.

4.2.1 Barriers

Barriers to mainstreaming SLM include technical, economic, political, social and institutional issues and factors that occur at each stage of the SLM technology outscaling process. Many SLM practices are already applied in Uzbekistan, but need to be more widely adopted. Soil reclamation measures are currently little used by farmers due to the high cost of farm machinery and equipment, as well as inefficient on-farm water use and poor knowledge on the part of land users. Advanced agronomic practices (crop diversification, water-saving, organic farming, etc.) that were demonstrated on pilot/experimental farms confirm their high level of efficiency and potential benefits for small-scale farms on salt-affected and degraded soils. However, pilot demonstrations of SLM approaches and salinity mitigation interventions in arid landscapes are poorly replicated outside project areas.

Moreover, institutional capacity and technical expertise in land degradation assessment, sustainable technologies and climate change adaptation are insufficient. Many practitioners in the field of natural resources have limited access to information and tools to enhance mainstreaming and scale-up of effective SLM practices across landscapes and production systems. These capacity-related barriers to SLM are often coupled with weak enabling environments for the harmonization and coordination of policy, legal and regulatory frameworks between sectors competing for land area and natural resources, across landscapes and river basins, and among weak institutions in charge of coordinating land issues and implementation of the national action programmes of UNCCD.

Another challenge is how to adapt to new and emerging threats to land resources, such as increasing competition for land due to population increase, changing markets, swings in food prices and the impacts of climate change.

Table A.1 in the Annex describes the barriers identified to scaling up SLM technologies and practices in Uzbekistan.

4.2.2 Decision-making processes

After identifying the different barriers to the implementation and scale-out of SLM, an assessment was conducted of existing key decision-making processes that can strategically contribute to SLM. This step includes an analysis of the decision-making processes that need to be addressed and their scope for promoting SLM. Such processes may occur in five main areas: policies and regulations; programmes and projects; financing and incentive strategies; territorial planning; and local-level knowledge and decisions (see Table A.2).

4.2.2.1. SLM policy and programmes

Since 2017, a new stage has begun for Uzbekistan's transition towards innovative advancement and a radical improvement in all spheres of the economy and development. The country has adopted a number of important decrees and resolutions issued by the President of the Republic of Uzbekistan and the Cabinet of Ministers, and launched various national programmes, institutional transformations and reforms aimed at ensuring food security and sustainable development in the long term. The "Strategy of Actions in five priority directions of development of the Republic of Uzbekistan in 2017–2021" (2017) has become a major policy document, which has defined priority directions of state policy in the medium term.

The "Strategy for the Transition of the Republic of Uzbekistan to a "Green" Economy for the period 2019–2030" (No. PR-П-4477, dated 10 April 2019) and Resolutions of the Cabinet of Ministers "On measures to implement national goals and objectives in the field of sustainable development for the period up to 2030" (RCM-841, dated 20 October 2018) serve as the main documents of state policy for achieving sustainable economic progress through the integration of 'green' economy principles into ongoing structural reforms. The main policy documents for regulating agricultural land-water policy in the long term are: (i) "The Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030" (No. PD-5853, dated 12 October 2019), aimed at the radical improvement of state policy and strengthening of reforms to improve competitiveness in the agriculture and food sector, including nine priority areas; and (ii) "The Strategy for Water Sector Development for 2020–2030" (No. PR-6024, dated 10 July 2020), aimed at ensuring the effective management and use of water resources, reclamation of irrigated lands, and achieving water and food security, etc. (see List of the President Decrees of the RUz, 2015–2018, Annex Table A.3).

In accordance with the Presidential Decree "On Organizational Measures for the Fundamental Improvement of the State Management of Agriculture and Water Resources", the responsibilities of the Ministry of Agriculture and Water Management were divided between two ministries – the Ministry of Agriculture and the Ministry of Water Resources–and roadmaps were approved for a fundamental reform of these systems through the introduction of modern information, communication and innovation technologies in these industries. The Ministry of Innovation Development, established in 2017, coordinates the activities of government bodies, research, information and analytical institutions and other organizations on the implementation of innovative ideas, developments and technologies.

According to the Decree of the Cabinet of Ministers "On measures to accelerate the creation of "green coverings" - protective forest plantations on the dried bed of the Aral Sea" in 2019 was allocated UZS 100 billion (or USD 11 764 705) in 2019 to create forest plantations on 500 000 ha of dried seabed.

The State programme for the development of the Aral Sea region 2017–2021 includes 67 projects (at a total of USD 1.2 billion) with the following objectives: providing drinking water to 74–77 percent of the population of Karakalpakstan and Khorezm; improving water resource management in Southern Karakalpakstan on 100 000 ha, creating 20 000 ha of forest plantations on the dried bottom of the Aral Sea. Under the Ministry of Finance, a fund was created for programme implementation.

In 2015, the Government of Uzbekistan adopted the "Comprehensive Program for Mitigating the Consequences of the Aral Disaster, Restoration and Socio-Economic Development of the Aral Sea Coastal Plain for 2015–2018". With the support of the Executive Committee of the International Fund for Saving the Aral Sea and the Charitable Foundation for the Protection of the Aral Sea Coastal Plain's Gene Pool, the initiative provides for the implementation of measures to improve the management system of water resources in the region, including their economical and rational use.

The "State Program of ameliorative improvement of irrigated lands and rational water use", which was implemented during 2007–2017, provided large-scale interventions for rehabilitation, construction and restoration of irrigation and drainage (I&D) infrastructure and development of water-saving technologies (drip irrigation, improved furrow irrigation method, etc.) at on-farm level, as well as the expansion of agroforestry and soil conservation in irrigated croplands.

As part of implementation of the Program for the Development of Agriculture for 2015–2019, stage-by-stage optimization of cropping patterns and the introduction of new non-traditional high-yielding crops, such as soybean and pepper, are continuing. About 170 500 ha of irrigated land, previously under cotton, had been released by 2020 for the cultivation of vegetables, melons, forage, oilseeds and other food crops, and orchards. Improvements to current cotton-wheat crop rotation are being carried out through the introduction of secondary crops (legumes, silage maize, etc.) following the harvesting of winter wheat. District authorities (*khokimiyats*) actively support the scaling-out of this technology through the involvement of agribusinesses, on the basis of a mutually beneficial agreement with farmers.

