Food and Agriculture Organization of the United Nations

AGENDA

Science, policy and practice for the sustainable management of salt-affected soils

Fourth Meeting of the International Network on Salt-affected Soils (INSAS)

| Dunhuang, **China**
| September 11-13, **2025**

International Network of Salt-Affected Soils

GLOBAL SOIL PARTNERSHIP

Fourth meeting
of the International network of salt-affected soils (INSAS)

Dunhuang, China, 11-13 September 2025

Registration links for online participants:
September 11 (workshop) — https://fao.zoom.us/webinar/register/WN_S3YJHVYvQdOJ9GeIHo_uEA
September 12 (technical session) — https://fao.zoom.us/meeting/register/LfMEPhNTRXeyYtrd6LoeQA
September 12-13 (trainings) — https://fao.zoom.us/meeting/register/BoDQg835TRuPkfY_0ie7Gw

Background. Salt-affected soils, characterized by high concentrations of soluble salts (saline soils) or exchangeable sodium (sodic soils), impact plant growth and agricultural productivity worldwide, particularly in arid, semi-arid, and coastal regions. These soils result from both natural processes, such as climate change and sea level rise, and human activities, including poor irrigation practices and unsustainable water use. According to the FAO's *Global Status of Salt-Affected Soils* report, more than 1 381 million hectares, or 10.7% of the Earth's land surface, are affected by salinity or sodicity. This challenge is intensifying due to increasing aridity and water scarcity, especially in developing countries, where soil degradation further undermines food security.

Climate change and the growing competition for water resources are compounding the risks, with significant crop yield losses already documented in salt-affected areas. The Global Soil Partnership's International Network of Salt-Affected Soils (INSAS) has emphasized the urgent need for updated, harmonized data on soil salinity and sodicity, along with practical, science-based solutions. The previously mentioned report, *Global Status of Salt-Affected Soils,* prepared by INSAS and launched at the International Soil and Water Forum in Bangkok, outlines key priority actions, include scaling up sustainable soil management practices, improving the assessment and monitoring of soil and water salinity and sodicity, and strengthening training, institutional capacities, and policy frameworks to combat salinization effectively.

The workshop aims to mobilize countries and partners to implement the key action areas identified in the Global Status of Salt-Affected Soils (GSAS) report, fostering coordinated progress under the framework of INSAS.

The meeting is co-organized by the China Agricultural University supported by Dunhuang Government of People's Republic of China and will have both in-person and remote participation via Zoom.

Venue: Dunhuang International Convention and Exhibition Center, No. 2713, Wenbo East Road, Yueyaquan Town, Dunhuang City, Jiuquan City, Gansu Province, China

Day	Events
Sep 11	**International workshop on salt-affected soils: SCIENCE, POLICY AND PRACTICE FOR THE SUSTAINABLE MANAGEMENT OF SALT-AFFECTED SOILS**
Sep 12	**Technical session of INSAS**
Sep 12-13	**Trainings on salt-affected soils and halophytes**
Sep 13	**Field trip to salt-affected areas**

September 11

Venue: Dunhuang International Convention and Exhibition Center

Online: https://fao.zoom.us/webinar/register/WN_S3YJHVYvQdOJ9GeIHo_uEA

8:00 – 9:00	Registration
9:00 – 09:45	**WELCOME AND OPENING REMARKS** Vice Chairman of the National People's Congress (TBC) Vice Governor of Gansu Province Principal of China Agricultural University President of Agricultural Development Bank of China Chairman of the Foundation of the National Development and Reform Commission of the People's Republic of China Director General of the Department of Rural Affairs and Agricultural Construction of the Ministry of Agriculture and Rural Affairs of the People's Republic of China Representative of FAO country office in China Director of the Department of Agriculture and Rural Affairs of Gansu Province Deputy Secretary of the Party Working Committee and Executive Deputy Director of the Management Committee of Shandong Province Yellow River Delta Agricultural High-tech Industry Demonstration Zone Deputy Director of Land and Water Division of FAO Chair of the International Network on Salt-affected Soils (INSAS)
9:45 – 10:00	Group photo
10:00 – 10:20	Coffee break
10:20 – 12:00	**KEYNOTE PRESENTATIONS** **Moderator: Mr Haixiang Gao, China Agricultural University** **Utilization and Water-saving Improvement of Saline-alkali Land** **Mr Shaozhong Kang**, China Agricultural University, Academician of the Chinese Academy of Engineering, China **The International Network on Salt-affected Soils: aims and activities** **Mr Jorge Batlle-Sales,** International network of salt-affected soils (INSAS), Chair, Spain **Comprehensive Utilization of Saline-Alkali Land: Strategic Pathways and Technological Innovation** **Mr Xurong Mei,** National Saline-Alkali Land Center, Director; Chinese Academy of Agricultural Sciences, Vice-President, China **Integration of biodegradable plastic mulch-films, super absorbing polymers and nanofibers in salt-affected ecosystem** **Mr Kazuyuki Inubushi,** Tokyo University of Agriculture, Japan **Ecological restoration of salt-affected soil in China** **Mr Shuwen Hu,** China Agricultural University, Professor, China
12:00 – 12:15	Q&A discussion

