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Upscaling Sustainable Land Management Practices in Central Asia: experience from regional FAO-GEF project

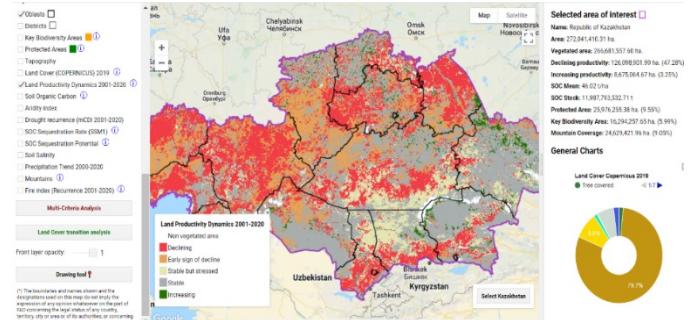
“Integrated Natural Resources Management in Drought-prone and Salt-affected
Agricultural Production Landscapes in Central Asia and Türkiye” (CACILM-2)



Makhmud Shaumarov
Regional Program Coordinator

Presentation Outline

1. Project Background
2. Key interventions
3. Results of National Activities
4. Regional Activity Results
5. Institutional Development & Sustainability
6. Upcoming events



Project Background

MAIN OBJECTIVES

Contribution to **UNCCD** and **UNFCCC** targets

- UN Convention to Combat Desertification
- UN Framework Convention on Climate Change



Upscaling Integrated Natural Resources Management in drought prone and salt-affected agricultural production landscapes in Central Asia and Türkiye.

COMPONENTS

1. **Multi-country collaboration and partnership** to promote effective implementation of the INRM.
2. **Integration of resilience** into policy, legal and institutional frameworks for INRM.
3. **Upscaling of climate-smart agricultural practices.**



IMPLEMENTATION

Scope: Central Asian Countries + Türkiye

Budget: GEF 10.87M \$ + Nat. Cofinancing 65M \$

Duration: 2017 – 2024



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Key Interventions

Level	Main activates
Regional	<ul style="list-style-type: none">• Strengthening cooperation with national and regional institutions• Work on knowledge platforms (WOCAT, TECA), mapping drought/salinity• Resource mobilization to upscale SLM: GEF-8, WB, IsDB, IFAD, Carbon Financing• Capacity development, communication, visibility and outreach
National	<ul style="list-style-type: none">• Improving legal and institutional framework: SLM, CA, SWRM• Enhance technical and institutional capacity• Updating drought/salinization monitoring system -> maps• Development of guidelines, instructions and recommendations• Working with National Work Groups on SLM• Soil carbon financing mechanism for rangelands
Pilot sites	<ul style="list-style-type: none">• Scaling up Conservation Agriculture practices, SPM, multiplication of drought/salt tolerant crop seeds, secondary cropping of forage/legumes, crops rotation etc.• Drought management: drip irrigation, melioration, restoration of wells and water points on pastures,• Sustainable Pasture Management: field surveys, rehabilitation, SLM plans, mapping drought and salinity• Farmer Field Schools on SLM, CA, seed production, SPM• Field days, workshops, awareness raising, knowledge dissemination