Recently adopted government decrees, resolutions and national programmes working towards mainstreaming SLM in Uzbekistan are summarized in Table A.3. Successful programmes to scale out SLM are illustrated in Table A.4.

4.2.2.2 Financing of SLM

Substantial funds are being allocated for the soil conservation measures aimed at improving land and water resources, including public, private and donor funding.

Domestic sources of financing: These include: the Republican Fund for Ameliorative Improvement of Irrigated Lands and rational use of water resources in the regions of Uzbekistan for the periods 2008–2012, 2013–2017, 2018–2019, the Fund for Reconstruction and Development, the Uzbekistan Action Program for Environmental Protection, as well as national and regional CACILM SLM projects for improving soil fertility, water saving and increasing agricultural production. The state programme for implementation of the Strategy of Action in 2019 allocated a total fund of UZS 16.9 trillion (USD 8.1 billion).

External financing: This includes funds from key donors such as the World Bank, the Asian Development Bank, the Islamic Development Bank, the Adaptation Fund, the Green Climate Fund and the International Fund for Agricultural Development. Over the past 10 years, more than 20 large-scale investment projects worth more than USD 1.5 billion have been implemented, aimed at: (i) supporting institutional reforms; (ii) rehabilitating the irrigation and drainage infrastructure; (iii) establishing advisory services and developing training programmes; and (iv) improved water management.

The International Fund for Saving the Aral Sea, created in accordance with the Heads of Central Asian States, provides loans for joint practical activities to five Central Asian Republics, as well as to prospective programmes for the rehabilitation of the Aral Sea Coastal Plain and the Aral Sea basin as a whole (UCA, 2013).

The UN Multi-Partner Human Security Trust Fund for the Aral Sea Region in Uzbekistan (MPHSTF) was created under the auspices of the United Nations in 2018. The fund aims to ensure the unification and mobilization of technical and financial resources of the Government of Uzbekistan, United Nations agencies and the donor community, bringing new knowledge, innovative technologies and approaches to the region.

Innovative sources of financing. Innovative financial mechanisms (IFM) are based on the sustainable generation of funds and incomes of the beneficiaries of projects and programmes. The main tools in the field of IFM are the use of fiscal incentives and anti-incentives in the form of payments for emissions or discharges of pollutants to water, air or soil, payments by users of utility services, and payments for the use of natural resources. Local governments and the private sector, represented by farmers, private firms or companies that have public-private property, have shown strong interest in such sources of financing, with a willingness to finance on-farm work within the framework of the Integrated Programs implemented in the country with the support of the Meliorative Fund. Their participation is manifested through the financing of various on-farm SLM work at their own expense, as well as through contributions in the form of labour and investments in agricultural activities, including the restoration/repair of the on-farm network, drainage, etc.

4.2.2.3. Extension mechanisms and services

Governmental institutions and organizations are paying special attention to increased knowledge, public awareness-raising and improved access to advanced technologies for sustainable water and land management. Campaigns and individual events such as fairs and 'Farmer Days', and Farmer Field Schools (See Box 3.3.) have been organized to increase knowledge and awareness of SLM, with the support of international projects, the *khokimiyats*, and the Ministry of Agriculture and the Ministry of Water Resources.

In accordance with the Decrees of the Cabinet of Ministers of the Republic of Uzbekistan, various forms of rural advisory services (RAS) have been created, including counselling centres and distribution services at national higher education institutions, departments and organizations. Currently, these RAS serve 35 000 farmers annually, and about 50 percent of all small-scale farms (Mamarasulov *et al.*, 2015). The main providers of rural advisory services are the following: i) Consultation and Information Centre of the Biology Faculty at Tashkent State University; (ii) Information and Consultation Center at Tashkent State Agrarian University; (iii) Khorezm Agro Advisory Centre NGO "KRASS"; (iv) information and consultancy services under farmers' organizations; and (v) the Uzbekistan Scientific Production Centre of Agriculture under the Academy of Science of Uzbekistan.

A significant contribution to raising awareness and the scale-out of SLM practices for a wide range of beneficiaries is being made by national and regional programmes and projects implemented in the country. In particular, in the framework of multi-country and national CACILM SLM projects (from 2007–2009 until 2022) about 160 technologies and approaches adapted and applied in Uzbekistan and other countries of Central Asia. (WOCAT DS-SLM 2018; CACILM2 2020; Korea Forest Service and UNCCD, 2011)

4.2.3 Mainstreaming objectives

The expected outputs of the mainstreaming strategy are the following:

1. integration of SLM scaling-out model into integrated crop planning/integrated water management (ICP/IWM) planning in line with National Agricultural Development Strategy 2030;
2. integration of FAO SLM approaches and tools into national programmes, initiatives and projects to improve the status of irrigated lands;
3. ensuring interaction between different stakeholders, SLM capacity-building activities, awareness-raising, and resource mobilization; and
4. scaling-out of SLM by involving local communities and knowledge sharing.

The strategy objectives and targeted activities are presented in detail in Table A.5.

4.2.4. Institutional mapping

A wide range of stakeholders are involved in land-use planning and sustainable land management in Uzbekistan. Since scaling-up of SLM is a long-term and evolving process, responsible institutions should constantly interact with partners and organizations at various levels. These include international donors, national funding agencies and programmes, local and national governments, the private sector, civil society, community organizations and the research community. Each of these groups plays a different role in mainstreaming and scaling out SLM.

At national level, stakeholders include government organizations, ministries and departments, research institutions and non-governmental organizations (NGOs) (see Table A.6).

Uzbekistan has an effective system of state monitoring of the environment (SME). The State Committee for Environmental Protection (Goskomekologiya) is responsible for SME implementation, including improving the accuracy, timeliness, usefulness and reliability of information. Responsibility for environmental monitoring is distributed among several national state institutions under the overall coordination of Goskomekologiya, as follows:

- *Goskomekologiya* conducts monitoring of pollution sources and terrestrial ecosystems; coordination of the collection, management and dissemination of environmental information; it also conducts environmental impact assessments and hosts state ecological expertise.
- *The Center for Hydrometeorological Service* conducts hydrometeorological monitoring, monitoring of air pollution, surface water and soil, and background monitoring.
- *The Ministry of Water Resources* conducts monitoring of agricultural flows – irrigation and drainage waters; monitoring of soil salinity, mineralization and groundwater level of irrigated lands.
- *The Ministry of Agriculture* conducts monitoring of soil condition and quality of land resources, monitoring of agricultural lands and crops, soil grading and soil quality control.
- *The State Committee for Geology and Mineral Resources* conducts monitoring of the condition of groundwater and hazardous geological processes.
- *The Ministry of Health* conducts sanitary and hygienic monitoring of the natural environment.