September 11

Venue: Dunhuang International Convention and Exhibition Center

Online: https://fao.zoom.us/webinar/register/WN_S3YJHVYvQdOJ9GeIHo_uEA

12:15 – 13:30	Lunch

Oral presentations

Moderator: Mr Shuwen Hu, China Agricultural University

13:30– 16:00

Efficient utilization of saline Resources
Mr Xiaojing Liu, Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, Researcher, China

Exploring salinization in the farming areas of Kuwait to improve farms productivities for food security – case of Abdali farming areas
Ms Amal Al-Kandari, Kuwait Institute for Scientific Research, Kuwait

Saline-sodic soil reclamation for agriculture in northeast China
Mr Zhichun Wang, Northeast Institute of Geography, Chinese Academy of Sciences, Researcher, China

Monitoring soil salinity in arid regions with Google Earth Engine and spectral indices
Mr Bekmurat Abdikairov, Institute of Agriculture and Agrotechnologies of Karakalpakstan, Uzbekistan

Research progress on salt alkali tolerance mechanism and salt alkali land agriculture of characteristic halophilic plants in northwest China
Mr Xing Xu, Ningxia University, Vice-President, China

Isolation and characterization of rhizosphere heat tolerant phosphate solubilizing bacteria and their effect on cotton growth and phosphorus fractions in alkaline soils online
Mr Suleman Shah, Agriculture Department, Government of Punjab, Pakistan

Improvement and Comprehensive Utilization of Coastal Saline-Alkali Land
Mr Jianjun Zhao, Hebei Agricultural University, President, China

Modeling soil organic carbon dynamics under climate-induced salinization in grassland ecosystems using the EcoSIM model online
Ms Ibtissame Lembaid, National Research Institute for Agriculture, Food and Environment (INRAE), Morocco/France

The current status of land and water resources in Xinjiang and the challenges faced in the comprehensive utilization of saline-alkali land
Mr Wanli Xu, Soil and Fertilizer Institute of the Xinjiang Academy of Agricultural Sciences, Director, China

Status and management of calcareous sodic soils in the state Bihar, eastern India online
Mr Shiveshwar Pratap Singh, Dr Rajendra Prasad Central Agricultural University, India

Soil salinity status of Iran
Mr Saeed Saadat, Soil and Water Research Institute, Ministry of Agriculture – Jahad, Iran

September 11 Venue: Dunhuang International Convention and Exhibition Center Online: https://fao.zoom.us/webinar/register/WN_S3YJHVYvQdOJ9GeIHo_uEA	
Oral presentations (cont'd)	
	Modeling gypsum concentration in saline soils in Peru using Pedotransfer equations online **Mr Renzo Huerta**, Universidad Nacional Agraria La Molina, Peru **Proximal and remote sensing approaches for assessing salt-affected soils in an estuarine area** online **Ms Ana Paz**, National Institute for Agricultural and Veterinary Research (INIAV), Portugal
16:00 – 16:20	Coffee break
16:20 – 18:00	*Oral poster session* **Moderator: Maria Konyushkova, FAO/GSP**
19:00	Gala Dinner