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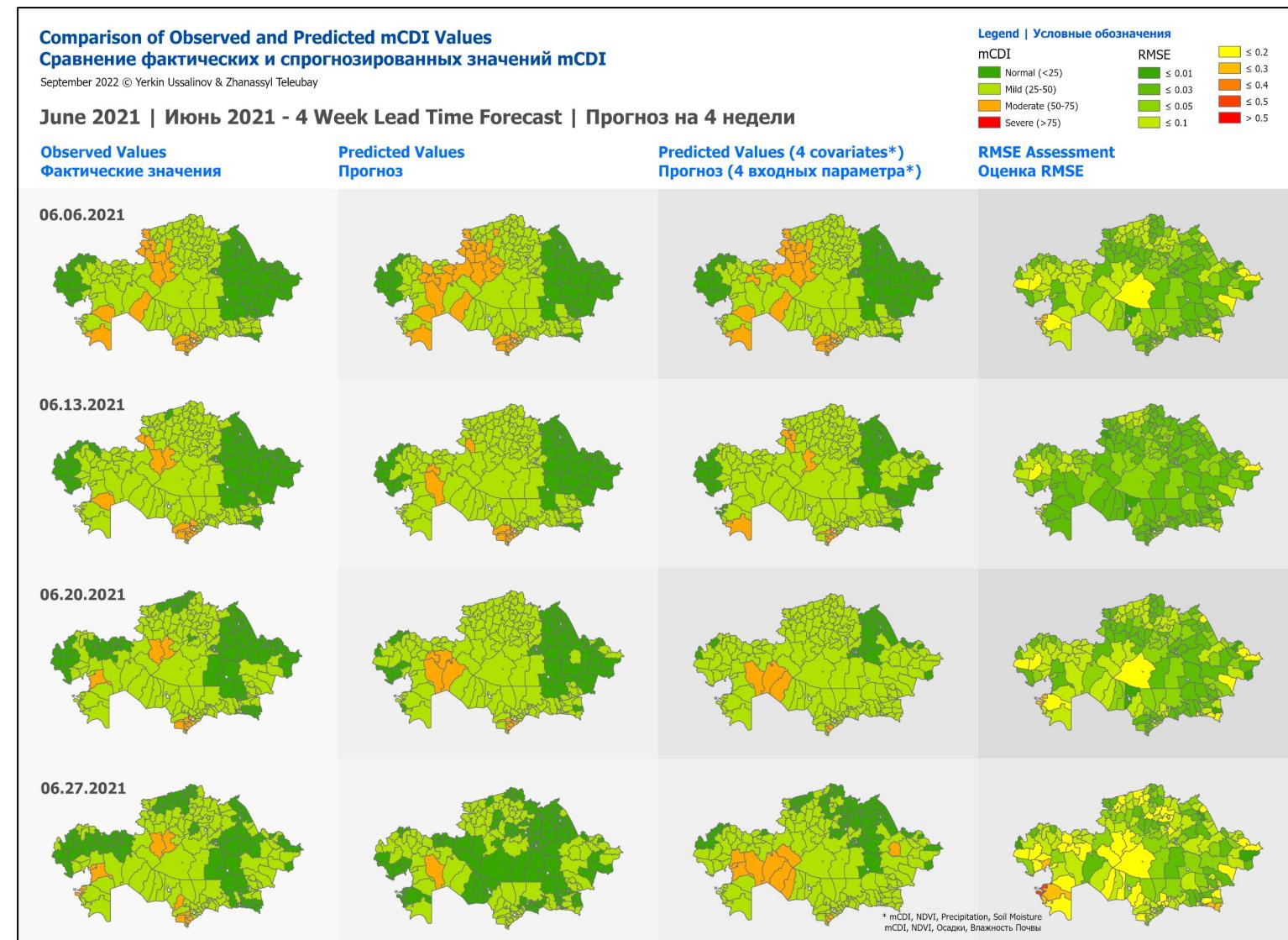


Results of National Activities

1. Sustainable Pasture Management: KAZ-100,000 ha; KRG-256,000 ha; TKM-100,000 ha; UZB-84,000 ha
2. Conservation Agriculture practices: KAZ, TJK, UZB-8,620 ha (min till + double cropping)
3. Crop diversification with Salt & Drought resistant seeds: UZB-6,300ha, KAZ-84ha,
4. Agroforestry: National Campaign “Plant Million Fruit Trees” in UZB; pistachio plantation UZB-1,200ha, new forestry nurseries in KRG, UZB, TKM.
5. Salinity Management: Mapping Land Degradation and Salinity in KAZ, KRG, UZB, TKM.
6. Drought Management: Drought mapping & forecasting, Drip irrigation in KRG, TJK, UZB, TKM; artificial glaciers; Water wells reconstruction & Sardobas in TKM (10); Greenhouses in KAZ-20, KRG, TJK-16, TKM-11, UZB-129.