The main stakeholders at regional and district level are: (i) regional and district *khokimiyats*; (ii) regional departments of the Ministries of Agriculture and Water Resources; (iii) Basin Irrigation Systems Administrations, Irrigation Systems Administrations; and (iv) research institutes, and NGOs. Organizations and departments at national and subnational level are responsible for developing strategies in the field of agriculture and water management, and for the operation of agricultural and water management facilities; they are financed from the public budget (except for NGOs).

Stakeholders at local level include: (i) agricultural producers and their associations, including women and youth; (ii) councils of farmers and citizens' bodies, including women and youth; (iii) NGOs; women and youth; and (iv) rural communities. Beneficiaries at local level conduct independent activities, depending on state policy. They are directly or indirectly affected by the negative impact of land degradation and are generally interested in introducing and scaling out the area under SLM.

The list of SLM stakeholders, with a description of their mandates, responsibilities and roles in mainstreaming and scaling out SLM at national and local level, is given in Table A.6.

References

Aw-Hassan, *et al.* 2016. Economics of land degradation and improvement in Uzbekistan. In: E. Nkonya, A. Mirzabaev & J. von Braun, eds. *Economics of land degradation and improvement – A global assessment for sustainable development*. Switzerland, Springer. https://link.springer.com/chapter/10.1007/978-3-319-19168-3_21#citeas

Bastidas Fegan, S. 2019. The Sustainable Land Management Mainstreaming Tool. Rome, FAO. 44 pp. Licence: CC BY-NC-SA 3.0 IGO

Bucknall, J., Klytchnikova, I., Lampietti, J., Lundell, M., Scatasta, M. & Thurman, M. 2003. *Irrigation in Central Asia: Social, economic and environmental considerations*. Washington, DC, World Bank.

Bot, A. & Benites, J. 2005. The importance of soil organic matter key to drought-resistant soil and sustained food and production. FAO Soils Bulletin 80. Rome, FAO.

CACILM. 2009. **Central Asian Countries Initiative for Sustainable Land Management**. *An update of the National Programming Framework of the Republic Uzbekistan, Tashkent.*

CACILM, NPF 2006**. Global Environment Facility (GEF) & Asian Development Bank (ADB).** *National Programming Framework: Republic of Uzbekistan*. Tashkent.

CACILM2. 2020. Integrated Natural Resources Management in Drought-prone and Salt-affected Agricultural Production Landscapes in Central Asia and Turkey (CACILM2), Services towards the execution of the Service between FAO Uzbekistan and UZGIP. Final Report, Tashkent.

Dalal-Clayton, B. & Bass, S. 2009. The challenges of environmental mainstreaming: Experience of integrating environment into development institutions and decisions. Environmental Governance No. 3. London, International Institute for Environment and Development.

FAO. 2011. *Questionnaire for mapping land degradation and sustainable land management (QM).* Version 2. Rome. https://www.fao.org/3/i3240e/i3240e.pdf

FAO. 2013a. Land degradation assessment in drylands: Methodology and results. 56 pp. Rome. www.fao.org/3/i3241e/i3241e.pdf

FAO. 2013b. Drought situation analysis on Uzbekistan for regional synthesis. Sub-regional Bureau for Central Asian Countries (FAOSEK), Final Report.

FAO & GEF. 2014. Decision support for mainstreaming and scaling up of sustainable land. Project document.

FAO. 2017a. Climate-Smart Agriculture Sourcebook, Summary (second edition). Rome.

FAO. 2017b. Sustainable land management (SLM) in practice in the Kagera Basin: Lessons learned for scaling up at landscape level. Results of the Kagera Transboundary Agro-ecosystem Management Project.

FAO. 2017c. Decision support for mainstreaming and scaling up of SLM. Project Implementation report (Unpublished).

FAO. 2018a. DS-SLM Project GCP/GLO/337. Implementation report (PIR) for 2016–2017 (Unpublished).

FAO. 2018b. *Handbook for saline soil management*. FAO GSP/EASP and Moscow State University. 145 pp. 2018/ Rome, Italy. https://www.fao.org/3/I7318EN/i7318en.pdf

Government of Uzbekistan. 2017. The Program of comprehensive measures for development of irrigation, improvement of the meliorative state of irrigated land and rational use of water resources for 2018-2019. PP-3405, 27 November 2017.

Government of Uzbekistan. Presidential Decree on Organizational Measures for the Fundamental Improvement of the State Management of Agriculture and Water Resources. PD-5330, February 12, 2018 and PD-5418 April 17, 2018.

Government of Uzbekistan. 2018. On measures to fundamentally improve the system of protection of the rights and legitimate interests of farmers, dekhkan farms and owners of households, efficient use of sown areas. № ПП-3680, 24 April 2018.

Government of Uzbekistan. The strategy for the transition of Republic of Uzbekistan to "green" economy for the period of 2019–2030.

Government of Uzbekistan. The strategy for the development of agriculture of the Republic of Uzbekistan for 2020–2030.

Gupta, R., Kienzler, K., Mirzabaev, A., Martius, C., de Pauw, E., *et al.* 2009. In: Research Prospectus: A Vision for Sustainable Land Management Research in Central Asia. Chapter 10 Economics of Land Degradation in Central Asia. Sustainable Agriculture in Central Asia and the Caucasus. CACILM Multi-country Partnership Framework. ICARDA CAC Program, Tashkent Uzbekistan.