September 12

Venue: Dunhuang International Convention and Exhibition Center

Online: https://fao.zoom.us/meeting/register/LfMEPhNTRXeyYtrd6LoeQA

Technical session of INSAS

Moderator: Mr Jorge Batlle-Sales, INSAS Chair

9:00 – 9:30	Report on the INSAS work in 2024-2025	Maria Konyushkova, GSP Secretariat
9:30 – 10:00	State and progress on the action areas of INSAS in **Asia**	Mr Sanjay Arora, ICAR-Central Soil Salinity Research Institute
10:00 – 10:30	State and progress on the action areas of INSAS in **Latin America and the Caribbean**	Mr Raul Lavado, University of Buenos Aires and CONICET, Argentina
10:30 – 10:45	Coffee break	
10:45 – 11:15	State and progress on the action areas of INSAS in **Near East and North Africa**	Mr Ahmad Majar, General Commission for Scientific Agricultural Research, Syria
11:15 – 11:45	State and progress on the action areas of INSAS in **Sub-Saharan Africa**	Ms Mary Idowu, Obafemi Awolowo University, Ile-Ife, Nigeria
11:45 – 13:00	Lunch	
13:00 – 13:30	State and progress on the action areas of INSAS in **Europe and Eurasia** online	Ms Katarzyna Negacz, Vrije Universiteit, the Netherlands, INSAS Vice-Chair
13:30 – 13:45	State and progress on the action areas of INSAS in **North America**	Ms Maria Konyushkova, GSP Secretariat
13:45 – 14:00	State and progress on the action areas of INSAS in **the Pacific**	Ms Maria Konyushkova, GSP Secretariat
14:00 – 15:00	Round table on developing work plans adapted to the regional context	all
15:00 – 15:15	Any other matters	
15:15 – 15:30	Closing remarks	INSAS Chair

September 12 **Venue: Dunhuang International Convention and Exhibition Center**		
Trainings on salt-affected soils and halophytes **Online: https://fao.zoom.us/meeting/register/BoDQg835TRuPkfY_0ie7Gw**		
9:00 – 10:00	1. Application of new quality productive forces in the agricultural sector	Trainer: Mr Zijun Xu, School of Ecology and Environment, Xinjiang University, China
10:00 – 11:00	2, Assessment of ecosystem functioning in salt-affected soil reclamation	Trainer: Mr Tairan Zhou, China Agricultural University, China
11:00 – 12:00	3. Mapping of salt-affected soils	Trainer: Mr Miao Lu, Chinese Academy of Agricultural Sciences, China
12:00 – 13:30	Lunch	
13:30 – 16:30	4. Hands-on training for the eHALOPH database: the potential of halophytes as a cash crop to transform agri-business	Trainer: Ms Bilquees Gul, University of Karachi, Institute of Sustainable Halophyte Utilization, Pakistan
September 13 **Venue: Dunhuang International Convention and Exhibition Center**		
7:30 – 12:00	Field trip to the field trials on salt-affected soils	
12:00 – 14:00	Lunch	
Trainings on salt-affected soils and halophytes (cont'd) **Online: https://fao.zoom.us/meeting/register/BoDQg835TRuPkfY_0ie7Gw**		
14:00 – 15:00	5. Treatment technology for salt leaching wastewater from saline-alkali soils	Trainer: Mr Zideng Gao, Beijing Dabeinong Technology Group Co., Ltd., China
15:00 – 16:00	6. Fundamental theories and technical systems of saline-alkali soil improvement	Trainer: Mr Tao Shuming, China

Oral poster session
(in alphabetic order)

Virtual assembly, parametric design, and finite element analysis of a peanut harvester digging system for saline-alkaline soil

Mr Farid Eltom Abdallah, Yellow River Delta Intelligent Agricultural Machinery Equipment Industry Research Academy, China

Mapping and characterizing soluble salts of coastal saline soils: the case of Cagayan River basin

Ms Jovette Almeda, Department of AgricultureBureau of Soils and Water Management, Philippines

Effects of crop rotation and nitrogen management on N_2O emissions in long-term field experiments in Hesse, Germany

Mr Mohannad Alobid, Justus-Liebig University of Giessen, Germany

Soil salinity mapping in agricultural farming area in the south of Kuwait: a way forward for sustainable agriculture for national food security

Mr Mohammad Alsayegh, Kuwait Institute for Scientific Research, Kuwait

Assessment of saline soil degradation for restoration with agrosilvopastoral systems in northwestern Mexico

Ms Monica Aviles, Institute of Agricultural Science, Autonomous University of Baja California, Mexico

Salinity in agricultural soils, water management, and crop alternatives in the arid region of northwestern Mexico

Ms Monica Aviles, Institute of Agricultural Sciences, Autonomous University of Baja California, Mexico

Integration of organic and inorganic sources of nutrients on growth, yield, uptake and quality of Brinjal (Solanum Melangena) in Coastal Karaikal Region

Ms Uma Bagavathi Ammal, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, India

Soil salinity mapping in East Nile Delta, Egypt using electromagnetic induction

Mr Abdelaziz Belal, National Authority for Remote Sensing and Space Sciences (NARSS), Egypt

Comprehensive management of salt leaching processes from saline soils in conditions of water scarcity

Mr D.T. Kodirov, Research Institute of Irrigation and Water Problems, Tashkent, Uzbekistan

Oral poster session (cont'd)