Example: Agricultural drought monitoring using GIS and remote sensing data from 2001 to 2021 and its prediction based on the deep learning techniques

- Monthly agricultural drought was assessed using a self-modified combined deficit index (mCDI) that combines the anomaly of the Normalized-Difference Vegetation Index, Precipitation, and Soil moisture data
- The accuracy of mCDI was evaluated using the wheat yield data from more than 15 million ha of agricultural land and accounted for 93%
- Based on the monitoring data, a deep learning model (TFT) was built to predict agricultural drought over the Republic of Kazakhstan for 4, 12, and 24 weeks
- The performed model for 4 weeks demonstrated outstanding results with an average MASE of 0.4-0.6 and a drought severity class match of around 85%, while 12 weeks prediction had around 45%. The 24 weeks prediction showed insufficient outcome, which requires further improvement.
- Overall, the results obtained will be useful for both farmers and decision-makers when planning the upcoming agricultural crop year



Comparison of observed and predicted mCDI values over Kazakhstan in June 2021

Interactive geoportal for agricultural drought monitoring and forecasting in Kazakhstan

- For convenient access to the obtained results, an open interactive geoportal in English and Russian languages was created, which contains all the agricultural drought monitoring and forecasting data in the Republic of Kazakhstan (<https://drought.erkin.us/>).
- The results are available not only for viewing in the geoportal but also for further analysis in the GIS environment via the WMS server at: <http://gis.erkin.us/geoserver/drought/wms>
- Further, for the use of the geoportal in the field, a mobile version will be developed that allows one to view the historical, current, and future agro-climatic conditions of the desired territory.
- We believe that the use of modern methods of data delivery will prevent the extreme consequences of agricultural drought and stabilize the socio-economic situation.

Agricultural drought monitoring using GIS and remote sensing data from 2001 to 2021 and its prediction based on deep learning techniques

The problem

Due to its geographic location and climate, Central Asia is vulnerable to desertification, land degradation and drought, and much of the land has already been affected.

According to the United Nations Development Program report, "[Strategic measures to combat desertification in the Republic of Kazakhstan until 2025](#)", Kazakhstan loses about 93 billion tenge annually due to desertification, land degradation and drought.

The northern grain-sowing regions of Kazakhstan, where 73% of the sown area of agricultural crops is concentrated, include the North Kazakhstan, Kostanay, Akmola and Pavlodar regions (more than 565 thousand sq. km). According to the [Köppen-Geiger classification](#), more than 80% of the cultivated area is located mainly in the cold semi-arid natural zone. Given that the lion's share is rainfed crops, i.e. agricultural crops are cultivated without artificial irrigation, drought is the main threat of crop failure. Therefore, there is a need for monitoring and forecasting agricultural drought throughout the Republic.

Main approach

Agricultural drought occurs when crop yields are below normal due to a prolonged lack of soil moisture in the root zone caused by less-than-normal rainfall ([Vyas et al., 2015](#)). Three remote sensing products were used in this study: NDVI, precipitation, and soil moisture, which reflect, respectively, the intensity of vegetation and the main soil water supply during the growing season. Agricultural drought was monitored and predicted using a modified Combined Deficit Index (mCDI) based on the monthly deficit of NDVI, precipitation, and soil moisture. All the input parameters for 20 years period are available on the [Historical Data](#) page.