Harari, N., Mekdaschi Studer, R., Bastidas Fegan, S., Schlingloff, S. & Bres, A. 2023. *Promoting sustainable land management through evidence-based decision support – A guide with country insights*. Rome, FAO. http://www.fao.org/3/cc6118en/cc6118en.pdf

International Monetary Fund. 2010. World Economic Outlook Data. www.imf.org/external/pubs/ft/weo/2011/01/weodata/

Korea Forest Service & UNCCD. 2011. *Combating Desertification and Land Degradation. Proven Practices from Asia and the Pacific*. https://www.droughtmanagement.info/literature/UNCCD_combating_desertification_land_degradation_2011.pdf

Liniger, H., Harari, N., van Lynden, G., Fleiner, R., de Leeuw, J., Zhanguo, B. & Critchley, W. 2019. Achieving land degradation neutrality: The role of SLM knowledge in evidence-based decision-making. *Environmental science & policy*, 94, S. 123–134. www.sciencedirect.com/science/article/pii/S1462901118306403

Mamarasulov Kh, *et al.*, 2015. Status of the Rural Advisory Services System in the Republic of Uzbekistan. A Collaborative Country Assessment, Tashkent.

Middleton N. & Thomas D. 1992. *World atlas of desertification*. UNEP.

Ministry of Innovation Development of the Republic of Uzbekistan. PD-5264, 29 November 2017.

Pankova, E.I. *et al*. 1996. *Natural and man-made salinization of soils within the Aral Sea basin*. 187 pp. (in Russian). Moscow, Dokuchaev Soil Science Institute.

Saliev, A. S. & Fayzullaev, M. 2013. Socio-economic development of the Republic of Uzbekistan for years of independence. Uzbekistan, *Bulletin Argo* 2013: 131–43.

Statistic State Committee of RUz. *Agriculture in Uzbekistan, 2014-2017*. Tashkent. https://stat.uz/en/press-releases/5828-for-2017-year

United Nations Convention to Combat Desertification Performance Review and Assessment of Implementation System (UNCCD PRAIS). 2018. Land degradation neutrality target setting program guidance.

United Nations Development Programme (UNDP). 2007. *Water: Critical resource for Uzbekistan's future*. Tashkent.

UNDP & Center for Economic Research and Reforms. 2015. *Uzbekistan towards 2030: Main directions of the transition to resource-efficient growth model*. Tashkent.

UNEP & Uzhydromet. 2016. Third National Communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/TNC%20of%20Uzbekistan%20under%20UNFCCC_english_n.pdf

WOCAT DS-SLM 2018. Country page: Uzbekistan https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/uzbekistan https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_UZB

ANNEX

Table A. 1 | Barriers to SLM implementation

Barriers to SLM implementation and scaling-out	Opportunities for integrating SLM
Policy and regulation barriers	
Insufficient execution of decisions made and measures for SLM scaling-out.	Improve the effectiveness and efficiency of existing services for oversight and monitoring of implementation of decisions and measures for the scaling out of SLM.
Inappropriate institutional capacity and intersectoral coordination.	Enhance strengthening of institutional capacity and intersectoral coordination plans.
Professional networks for technology exist, but are not sufficiently active.	Enhance networking of SLM collaboration for scaling out.
Programmes and projects	
The state programmes on improvement of the irrigated lands exist, but scaling-out of technologies is insufficiently active.	Enhance SLM outscaling planning and implementation.
Integration of FAO LADA, Integrated Landscape Management approaches and instruments (Participatory Land Use Development (PLUD), Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralist (SHARP) etc.) into assessment, planning and implementation is insufficient.	Expand capacity-building initiatives and programme to integrate FAO approaches and tools (LADA, ILM, PLUD, SHARP, etc.) into regional and local SLM scaling-out plans.
Economic, financing and incentive barriers	
Expensive agricultural equipment and high cost of installation limit access and scaling-out of SLM technologies on small farms.	Strengthen support of local communities for acceptable and low-cost farming techniques, and standard purchase agreement.
Facilitation services for technical maintenance and financial support are insufficient.	Involve local communities and civil society.
Technologies and knowledge barriers	
Insufficient skills and experience for installing and maintaining SLM technology at wider scale.	Expand capacity-building initiatives and programmes.
Insufficiently coordinated activities of agricultural advisory centres and services for scaling up and transferring the technologies inhibit the scaling-out of SLM on a large scale.	Establish an SLM technology operation and maintenance programme in collaboration with agricultural and water services and educational institutions.
Technology may require modification to fit local household conditions.	Modify technology to meet local needs.
SLM technology and tool guides and information are not widely available.	Disseminate adequate information and guides, and conduct awareness campaigns.

Table A. 2 Decision-making processes

Decision-making processes	Description of the process and opportunities for mainstreaming SLM
1. Policies and regulations	
See Table A.3	
2. Strategies, programmes and projects	
"Program of integrated measures for the development of irrigation, improvement of the meliorative state of irrigated land and rational use of water resources for the period 2018–2019"	Integrate SLM into the Program of meliorative improvement of irrigated land, focusing on the introduction and scaling-up of new drought-resistant and salt-tolerant high-yielding varieties of crops that are most adapted to salinization and the negative impacts of climate change.
The Program of actions on environmental protection of the Republic of Uzbekistan for 2013–2017, (updated every 5 years), includes a set of measures to improve environmental protection (forestation, to increase soil carbon, agrobiodiversity, etc.).	Scale-out implementation of SLM technologies for agroforestry and afforestation to mitigate the risks of drought, the effects of climate change, sequestration of carbon dioxide and diversification of the incomes of rural people.
The Concept of Cooperation among the Commonwealth of Independent States (CIS) countries in the field of land melioration aims to achieve a neutral balance of land degradation.	To integrate regional programmes on improvement of salt-affected, hard-to-reclaim irrigated lands (similar to Djizak region) into priority action plans within the framework of the CIS Cooperation Concept.
3. Financing and incentive strategies and mechanisms	
The State Fund of Meliorative Improvement of Lands, which has been operating since 2007, and the Innovation Supporting Fund established in 2017, carry out financing of technical activities (rehabilitation of drainage infrastructure), and introduce best practices, technologies and modern achievements of world science.	To involve the Fund of Meliorative Improvement of Lands and the Innovation Supporting Fund in financing a set of measures for the effective rehabilitation of salinized irrigated lands.
4. Local-level decisions	
Agricultural consultancy services are provided by a wide range of information providers and advisory services, but there is no unified coordination of their activities.	Strengthen advisory services through the creation of a network to support information sharing between local partnerships.