Adaptation of rice production to salinisation and climat change in Mali

Ms Djeneba Dembele, Institute of Rural Economy, Mali

Yield and bulb quality of yellow onion (*Allium cepa* L.) under two fertigation programs in a saline-sodic soil, Ica, Peru

Mr Alaluna Edgardo, Molinos & Cia. S.A, Peru

Physicochemical and morphological characterization of Moroccan phosphogypsum and its impact on chemical properties of saline soil

Ms Zineb El Mouridi, National Institute of Agricultural Research (INRA), Morocco

Monitoring, predicting and quantifying soil salinity, sodicity in arid land using soil and geospatial techniques, case study: Dongla, Northern State, Sudan

Ms Alshfa Elgaber, University of Khartoum, Sudan; University of Sopron, Hungary

A sulfate-palygorskite composite amendment for saline-alkali soil: simultaneous alkalinity reduction, nutrient enrichment, and crop growth promotion

Ms Yijue Fei, College of Science, China Agricultural University, China

Changes in anion activity induced by microbial inoculants in saline soils under moisture-stressed conditions

Ms Rupa Lalitha Gandikota, Tamil Nadu Agricultural University, India

Effects of calcium-based organic fertilizer on soil properties, microorganisms, and fruit quality in coastal saline-alkali jujube orchards: a five-year field experiment

Mr Panpan Gao, China Agricultural University, China

Sustainable practices for saline soil rehabilitation in semi-arid area, Iran

Mr Karim Ghorbani, Ministry of Agriculture–Jahad, Iran

Salinity and water stress interaction in maize (*Zea mays* L.)

Ms Noreen Haider, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

Characterization and classification of salt affected soils of Amibara Irrigation Project at Middle Awash of Afar Region, Ethiopia

Mr Lemma Mamo Haile, Ethiopian Institute of Agricultural Research, Ethiopia

Oral poster session (cont'd)

Ten-year rice cultivation enhances soil aggregate evolution and mineral structural regulation in salt-alkali soils: roles of Fe/Al oxides and organic carbon

Mr Hao Hu, China Agricultural University, China

Potential of halophyte-based agriculture for improving soil health in salt-affected areas of Punjab, Pakistan

Ms Saira Hussain, Bahauddin Zakariya University, Pakistan

Integrated soil and water management under saline/sodic conditions: a review with special reference to India

Mr Sivakumar K, Tamil Nadu Agricultural University, India

What motivates rice farmers to visit private soil testing laboratories? A case study from Eastern Guilan Province

Mr Ehsan Kahneh, HSRI, AREEO, Iran

Preparation of novel composites with high water absorption and retention for saline soil improvement

Mr Binbin Liu, China Agricultural University, China

Impact of soil and water on the nutritional profile of saltmarshes: case study in the United Arab Emirates

Ms Dionysia-Angeliki Lyra, International Center for Biosaline Agriculture, United Arab Emirates

Integrated modeling and sustainable practices for managing salt-affected soils under climate change: A DSSAT-based study on rice cropping systems

Ms Amna Manahil, Ghazi University, Pakistan

Sustainable management of salt-affected soils in Zimbabwe: Practices and policy

Ms Shelter Mangwanya, Chemistry and Soil Research Institute, Zimbabwe

Developing a climate resilient agriculture research model for resilient and sustainable farming systems

Ms Fozia Memon, Directorate of Agriculture Research Tandojam, Pakistan

Evaluating the optimal land use pattern for saline-sodic soils from the perspective of nitrogen metabolism

Ms Yunshan Meng, China Agricultural University, China

Oral poster session (cont'd)

AI-driven mapping of soil salinity in the Sistan Delta Plain, southeastern Iran

Mr Seyed Roohollah Mousavi, University of Tehran, Iran

Sustainable management of salt-affected soils: practices and policy

Mr Daniel Nhunda, Sokoine University of Agriculture, Tanzania

Saline agriculture in Madagascar : opportunities and challenges (a review)

Ms Fanambinantsoa Noromiarilanto, University of Antananarivo, Madagascar

Effects of bio-stimulants on increasing tolerance of canola in salt affected soils of Iran

Mr Fereydun Nourgholipour, Soil and Water Research Institute, Agricultural Research, Education and Extension Organization, Karaj, Iran

Response of sorghum to dual application of silicon and mycorrhiza under saline water irrigation

Mr Senthilvalavan P, Centre for Water and Geospatial Studies, Tamil Nadu Agricultural University, India

Spatial and policy-driven assessment for sustainable management of salt-affected soils in coastal agro-regions of Tamil Nadu, India

Mr Joseph Pious K, Loyola College, India

Phosphoric acid-activated shrimp shell biochar-chitosan for mitigating soil sodicity and tebuconazole contamination