All the processing was carried out on the Google Earth Engine cloud platform. Source codes available on [the GEE platform](#)

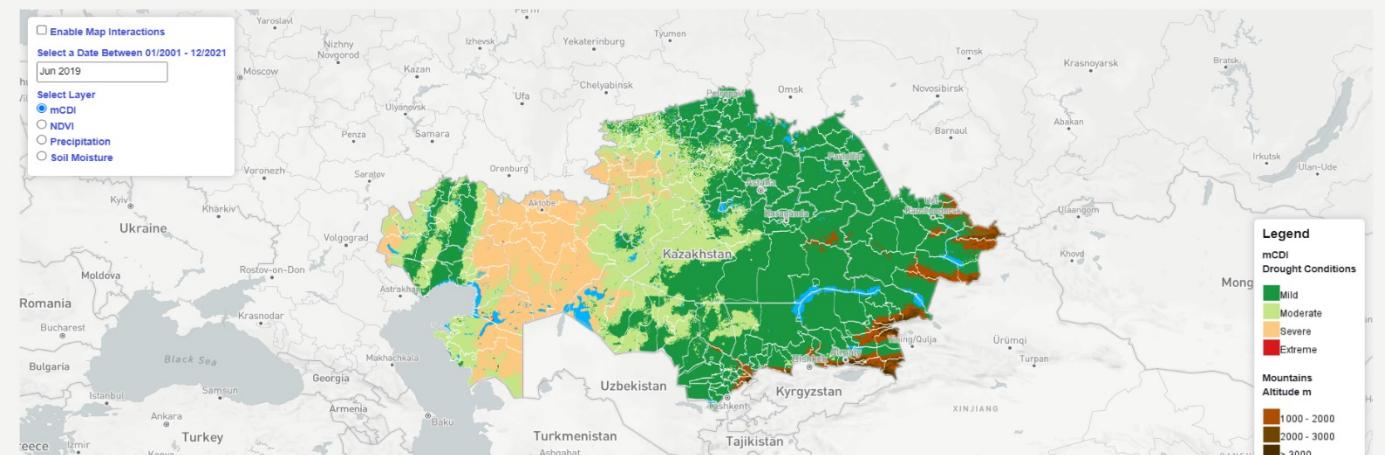
Historical Data

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Agricultural drought was monitored and predicted using a modified Combined Deficit Index (mCDI) based on the monthly deficit of NDVI, precipitation, and soil moisture.

All data presented on this page is available via WMS Server: <http://gis.erkin.us/geoserver/drought/wms>



Interactive geoportal that contains all the agricultural drought monitoring and forecasting data in the Republic of Kazakhstan