Table A. 3 | List of main legal and regulatory documents, programmes and action plans

Name of document
National legislation and government decrees
The Law of the Republic of Uzbekistan "On Nature Protection"
The Law of the Republic of Uzbekistan "On Water and Water Use"
The Land Code of the Republic of Uzbekistan
The Law of the Republic of Uzbekistan "On Mineral Resources", 23.09. 1994 No 2018-XII
The Law on State Land Cadastre 666-I 28/08/1998
The Law to raise the fertility of agricultural land, 2006
The Law of the Republic of Uzbekistan "On Security of Hydrotechnical structures", 1999
The Law of the Republic of Uzbekistan "On Protection of Population and Territory from Natural and Anthropogenic Emergency Situations", 824-I 1999
"On Environmental Action Program of the Republic of Uzbekistan for 1999-2005"
Decree of President "On additional measures to support the activities of the Women's Committee of Uzbekistan". Adopted on 25 May 2004.
Decree of President "On measures to enhance the role of women in state and public development of Uzbekistan" (2 March 1995)
"On Approval of Provision for Conservation Zones around Reservoirs and the Other Water Bodies, Rivers, Main Canals and Collectors, and Sources of Municipal Water Supply, Curative and Recreation Springs in the Republic of Uzbekistan, №174 07.04.1992
"On Limited Water Use", №385 03.08.1993
Decree 'On measures to implement the law of the Republic of Uzbekistan "On the safety of Hydrotechnical structures" 499 16/11/1999
"About the strategy of action in 5 priority areas of development of the Republic of Uzbekistan for 2017-2021", DP-4947 dated February 7, 2017. Appendix 1.
"About formation of the Ministry of Innovation Development of the Republic of Uzbekistan" No. DP -5264 dated 11.29.2017
The concept of agricultural development of the Uzbekistan Republic until 2030. Tashkent, March 2018
The concept of development of the agricultural machinery industry for the period 2018-2021
"About measures for further reform and development of agriculture for the period 2016-2020" № DP-2460 dated 12/29/2015
"About measures to improve the procurement system and the use of horticultural production, potatoes and melons" No. DP-2520 dated April 12, 2016
"On additional measures to improve the activities of farms, dekhkan farms and owners of households" and "On measures to fundamentally improve the system of protection of the rights and legitimate interests of farmers, dekhkan farms and owners of households, efficient use of sown areas" N DP-3680 dated 04.24.2018
About the Program of further modernization, technical and technological rearmament of agricultural production for 2012-2016. №139 dated 21.05.2012. №DP–1758.
About measures for the organization of carrying out tests of selection achievements. № 369 dated 29.12. 2014
About formation of Uzagrotekhsanoat holding joint-stock company. N DP-4857 dated 17.11.2016
About the State Program on development of Aral Sea coastal area for 2017–2021. DP N-2731 dated 18.01.2017
About the Strategy of actions for further development of the Uzbekistan Republic N DP-4947 dated 07.02.2017

Water resources
Decree “On urgent measures to guarantee water supply for Karshi Main Canal in 1999-2000”, № 337 09.07.1999
Decree “On establishing the State Inspection for the Control and Supervision of the technical condition and operating safety of the largest and most important waterworks (Gosvodkhoznadzor) under KM of Uzbekistan” #DP-2272 24.03.1999
Resolution “On issues of organization and activities of the State Inspection on Control and Supervision of the technical condition and safety of the largest and most important water management objects under KM of Uzbekistan”. #143 of Uzbekistan 30.03.1999
Resolution “On measures to improve the reliability of operation and maintenance of Karshi Main Canal with Pumping Station Cascade. № 357 21.07.1999
Decree “On enactment of the Law of the Republic of Uzbekistan "On the safety of Hydrotechnical structures". № 827-I 20.08.1999
Decree “On urgent measures for the rational use of water resources of the Naryn-Syrdarya Basin during the vegetation period of 2000”. 36 02.03.2000
The Order “On the action of the headquarter to regulate intergovernmental water management issues. 104-F 02/03/2001
Resolution “On improvement organization of water management”. 21.07.2003 № 320
Resolution “On measures to improve the guaranteed water supply and rational use of available water resources of the Syrdarya River”. 46 25.01.2003
Resolution “On additional measures to ensure the water supply from Arnasai depression to irrigated land in Djizak region” №91 dated 19.02.2003
Resolution “On the establishment of zones formation of fresh groundwater deposits” №14 12.01.2004
Resolution “On the establishment of water protection and coastal zones along Surkhandarya river in Surkhandarya region” №15 12.01.2004
Decree “On urgent measures to mitigate the expected low water in 2007” #629 27.04.2007
Decision of the President of RUz “On measures to implement the investment project "Reconstruction of Raish Hakent-1 Pump Station in Andijan” # DP -958 12.09.2008
Decree “On measures to implement the project "Development of technologies on reducing salinity of drainage water for re-use in the Republic of Uzbekistan” № DP-1280 08.02.2010
Decree “On measures to implement the project "Development of technologies on reducing the salinity of drainage water for re-use in the Republic of Uzbekistan” # DP -1172 10.08.2009
Decree “On Measures to improve of land use efficiency”, №575 29.11.1994
Decree “On implementation of complete inventory of land use in the Republic of Uzbekistan. №636 31.12.1994
Decree On improvement of land use efficiency”, # DP-1009, 24.11.1994
“About organizational measures to fundamentally improve the system of state management of agriculture and water resources” DP -5330 dated February 12, 2018 and DP -5418 dated 04/17/2018
The Program of comprehensive measures for development of irrigation, improvement of the meliorative state of irrigated land and rational use of water resources for 2018-2019. No. DP -3405 dated 27.11.2017
About additional measures for increase in efficiency of meliorative improvement of the irrigated lands and rational use of water resources, № DP-1958 dated 19.04.2013.

