



International Training on

Harnessing Soil Microbiome for Agro-Environmental Sustainability and Achieving Land Degradation Neutrality

[26-30 October, 2026]

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Last Date to Apply: 21 August, 2026

Organised by:

Centre of Excellence on Sustainable Land Management
ICFRE, Dehradun, India

Background

Healthy soils are an invaluable resource for diverse ecological functions. In recent years, soil degradation owing to intensive agriculture, land-use change, erosion, compaction, pesticide and antibiotic contamination has emerged as a serious global environmental crisis. About 3.2 billion people around the world have been adversely impacted by land degradation. Consequently, researchers have increasingly realized the role of microbial communities and the hidden power of the soil microbiome in safeguarding and enhancing soil health, and there is growing interest in practices that can maintain healthy soils. Microorganisms are overwhelmingly abundant in soils, residing in the soil and deep subsurface of the Earth. Soils harbour the most diverse and complex microbiome on Earth, often containing more than 0.5 mg of microbial biomass carbon and >50,000 species per gram. Microbiomes are sets of microorganisms that inhabit specific plants or environments. Soil surrounding specific plant communities' harbours distinct sets of microbiomes that play a crucial role in nutrient mobilization, maintaining soil structure and fertility, suppressing plant pathogens, and keeping the ecosystem intact. Bacteria and fungi are generally the dominant microorganisms in soil, with greater biomass than protists and archaea. The abundance of microorganisms in different environments forms the foundation of soil health and serves as a crucial driver for the sustenance of life on Earth. The quality and health of soils are linked to global food and water security and have important implications for energy security and climate change mitigation. Soil microbial communities have direct and indirect influences on a multitude of processes, including nutrient cycling, organic matter dynamics, soil structure, carbon transformation, sequestration, and productivity.

They act as key drivers in reversing land degradation and serve as the fundamental engine of soil health, making them essential for achieving Land Degradation Neutrality (LDN). Real-world case studies and examples provide tangible evidence of the effectiveness and potential of soil microbe-based approaches in maintaining soil health, promoting organic matter decomposition and nutrient cycling, enhancing crop productivity, and addressing the challenges of land degradation and desertification.

The proposed training aims to develop a deeper understanding among key stakeholders of the hidden potential of soil microbiomes in improving soil health, promoting sustainable land management, and achieving Land Degradation Neutrality (LDN). The curriculum will include lectures on state-of-the-art approaches and technologies for harnessing soil microbiomes to achieve agro-environmental sustainability and land degradation neutrality. This will be supplemented with demonstrations of real-world case studies, best practices, and successful microbiome-mediated soil health and land restoration measures developed by institutes of excellence in the country.

Target Audience

- Natural resource managers
- Forestry and agriculture professionals
- Government and NGO staff working on land and climate projects
- Researchers, students and extension workers

Learning Objectives

- Understand the structure, diversity, and ecological functions of soil microbiomes and their significance in maintaining soil health and ecosystem resilience.
- Understand the role of soil microorganisms in nutrient cycling, organic matter decomposition, carbon sequestration, and the maintenance of soil fertility.

- Assess the impacts of land degradation, climate change, unsustainable land-use practices, and pollution on soil microbial communities and ecosystem functioning.
- Evaluate the contribution of soil microbiomes to sustainable agriculture, agroecological intensification, and climate-resilient farming systems.
- Gain insights of advanced tools and technologies for studying soil microbiomes, including molecular, genomic, metagenomic, and bioinformatics approaches.
- Understand the role of beneficial microorganisms such as plant growth-promoting rhizobacteria (PGPR), arbuscular mycorrhizal fungi (AMF), nitrogen-fixing bacteria, phosphate-solubilizing microorganisms, and microbial consortia in restoring degraded lands.
- Learn strategies for integrating microbiome-based interventions into sustainable land management (SLM), ecosystem restoration, and regenerative agriculture.
- Examine successful national and international case studies demonstrating microbiome-mediated restoration of degraded landscapes and enhancement of agricultural productivity.
- Strengthen the capacity of participants to design and implement microbiome-based solutions that contribute to the achievement of Land Degradation Neutrality (LDN), Sustainable Development Goals (SDGs), and climate adaptation and mitigation targets.

About the Venue: CoE-SLM, ICFRE, Dehradun, Uttarakhand, India

The Centre of Excellence on Sustainable Land Management (CoE-SLM), established at the Indian Council of Forestry Research and Education (ICFRE), Dehradun, following the Hon'ble Prime Minister's announcement at the 14th Session of the Conference of the Parties (COP14) to the United Nations Convention to Combat Desertification (UNCCD) and inaugurated on 20 May 2023, serves as India's national hub for promoting sustainable land management and achieving Land Degradation Neutrality (LDN).

The Centre advances science-based land restoration through research, policy support, capacity building, knowledge exchange, and the dissemination of best practices across ICFRE's nationwide research network, while fostering South-South cooperation and partnerships among governments, research institutions, and development organizations. CoE-SLM regularly organizes national and international training programmes, workshops, technical consultations, and field-based learning opportunities for researchers, policymakers, practitioners, and development professionals from across the world. Located within the lush green ICFRE campus in the picturesque Doon Valley, between the Himalayas and the Shivalik ranges, the Centre provides an excellent setting for learning and collaboration. Late October weather in Dehradun is pleasant (25–28°C daytime; 12–16°C mornings/evenings). Participants are advised to carry light clothing, a light jacket, comfortable walking shoes, and a cap for field visits.

Chief Patron

- Smt. Kanchan Devi, Director General, ICFRE

Patron

- Dr. Rajesh Sharma, Sci-G & Director, CoE-SLM

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- Dr. Tanay Barman, Research Associate
- Dr. Arpit Huria, Research Associate
- Sh. Ajay Chauhan, Research Associate
- Sh. Vinod Kumar, Senior Technician
- Sh. Rahul Chamoli, Technician

Course Outline

Module I: Fundamentals of Soil Microbiome

- Global Status of Land Degradation and the need for Soil Health Restoration
- Concepts and Principles of Soil Microbiome
- Emerging Pollutants as Silent Threats to Soil Health and Sustainability
- Soil Biodiversity and Ecosystem Functioning

Module II: Soil Microbiome and Agro-Environmental Sustainability

- Role of Soil Microorganisms in Nutrient Cycling
- Microbial Regulation of Soil Organic Matter and Carbon Sequestration
- Plant–Microbe Interactions for Sustainable Agriculture
- Microbial Strategies for Climate-Resilient Agriculture

Module III: Soil Microbiomes for Land Restoration

- Microbial Approaches for Restoring Degraded Lands
- Microbiome-Based Biofertilizers and Biostimulants
- Microbiome-Assisted Nature-based Solutions (NbS)

Module IV: Emerging Technologies

- Modern Tools for Soil Microbiome Research
- Bioinformatics and Artificial Intelligence in Soil Microbiome Studies
- Microbiome Engineering and Synthetic Microbial Communities



For more information, contact:

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