Ms Chenyu Qi, College of Science, China Agricultural University, China

Improving groundnut productivity in salt-affected coastal soils through organic and micronutrient amendments

Mr Kamaleshwaran R, School of Agriculture and Animal Sciences, Gandhigram Rural Institute (DTBU), India

Evaluation of soil amendments on erodibility, crop productivity, and soil properties on salt-affected soils of western India

Ms I Rashmi, ICAR–Indian Institute of Soil and Water Conservation, Research Centre, Kota, Rajasthan, India

Sustainable management of salt-affected soils under climate change: Capacity building through assessment tools, crop modeling, and halophyte integration

Mr Muhammad Rehan, Ghazi University, Dera Ghazi Khan, Punjab, Pakistan

Oral poster session (cont'd)

Physicochemical characteristics of potential salt-affected soils in the Colombian Caribbean

Mr Cristian Rincón, Universidad del Magdalena, Colombia

Genotypes of *Chenopodium quinoa* respond differently to drought, salinity and sowing date under field conditions

Mr Muhammad Saqib, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

Advancing the geospatial monitoring of salt-affected landscapes in arid coastal ecosystems: a remote sensing-based approach for sustainable land use in southwestern Morocco

Ms Najat Sarkouh, University Mohamed V Rabat, Morocco

Characterisation and mapping of soils around Guiers Lake in northern Senegal

Mr Jean Henri Bienvenue SENE, Institute of Environmental Sciences, Faculty of Sciences and Techniques, Cheikh Anta Diop University, Senegal

Use of rice landraces and rhizobium inoculated seed cope to salinity stress in seedling stage

Mr Abhisek Shrestha, Agriculture and Forestry University, Nepal

Landscape mapping of soils susceptible to salinization and salinized soils in the brazilian semiarid region

Mr Mayron Silva, University of Pernambuco (UPE), Brazil

Rational measures of agromelioration on salt-affected Luvic Kastanozems

Ms Ludmila Vorotyntseva, National Scientific Center «Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky», Ukraine

Phytoremediation potential of *Conocarpus erectus* L. for saline sodic soils

Mr Hafiq Abdul Wahab, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

Enhancement of the formation and stability of iron-bound organic carbon through saline-alkali soil improvement and its potential mechanisms

Mr Shuhan Wang, College of Resources and Environmental Sciences, China Agricultural University, China

Oral poster session (cont'd)

A novel sodium alginate / chitosan-based composite loaded with biochar and palygorskite for improving saline-alkali soil

Mr Baoolong Wang, China Agricultural University, China

Effects of different land use patterns on hydraulic conduction function: the role of macroaggregate structure

Mr Tianhao Wang, China Agricultural University, China

Effect of bio-based amendments on the structure and hydraulic properties of coastal saline soils

Mr Zhe Wei, China Agricultural University, China

Optimizing saline soil management to halve nitrogen losses and boost global yield

Ms Wen Wen, Zhejiang University, China

Genotypes of wheat (*Triticum aestivum* L.) respond differently to drought under salt-affected field conditions

Mr Muhammad Saad Bin Zafar, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

Prioritizing soybean cultivation to restore soil quality in saline-sodic farmland

Ms Luxin Zhang, China Agricultural University, China

Effect of saline-alkali soil reclamation on soil permeability and its mechanism

Mr Yun Zhang, China Agricultural University, China

A hybrid method for improving groundwater evapotranspiration modeling in saline areas using remote sensing data

Ms Liya Zhao, School of Agriculture and Biotechnology, Sun Yat-sen University, China

Trainings

Training 1

Application of new quality productive forces in the agricultural sector

Trainer: Mr Zijun Xu, School of Ecology and Environment, Xinjiang University, China

Duration: 60 min

Abstract

With the rapidly changing global climate, the agricultural systems are confronted with more unpredictable and harsh environmental conditions than before which lead to compromised food production. Thus, to ensure safer and sustainable crop production, the use of advanced nanotechnological approaches in plants (phytonanotechnology) is of great significance.

This training examines the transformative role of nanotechnology in advancing new quality productive forces within the agricultural sector. Integrating theoretical foundations with practical applications, it explores cutting-edge uses of nanomaterials in precision fertilization, crop yield enhancement and environmental sustainability. Participants will engage with methodologies for nanocarrier design, biosensor development, and nanobiosafety assessment. Through in simulations of field conditions, attendees will acquire competencies for translating nanotechnology from laboratory research to agricultural implementation, thereby supporting sustainable intensification goals.