Land resources and agriculture
Decree "On approval of normative acts in accordance with the Law of the Republic of Uzbekistan "On Mineral Resources", №19 3.01.1997
Decree "On State of Land Cadastre in Uzbekistan, №543 31.12.1998
Decree "On urgent measures to improve the irrigated lands in Fergana region. Rishtan district № 485 12.19.2000
Resolution "On approval of the regulations on land monitoring in Uzbekistan" 496 23/12/2000
Decree "On measures to develop system of improvement of irrigated lands" DP -3932 29/10/2007
Decree "On measures to optimize the crop areas and increase the production of food crops", 20.10.2008
Resolution "On measures to support farms growing agricultural products for state needs on the low lands"№ DP -725 5.11.2007
Decision "On additional measures for strengthening of incentives for livestock increase in personal households, dekhkan and private farms, and expansion of cattle-breeding production" №PS-842 dated 21.04.2008
Decision "On the formation of the Special Commission to develop proposals on measures to optimize size of land plots in farms"№ F-3077 October 5, 2008
Resolutions " On the State Programme for on improvement of irrigated lands for the period 2008–2012" #PP-817 19/03/2008
Decision "On measures to optimize the crop area and increase the production of food crops DP -4041 20.10.2008
The concept of cooperation of the CIS countries in the field of land melioration
Hydrometeorology, emergency response
Decree "On measures to improve the hydro meteorological support of national economy" №70 27.02.1995
Decree " On improving the Hydro meteorological Service of Uzbekistan № 183 14.04.2004
Decree of the Cabinet of Ministers of the Republic of Uzbekistan (No. 427 7.10.1998) Annex 1. Regulations on the procedure for preparing the population of the Republic of Uzbekistan for protection against emergency situations
Decree "On the State System of Prevention and Elimination of Emergency Situations" № 558 of 23.12.97.
Decree "On Additional Measures to Protect the Population and Territories from Emergency Situations in Uzbekistan Related to Mudflows, Floods, and Landslides," 2011.
Resolution "On further improvements of the State system of warning and response in emergency situations in Uzbekistan" № 242. 8.24.2011
Resolution "On the approval of the State Program on the prediction and prevention of emergency situations" № 71. 03.04.2007
National and sectoral programmes, strategies and action plans
National Programme of Action on Environment Protection of the Republic of Uzbekistan for the period 2013–2017. 2012
National Programme of Action on Environment Protection of the Republic of Uzbekistan for the period 2008–2012. 2007
National strategy to reduce greenhouse gas emissions (Uzbek strategy to mitigate the effects of climate change). 2000
The Initial Communication of the Republic of Uzbekistan under the UNFCCC. 2001
The World Bank's Medium-Term Welfare Improvement Strategy, 2003
The WB Irrigation and Drainage Development Strategy, 2001
National Programme Framework CACILM (NFP, 2006, 2009)
State program on prediction and prevention of emergency situations
Program on environmental monitoring in the Republic of Uzbekistan for 2011–2015
Welfare improvement strategy of the Republic of Uzbekistan for 2008–2010, ADB, 2007
Second National Communication of the Republic of Uzbekistan under the UNFCCC, 2008
State Program on "Year of Rural Development", 2009
State Program on "Land improvement of irrigated lands" for the period 2008–2012. 2007

Table A. 4 | Successful programmes for scaling out SLM in Uzbekistan

Key success factor	Case study 1: GEF/ UNDP Project "Achieving Ecosystem Stability" (2011–2015)	Case study 2.: GEF UNDP Project "Reducing pressures on natural resources from competing land use in non-irrigated arid mountain, semi-desert and desert landscapes of Uzbekistan" (2014–2017)	Case study: ZEF / UNESCO project "Ecological and Economic restructuring of Land and Water Use in the Region Khorezm – Pilot Project in Development Research" (2001–2012)	Case study: GEF/ FAO project "Decision Support for Mainstreaming and Scaling out Sustainable Land Management – Uzbekistan" (2016–2018)
Consistent funding and adaptive planning	Communication plan and participatory project on the SLM policies of integrated land use in drought-prone regions are developed.	Plan of alternative actions for land-use improvement: creation of centre for processing herbs; innovative approaches in livestock production; construction of a livestock complex with alternative energy sources.	A comprehensive, evidence-based plan of restructuring land use at three levels of activity: policy, institutional and technological.	Strategy and plan for scaling out SLM are developed for: - irrigated zones - rainfed zones
2.Selection of SLM options for scaling up and out, based on best available evidence	SLM practices: rotation of pastures enrichment of pastures mobile sands fixing More than 16 000 ha of lands around settlements were rehabilitated.	1) Selection of pilot sites (240 ha) for adoption of SLM agro-technologies for rainfed agriculture 2) adaptation of zero tillage for cultivation of drought-resistant rainfed crops 3) Creation of an orchard (2.1 ha) with drip irrigation for demonstration and scaling-out	Resource-saving technologies in agriculture, control over drainage and salinization, agroforestry, new market crops on degraded lands, etc.	SLM technologies for the irrigated lands: diversification of crops with introduction of bean, cultivation of promising drought- and salt-resistant varieties of cotton: for rainfed lands: planting of almonds on small terraces, desert drought-resistant herbs on rainfed areas.
Identify and engage stakeholders at all relevant scales, recognizing and appealing to the motives of different groups.	Various groups of stakeholders, including women, cattle breeders, shepherds are attracted. Alternative sources of income are created.	Various groups of stakeholders, including women, are attracted. Alternative sources of income are created.		Wide range of stakeholders, including local authorities, farmers, women, *aksakals* are involved in scaling SLM up and out
Build capacity for scaling up	Ten educational workshops were held in which 237 people, including 109 women, participated. Local cattle farmers are trained in SLM approaches and methods of agriculture.	Creation of the information and resource centre for land use at Agricultural University.	A long-term scientific research programme is realized. A total of 14 graduate students, 28 masters and bachelors are prepared.The agro-advisory centre is created.	Multi-level approach to increase potential: national, subnational and local level. Training of various target groups. Total number of those trained – 740 people, including 200 women