Example: Decision Support System for LDN Monitoring



Search places

Earth Engine Apps

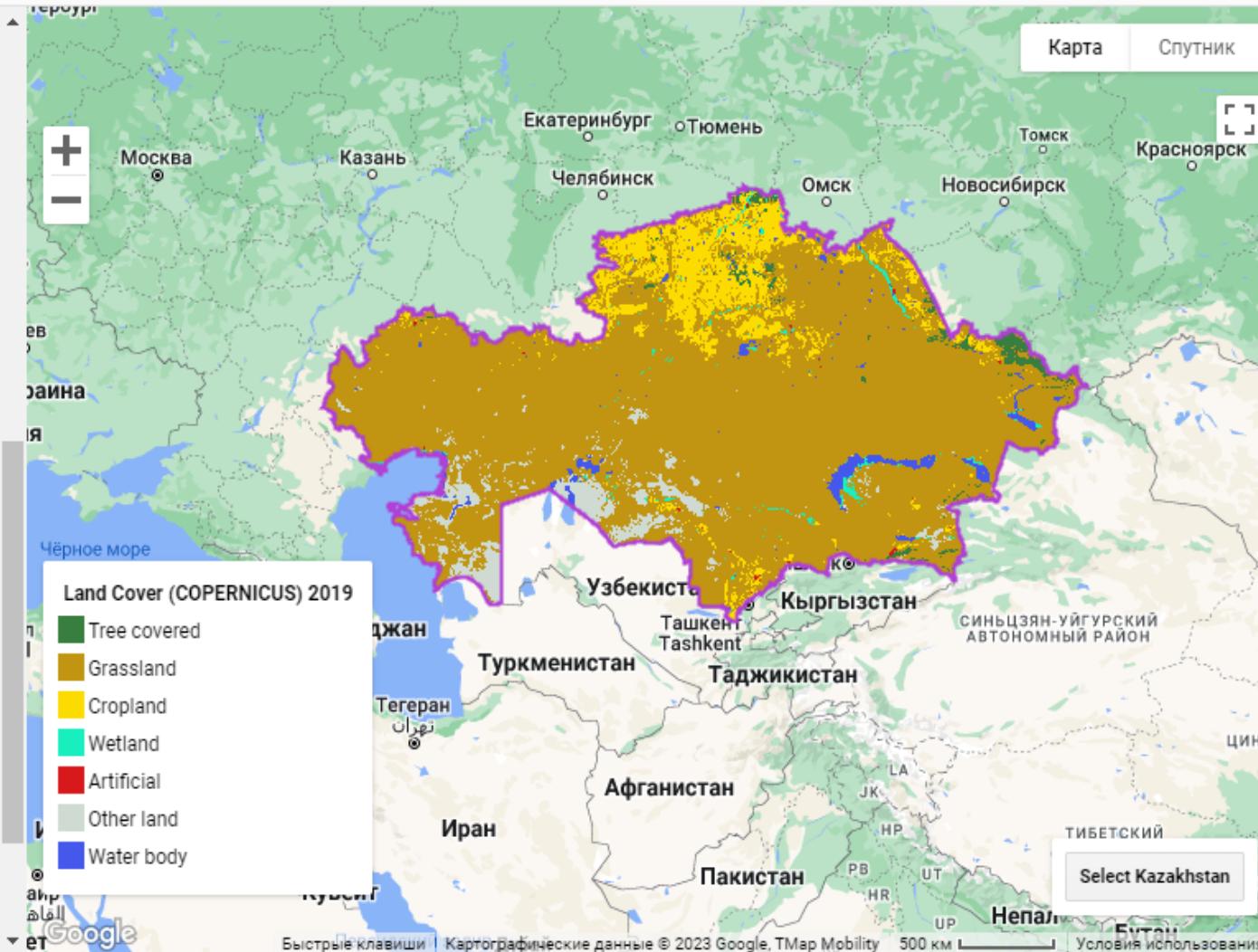
Layers

- Oblasts
- Districts
- Key Biodiversity Areas ①
- Protected Areas ①
- Topography
- Land Cover (COPERNICUS) 2019 ①
- Land Productivity Dynamics 2001-2020 ①
- Soil Organic Carbon ①
- Aridity index
- Drought recurrence (mCDI 2001-2020)
- SOC Sequestration Rate (SSM1) ①
- SOC Sequestration Potential ①
- Soil Salinity
- Precipitation Trend 2000-2020
- Mountains ①
- Fire index (Recurrence 2001-2020) ①

Multi-Criteria Analysis

Land Cover transition analysis

Front layer opacity: 1



<https://wocatapps.users.earthengine.app/view/kazakhstan-ldn>

6/1/23

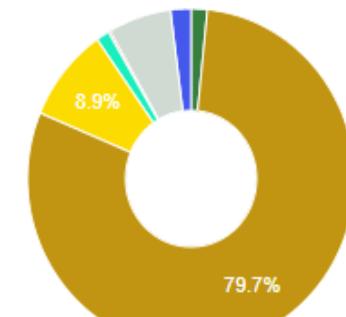
2nd INSAS Meeting, Tashkent

Selected area of interest

Name: Republic of Kazakhstan
Area: 272,041,410.31 ha.
Vegetated area: 266,518,334.87 ha.
Declining productivity: 115,146,299.16 ha. (43.20%)
Increasing productivity: 8,481,959.65 ha. (3.18%)
SOC Mean: 46.02 t/ha
SOC Stock: 11,987,793,532.71 t
Protected Area: 25,976,255.38 ha. (9.55%)
Key Biodiversity Area: 16,294,257.65 ha. (5.99%)
Mountain Coverage: 24,629,421.96 ha. (9.05%)

General Charts

Land Cover Copernicus 2019
Tree covered 1/7



8

Results of National Activities, cont.