Learning outcomes

Upon completion, participants will be able to:

1. Elucidate fundamental principles of nanotechnology, articulating how nanomaterial properties (e.g., targeted delivery, stimuli-responsive release) optimize agricultural resource efficiency.

2. Design integrated nano-agricultural solutions by developing sensor-based crop health monitoring systems for data-driven decision-making.

3. Operate nano-agrochemical delivery systems through safe preparation and application protocols for nanofertilizers.

4. Evaluate techno-economic viability by analyzing cost-benefit ratios and scalability constraints of nanoagricultural implementations.

5. Implement safety and regulatory frameworks in accordance with ISO/FAO standards for environmental risk assessment of nano-enabled agricultural products.

Prerequisites

1. Foundational knowledge in agricultural sciences, biotechnology, or materials science.

2. Proficiency in basic data analysis tools (e.g., Excel).

3. No prior hands-on experience in nanotechnology is required; cross-disciplinary professionals are encouraged to participate.

Equipment / Software needed

Hardware : laptop (Windows 10+).

Training 2
Assessment of ecosystem functioning in salt-affected soil reclamation

Trainer: Mr Tairan Zhou, China Agricultural University, China

Duration: 60 min

Abstract

This training distils the science of saline–alkali land rehabilitation into an integrated learning experience. By dissecting benchmark case studies, participants will learn how to quantify soil ecological functions and master the analytical tools needed for evidence-based decisions. Core topics include soil-health diagnostics, field-level recognition of microbial metabolic constraints, valuation of ecosystem services, and cost–benefit analyses. The course also introduces the newest post-reclamation cropping systems and their ecological implications, clarifying which indicators deserve priority attention and how to interpret them.

Learning outcomes

• Identify microbial metabolic constraints in saline–alkali soils through rapid, evidence-based field recognition techniques.
• Apply valuation frameworks to ecosystem services generated by rehabilitated land, integrating both biophysical and economic indicators.
• Conduct robust cost–benefit analyses of reclamation options, comparing short-term investments with long-term ecological and agronomic returns.
• Design and evaluate post-reclamation cropping systems that maximize productivity while safeguarding newly restored soil health.

Prerequisites

No prior experience required**.**

Equipment / Software needed

No equipment / software required**.**

Training 3
Mapping of salt-affected soils

Trainer: Mr Miao Lu, Chinese Academy of Agricultural Sciences, China

Duration: 60 min

Abstract

Salt-affected soils are a global issue, containing high levels of soluble salts that adversely affect crop growth. Understanding the classification and distribution of salt-affected soils are essential for sustainable management. This training focuses on mapping of salt-affected soils, combining theoretical knowledge and practical skills to enhance understanding of soil classification, distribution, and sustainable management. The training is structured into five key steps, including data collection and processing, explanatory variable selection, salinity inversion modelling, accuracy evaluation, and soil salinity mapping.

Learning outcomes

Participants will be able to:

- Master the data requirements and pre-processing methods for salinization soil mapping.
- Understand the driving factors of salinization and select key variables.
- Apply soil sample data to support modelling and validation.
- Complete end-to-end salinization mapping practices.

Learn error source analysis and validation strategies to ensure the reliability of results.

Prerequisites

- Basic familiarity with remote sensing (e.g., understanding of spectral indices, satellite imagery interpretation).
- Foundational knowledge of geospatial tools (e.g., GIS software like QGIS or ArcGIS).

Introductory programming skills (e.g., Python or R for data handling/analysis).

Equipment / Software needed

- Participants must bring laptop with Python 3.9+ and an IDE (such as PyCharm) pre-installed. Required Python packages include pandas, numpy, scikit-learn (sklearn), and GDAL. ArcGIS 10.2+ will be used for map visualization and result compilation.

The trainer will provide temporary resources.

Training 4
Hands-on training for the eHALOPH database: The potential of halophytes as a cash crop to transform agri-business

Trainer: Ms Bilquees Gul, Dr. Muhammad Ajmal Khan Institute of Sustainable Halophyte Utilization, University of Karachi, Pakistan

Duration: 3 hours

Abstract

eHALOPH (http://www.sussex.ac.uk/affiliates/halophytes/) is an open-access, online repository providing a comprehensive database of halophytes—plants capable of completing their life cycle under saline conditions (≥80 mM NaCl). The database integrates taxonomic classifications, global distribution, ecological traits, and experimentally determined salinity tolerance thresholds, alongside detailed information on plant type, life form, ecotypes, maximum salinity tolerated, presence or absence of salt glands, photosynthetic pathway, antioxidants, secondary metabolites, compatible solutes, habitat, economic uses, and availability of publications on germination, microbial interactions, mycorrhizal status, bioremediation, and molecular data.

eHALOPH facilitates trait-based analyses of salt tolerance and informs the selection of species for biosaline agriculture, ecological restoration, bioremediation, and rehabilitation of degraded wetlands or other salinized habitats. The platform incorporates structured search and filtering tools, enabling targeted investigations into halophyte biodiversity, functional ecology, and adaptive mechanisms under saline stress.