Key success factor	Case study 1: GEF/ UNDP Project "Achieving Ecosystem Stability" (2011–2015)	Case study 2.: GEF UNDP Project "Reducing pressures on natural resources from competing land use in non-irrigated arid mountain, semi-desert and desert landscapes of Uzbekistan" (2014–2017)	Case study: ZEF / UNESCO project "Ecological and Economic restructuring of Land and Water Use in the Region Khorezm – Pilot Project in Development Research" (2001–2012)	Case study: GEF/ FAO project "Decision Support for Mainstreaming and Scaling out Sustainable Land Management – Uzbekistan" (2016–2018)
Foster institutional leadership and policy change to support scaling-up	Two draft standard and legal documents on effective use of pastures are submitted for consideration by the Government	1) Basic provisions of the concept of the draft bill of RUZ "About Pastures" are developed; 2) Changes are made to the Provision "About National Interdepartmental Coordination Council on Monitoring of Lands"; and approved by the joint Resolution of the relevant ministries and departments.	Official relations are established between the high-ranking politicians and decision-makers at national, regional and local levels and stakeholders (farmers, heads of WUAs).	Relationships with decision-makers at national, subnational and local level are established.
Mobilize: achieve early tangible benefits and incentives for as many stakeholders as possible, to engage in activities for scaling-up	Two project communities "Kazakhdarya" and "KyzylRavat" with a population of more than 5 000 people are mobilized in project activities. Pasture Users Councils are created and pasture rotation is implemented.			Mobilization of local communities in joint decision-making on scaling out of SLM practices through PLUD workshops, 4 water consumers associations (WCAs) in Kamashi and 1 WCA/ WUA in Zarbdar). Total number of participants: 160.
Reflect and communicate	Two project communities and the population of nearby *kishlaks* have adopted and continued the actions initiated by the project.		The agro-advisory centre created as the basis of the project provides information to land users about scientific developments and innovations in agriculture.	Farmers in the project areas have accepted crop diversification, through the introduction of bean cultivation. Mung is seeded as a double crop after harvesting of winter wheat on 2 400 ha in 2017.

Table A. 5 | Mainstreaming strategy objectives

Mainstreaming objectives	Expected results	Component or activities	Decision-making process to be addressed	Target group	Level decisions address				
					Policies	Programmes	Finance	Subnational Planning	Local decisions
Mainstreaming objective 1									
Integration of SLM scaling-out model into integrated catchment planning (ICP) planning in line with the Agricultural Development Strategy until 2030	Sustainable SLM scaling-out planning in catchment areas	1. Review/update of national SLM policies, strategies and programmes, and initial information and training sessions on integrated catchment planning, Land Resources Management and resilience gap analysis tools and guides.	Participatory Territorial planning process	Draft CACILM-2 Program, Khokimiat, departments of the Ministry of Agriculture and the Ministry of Water Resources, farmers	+			+	
		2. Assessment of the current state of DLDD, SLM and development of SLM options based on the FAO LADA, LRM and SHARP instruments.							
		3. Integration of SLM scaling-out model into the ICP (integrated catchment planning) in the Upper Kashkadarya in partnership and collaboration with the FAO SLM projects.							
Mainstreaming objective 2									
Integration of FAO SLM approaches and tools into the State Program on improvement of the meliorative condition in irrigated lands	Integration of SLM into Salinity Mitigation Plan for salt-affected irrigated lands in Djizak region with support of the Meliorative Fund	1. An overview of institutional transformations, analysis of key institutions and mapping of SLM target groups/ actors.	Participatory Territorial planning process	Meliorative Fund, Khokimiyat, divisions of Ministry of Agriculture and Ministry of Water Resources, farmers	+			+	
		2. Conducting multistakeholder workshops and modular training programme, establishment of the Inter-Agency Working Group on coordination, oversight and monitoring of SLM out-scaling activities.							
		3. Integration of SLM scaling-out activities into the Salinity Mitigation Plan for salt-affected irrigated landscapes in Djizak region.							

Mainstreaming objectives	Expected results	Component or activities	Decision-making process to be addressed	Target group	Level decisions address				
					Policies	Programmes	Finance	Subnational Planning	Local decisions
Mainstreaming objective 3									
Ensuring coordination and interaction between target groups of stakeholders, capacity building, awareness and resource mobilization for scaling-out of SLM	Adequate capability and partnership for effective SLM scaling-out financing flow has been strengthened.	1. Creation of a Working Group to support the SLM scaling-out activities.	Building partnerships processes	Stakeholders of all levels (starting from decision-makers to farmers and *dekhkan*, including NGOs)	+		+		+
		2. Involvement of all target actors, including NGOs, in SLM scaling-out network to enhance interactions and partnerships through multistakeholder dialogue, forums and public consultations.							
		3. Adaptation of FAO approaches and instruments (LADA, PLUD) to involve beneficiaries in the participatory ICP/ILM planning and assessment process.							
		4. Development of specific SLM Financing Capacity Building Program to sustain financing flow for SLM scaling-out.							
Mainstreaming objective 4									
Mainstreaming of approaches and technologies for SLM scaling-out and sharing of local experience and skills	The base and enabling conditions for implementation and sharing of local experience on SLM have been created.	1. Development of incentives and motivation to introduce best practices and improve experience on SLM.	Building an enabling environment comprising appropriate policies, incentives, capacity-building processes.	Khokimiyat, departments of the Ministry of Agriculture and the Ministry of Water Resources, farmers, *dekhkan*	+			+	+
		2. Demonstration of SLM technologies through implementation of pilot projects at local level.							
		3. Involving farmers and the local community in the process of testing and implementing practices and technologies.							

Table A. 6 | Key stakeholders related to the mainstreaming and scaling-out of SLM in Uzbekistan

Stakeholders	Roles in the process of scaling-out of SLM
Key stakeholders:	
Higher power structures: Oliy Majlis, Office of the President	It adopts laws, determines the main directions of state policy, including the use of natural resources, protection, improvement and maintenance of the environment.
Executive structures	
Cabinet of Ministers (KM)	It provides guidance on the economy, execution of laws and decisions of the Oliy Majlis, decrees and orders of the President of the Republic of Uzbekistan, pursues a unified policy to maintain the proper state of the environment and regulates the use of natural resources.
Ministry of Innovation Development of the Republic of Uzbekistan and the Innovation Development Fund of the Republic of Uzbekistan	They coordinate the activities of government bodies, of research, information and analytical institutions and other organizations on the implementation of innovative ideas, developments and technologies and finance the development of new equipment and technologies, research, equipping and strengthening the material and practical base of research laboratories of research institutes and universities.
Ministry of Agriculture (MA) Ministry of Water Resources (MWR)	They pursue unified water management and agricultural policy, coordinate activities for the reform of agriculture, are responsible for the effective and rational use of land and water resources, for the introduction of modern agricultural technologies and the creation of a system for monitoring agricultural production, protecting water resources and their rational use.
The Fund for the Development of Agriculture and Food Supply under the Ministry of Agriculture Fund for Development of Water Management under the Ministry of Water Resources.	Financial support for the development and implementation of scientific research, innovative projects and advanced technologies, the promotion of scientific work, the publication of guidelines and articles on agriculture and food security, as well as implementation of innovative projects and modern technologies.
Meliorative Improvement Fund for Irrigated Lands	They fund activities of the State Program of meliorative improvement of irrigated land.
State committees:	
State Committee on Land Resources, Geodesy, Cartography and State Cadastre (*Goskomzemgeodezkadastr*)	It performs state policy in the field of rational use of land resources, regulates land relations, land management, monitoring of land protection activities, increasing fertility and restoring soil.
State Committee for Nature Protection (*Goskomekologiya*) State Forestry Committee	It supervises the implementation of laws and regulations related to environmental protection and environmental management. It ensures the management and rational use of forest resources, and introduces advanced scientific and technical achievements in the industry.
Local government bodies (*Khokimiyats*)	The executive and representative body ensures the implementation of laws and decisions of the Government and the President, has the highest influence on stakeholders, and a wide range of powers at local level, including the use of land and water resources.
Stakeholders	Roles in the process of scaling-out of SLM