1. Water saving: irrigation monitoring system in KRG; hydro-taran pumps in KRG; crop-water technical maps in UZB – 50% water saved nationally
2. National Capacity building: Conservation Agriculture Practices, Sustainable Pasture Management, Agroforestry, Double Cropping, Crop Rotation, Crops Diversification, Drought/Salt Resistant Crop Seeds Multiplication etc.
3. CD for applying tools: AquaCrop, Exact, Carbon Balance, Collect Earth, WOCAT SLM, SHARP, ASIS;
4. Value Chain Development: VC assessments in TJK, UZB, KAZ, TKM.
5. Farmer Field Schools + Soil Doctors Program in KAZ, TJK, UZB, TKM
6. Field trainings, field days and presentations at demo sites



Regional Activity Results

1. Project upscaling: INRM technology Roadmaps; Cost-benefit analysis of SLM tech, investment packages for IFIs, Res.Mob. & co-financing, Soil Carbon Financing etc.
2. Regional Partners: national strategic partners, WB, IFAD, IDB, IUCN, CGIAR, FTFP; WOCAT+Uni-Bern, Uni-Giessen, UNECE, UNEP, UNCCD, GEF, ICSD, IFAS, GIZ, CAREC.
3. Regional KM Platform with WOCAT, FAO-TECA database.
4. Updating global WOCAT database of SLM tech. for CA countries.
5. Communication Strategy, Gender mainstreaming Strategy
6. Regional/International CD on Drought, SPM, LD, Salinity
7. Policy dialogue on Landscape Rehabilitation with UNECE
8. Study tours on SLM upscaling for decision-makers



Institutional Development & Sustainability

1. Policy Dialogue, Working Groups “Law on Pastures”, “Land Code”, RAS, CA strategy in UZB
2. Mechanism for Soil Carbon finance in KAZ, Forest Carbon Finance in UZB;
3. Policy Dialogue on Water Monitoring System in KRG, Crop-Water Mapping in UZB
4. VC assessments, Economic Analysis of SLM, ELD methodology; incentives assessment for SLM upscaling; Carbon Balance in SLM (8MTe), Review of SLM and FFS in CA countries
5. SLM Decision Support: Geoportal & maps for SOC, LD, Drought etc.
6. Tracking GEF indicators; Outcome Maps for Strategic & Boundary
7. PILA reports for SLM and EWS, DRM, AMS
8. Facilitating UNCCD NAP reporting
9. Infrastructure: 12 Agro-meteo stations in UZB;





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JOIN TODAY

PANEL SESSION “Addressing land and water salinity management challenges in Central Asia”

Time: 17:00 – 19:00

Objective: To promote sustainable agriculture and food security in Central Asia by addressing the challenges of land and water salinity

Expected Outputs: Enhancing Awareness, Collaboration, Best Practices, and Representation in Central Asia's Soil Salinity and Irrigation Challenges.

World Class Panelists

Regional and Global Prospectives

Topics: challenges of soil salinity and irrigation in Central Asia, causes and effects of soil salinity in the region, practical agriculture and irrigation practices to reduce soil salinity, and policy & strategy recommendations, also financial mechanisms to support sustainable agriculture and food security.



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Upcoming regional activities

Workshop “Managing Soil Salinization in Arable Areas of Central Asia: Causes, Impacts, Best Practices, and Regional Cooperation”

Date: September 2023

Objective: To address the challenges of soil salinization in Central Asia and formulate effective recommendations to manage it.

Outputs from the workshop include increased awareness, recommendations for effective management of soil salinization, and the need for regional cooperation.

Soil salinization reduces soil fertility, limits crop growth and yield, and ultimately affects food security and the livelihoods of farmers.

The main cause of accelerated soil salinization is improper irrigation, which often involves excessive water use and results in rising groundwater levels and the accumulation of soluble salts in the soil.

The workshop will provide a platform for experts, policymakers, and stakeholders to discuss the challenges of managing soil salinization in arable areas of Central Asia.



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Thank you!

Makhmud.Shaumarov@fao.org