The current version (3.11) retains the foundational HALOPH format, organizing data taxonomically by family, genus, species, and botanical author. Taxonomic nomenclature has been updated by *The Plant List* (v1.1) using automated verification to ensure consistency with accepted binomials. Geographical distribution data have been enhanced with interactive distribution maps generated via Google Maps APIs, providing visual representations of species occurrence at varying spatial scales. By integrating comprehensive trait, ecological, and distributional data, eHALOPH serves as a central resource for both fundamental research on halophyte biology and applied strategies in salinity management, sustainable agriculture, and ecosystem restoration.

Learning Outcomes

By the end of the training, participants will be able to:

- Utilize relevant databases and research tools, such as eHALOPH, for species selection and comparative studies.
- Identify and classify halophyte species based on morphological traits, habitat preferences, and salinity tolerance thresholds.
- Explore practical uses of halophytes in agriculture and environmental management.
- Interpret and analyze experimental or field data related to salt tolerance and productivity in halophyte systems.

Prerequisites

No prior experience required. Basic familiarity with web-based databases is helpful but not essential.

Equipment / Software needed

- Hardware: Participants should bring a personal laptop (Windows) with at least 4 GB RAM, a functional web browser (Google Chrome, Microsoft Edge, or Mozilla Firefox).
- Software: No specialized software installation is required, as eHALOPH is a web-based database. Participants should ensure their browser is updated to the latest version for full compatibility.

Internet Access: A stable internet connection is required to access the eHALOPH database and participate in live demonstrations.

Training 5
Treatment technology for salt leaching wastewater from saline-alkali soils

Trainer: Mr Zideng Gao, Beijing Dabeinong Technology Group Co., Ltd., China

Duration: 60 min

Abstract

Treatment technologies for salt leaching wastewater—generated during saline-alkali soil reclamation—are critical for sustainable agriculture. Background: Salt leaching (flushing soils with freshwater) produces high-salinity wastewater containing salts and agrochemicals, causing groundwater contamination and ecosystem damage if untreated. Engineering Solutions: Integrated systems deploy: (1) Pretreatment (sedimentation/coagulation); (2) Desalination via membrane processes (RO/electrodialysis) or thermal methods (MVC); (3) Resource recovery (NaCl crystallization); (4) Zero Liquid Discharge (ZLD) with solar concentrators. Status & Challenges: ZLD achieves 70-85% water recovery in regions like China's Yellow River Delta, yet faces: (1) High energy consumption (≥15 kWh/m³ for RO-ZLD); (2) Solid residue disposal (≥3.5 tons/1000m³); (3) Membrane fouling from complex matrices. Future Directions: Focus includes: (1) Hybrid renewable energy systems (solar-thermal/electrodialysis) to reduce energy by 40%; (2) Circular agriculture models; (3) Low-cost integrated agronomic techniques; advancing energy efficiency and resource valorization remains imperative for scalable land reclamation.

Learning outcomes

1. Master core treatment technologies

    Understand principles of desalination (RO/electrodialysis, MVC) and ZLD systems
    Design integrated pretreatment-solar concentrator workflows

2. Execute resource recovery operations

    Extract industrial salts ($NaCl/Na_2SO_4$) via crystallization
    Convert residues into soil amendments

3. Quantify system performance

    Calculate energy-water recovery ratios (e.g., ≥15 kWh/m³ vs. 70-85% efficiency)
    Assess solid residue management costs (≥3.5 tons/1000m³)

4. Develop sustainable innovations

    Design hybrid renewable energy systems
    Implement IoT monitoring against membrane fouling

5. Integrate circular agriculture solutions

    Apply treated water for halophyte irrigation
    Combine brackish water irrigation, biochar amendments, and salt-tolerant crop rotation

Prerequisites

No prior experience required

Equipment / Software needed

Laptop (optional).