Stakeholders	Roles in the process of scaling-out of SLM
Water institutions	
Basin Irrigation Systems Administrations (BISAs); Irrigation Systems Administrations (ISAs)	They are responsible for the implementation of unified policy in the regulation and use of water resources, ensuring the technical reliability of irrigation systems and water management facilities. They may assist in the introduction and scaling-out of advanced water-saving technologies.
Scientific organizations and societies	
Academy of Sciences, scientific and industrial organizations and associations, departments and laboratories (State Forestry Committee, Plant Protection, etc.) Agricultural advisory centres at universities	They conduct research on SLM technologies and innovations, provide advice and training for land users. They provide various agricultural advisory services to land users.
Agencies and media organizations	They disseminate information and increase public understanding of the role and importance of SLM.
Primary stakeholders:	
Civil society: Village Community Assemblies (VCAs)	An independent body of self-government, these carry out public initiatives and activities on sites, can assist in ensuring the participation of local communities in the scaling-out of SLM, and monitor implementation in the field.
Councils of farms, *dekhkan* farms and owners of households	They unite all land users, protect their rights, and are responsible for the rational use of land resources. They can assist in the creation and expansion of the network of consulting services and the scaling-out of SLM.
Water Users Associations (WUAs)	Associations of farms and other legal entities and individuals providing services for the distribution of water and the operation of on-farm irrigation and drainage systems. They can assist in the introduction and scaling-out of water-saving technologies.
Farmers and *dehkans*	They conduct independent agricultural activities that directly depend on state policy. They are directly or indirectly experiencing the negative impacts of land degradation and are interested in the scaling-out of SLM.
International organizations-partners:	
FAO, GEF, WOCAT, ISRIC, Global Soil Partnership/European Soil Partnrship, International Center for Biosaline Agriculture (ICBA), International Center for Agricultural Research in the Dry Areas (ICARDA), CACILM, Lomonosov Moscow State University	Submission of technical manuals and recommendations on tools and approaches to SLM scaling-out, carrying out training, PLUD workshops, assessment of land degradation, development of DS-SLM mainstreaming strategy, etc.

Table A. 7 Questionnaire for network of local communities for Mainstreaming and Scaling up of SLM in project area

Decision Support for Mainstreaming and Scaling-up of Sustainable Land Management (DS-SLM)

Questionnaire or local communities network for Mainstreaming and Scaling up of Sustainable Land Management (DS-SLM)

1.Surname,Name of the respondent______________________________________

2. Name of *Makhalla* (VCA)____

3. Settlement (village, settlement) ______________________________________

4. Education ____

5. Speciality____

6. Your experience in agriculture (how many years?) _________________________

I. The household

Number of members in your family _______________

Type of housing: own house, apartment (underline)

Source of water supply: water supply system, imported water, from a canal, river, collector, well in the yard, other (underline)

II. Land ownership and land use

Does your family have land plots: rainfed _____ ha, irrigated ______ ha?

What crops and on what area do you grow them?

____

____

____

Is there a source of water for irrigation? Yes, No (underline)

Do you think the yield on your site is high enough? Yes, No (underline)

If the yield is low, what is the reason? Please give your opinion:

(a) lack of water or little rainfall; (b) lack of manure and fertilizers;

(c) poor quality seeds; (d) crop pests/diseases; (e) lack of own experience and of knowledge of the best technologies (underline as appropriate)

III. Technologies and practices

Are you familiar with agricultural technologies to prevent erosion, preserve moisture, increase fertility and crop yields? Yes No (underline)

What methods of moisture conservation on rainfed lands do you know?

____
____
____
____

What measures do you use on your plots to improve the soil, retain moisture, increase yields?

____
____
____
____

Are there forest belts around your fields? Yes No (underline)

If not, why don't you create them around your fields?

(a) expensive; (b) do not expect benefits from forest belts (underline as appropriate)

Are there tree plantations on the plot? Yes No (underline)

Do you consider crop rotation to be an important activity for increasing yields and improving soil? Yes No (underline)

How can crop rotation be improved in the cotton-wheat system?

____
____
____
____

Do you agree to apply the best practices and technologies in your country and cooperate with the project? Yes No (underline)

What help is needed (from local authorities, agricultural scientists, specialists) to increase productivity?

____
____
____

IV. Water use on irrigated lands

Which water-saving irrigation methods do you know?

What is your opinion: do you need water-saving irrigation products, and would you use them at home? Yes No (underline)

What is holding back water-saving irrigation practices?

Do you think there is a need for water accounting and control of the water used?
Yes No (underline)

Is water distributed fairly among WUA members? Yes No (underline)

How can the water distribution process be improved?

7. Do you take part in joint water distribution, *hashars* (community work day) for improvement, repair of collectors, etc.? Yes No (underline)

V. Scaling-up of SLM agricultural technologies

What do you think – what should be done to implement and scale out best practices on the farms?

a) training; b) awareness-raising; c) improved technologies; d) (underline as appropriate) or something else. Your proposals:

Which advanced technologies do you know and/or would like to apply on your site?

What constraining factors hinder the introduction of new agricultural technologies?

a) shortage of machinery

b) lack of experience, information, knowledge

c) financial difficulties (underline as appropriate)

What are your suggestions for the introduction of new agricultural technologies?

Thank you for your support and participation in the activities of the project to scale out agricultural technologies to improve the use of lands prone to degradation and drought.

ISBN 978-92-5-138164-9

9 789251 381649

CC7703EN/1/02.24