Training 6
Fundamental theories and technical systems of saline-alkali soil improvement

Trainer: Mr Tao Shuming, China

Duration: 60 min

Abstract

This course systematically introduces the formation mechanisms, classification standards, and improvement principles of saline-alkali soils, focusing on four major technical systems:

- **Hydraulic improvement:** Techniques including irrigation-drainage system establishment, groundwater level control, and flood diversion for sediment deposition to achieve rapid desalination through water-salt regulation.
- A**gricultural technical improvement:** Deep ploughing and sun exposure (optimal in spring/ autumn), land leveling, soil replacement, and organic fertilizer application to improve soil structure.
- **Biological improvement:** Ecological restoration methods like planting salt-tolerant plants (e.g., *Suaeda salsa, Tamarix chinensis*), straw returning, and microbial agent application
- **Chemical improvement:** Application principles and operational standards of amendments including gypsum, phosphogypsum, and humic acid fertilizers.

Learning outcomes

Participants will gain the following knowledge, skills, and competencies:

- **Comprehensive understanding** of saline-alkali soil formation mechanisms, classification standards, and improvement principles
- **Practical skills** in implementing four major technical systems:

⇒ Hydraulic improvement techniques (irrigation-drainage system design, groundwater level control, flood diversion for sediment deposition)

⇒ Agricultural technical methods (deep ploughing, land leveling, soil replacement, organic fertilizer application)

⇒ Biological restoration approaches (salt-tolerant plant selection, straw returning, microbial agent application)

⇒ Chemical amendment utilization (gypsum, phosphogypsum, humic acid fertilizers application principles)

Analytical ability to select appropriate technical combinations based on soil conditions and improvement goals

Prerequisites

- **Basic knowledge** of soil science or agricultural principles is recommended but not mandatory
- **Field experience** in agriculture or land management will enhance learning but is not required
- **No prior experience required** for the fundamental concepts, as the course systematically introduces all necessary knowledge

Field excursion

Field excursion. 13 September 2025, 7:30—12:00

Departure 7:30 h from the Dunhuang International Convention and Exhibition Center. Kindly arrive at least 15 minutes in advance.

We cordially invite you to an exclusive field excursion to our pioneering research and demonstration agro-park, a living laboratory dedicated to transforming salt-affected lands into productive, sustainable agricultural ecosystems. This tour offers a unique opportunity to witness world-class innovation in action, exploring integrated solutions that address critical challenges in soil health, crop resilience, and resource management, directly contributing to FAO's vision for a food-secure world. The excursion follows a planned route through key research areas.

Journey Through Innovation – Key Thematic Stops:

Theme 1: Integrated Crop Management Systems for Enhanced Saline Resilience (Approx. 80 minutes)

- Observe large-scale demonstration plots for pivotal crops including sunflower, sorghum, cotton, and maize.
- Witness comparative studies showcasing the efficacy of comprehensive improvement packages—integrating advanced soil amendments, precision fertigation, and water-efficient technologies—versus conventional farming practices.
- Gain insights into strategies for optimizing crop performance and yield stability in challenging saline environments.

Theme 2: Breakthroughs in Soil Health Rejuvenation & Genetic Resource Utilization (Approx. 85 minutes)

- Explore dedicated trial sites for diverse varieties of sunflower, sorghum, cotton, and maize, selected for their adaptability and productivity in reclaimed soils.
- Discover cutting-edge research on novel soil remediation agents, including advanced polymer-based desalination materials, organic-inorganic composite soil conditioners, and targeted microbial inoculants designed to revitalize soil structure and fertility.
- Understand the scientific principles behind enhancing nutrient bioavailability and fostering beneficial soil ecosystems in salt-affected agroecosystems.

Theme 3: The Next Generation of Farming: Smart Agriculture & Precision Ecosystem Management (Approx. 40 minutes)

- Visit our Smart Agriculture Hub to experience the integration of digital technologies, IoT-based sensor networks, and AI-driven data analytics for optimized resource management.

Learn how precision agriculture techniques are being deployed for real-time monitoring, site-specific interventions, and enhanced decision-making to improve sustainability and productivity in saline landscapes. This meticulously curated tour is designed to provide profound insights into scalable and sustainable solutions for saline-alkali land management, fostering dialogue and collaboration towards achieving resilient agri-food systems globally.

The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

Land and Water Division
GSP-secretariat@fao.org
www.fao.org/global-soil-partnership

Food and Agriculture Organization of the United Nations
Rome, Italy

The International Network of Salt-Affected Soils (INSAS), launched in 2019 during the International Center for Biosaline Agriculture's (ICBA) first Global Forum on Innovations for Marginal Environments, is a Technical Network of the Global Soil Partnership (GSP) and follows its Rules of procedure. The Network aims to facilitate the sustainable and productive use of salt-affected soils for current and future generations. INSAS's mission is to support and facilitate joint efforts towards the sustainable management of SAS for food security, agricultural sustainability and climate change mitigation.

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