6. Desert Soilification Vs. Desertification - Environment

Researchers at the Central University of Rajasthan (CUoR) have successfully grown wheat in the arid Thar desert using an indigenous bioformulation-based soilification technology.

Desert Soilification

Definition - A biotechnological and ecological process that converts barren desert sand into soil-like, agriculturally productive land.

Mechanism - Modifies sand's physical structure, enhances water retention, and stimulates microbial activity to support crop growth.

Objective - Develop sustainable methods to reclaim desert lands for agriculture, promoting food security and ecosystem restoration.

Desertification

Definition - Land degradation in arid, semi-arid, and dry sub-humid regions due to climatic variations and human-induced pressures.

Impacts - Reduces the biological and economic productivity of land. Key drivers include soil erosion, salinity, deforestation, unsustainable farming, and overgrazing.

Extent in India - ~29.77% of India's total geographical area (~97.85 million hectares) is undergoing land degradation (ISRO Desertification and Land Degradation Atlas, 2021).

Major affected states - Rajasthan, Maharashtra, Gujarat, Karnataka, Jharkhand, Odisha, Madhya Pradesh, Telangana. Rajasthan alone accounts for ~20% of India's desertified area.

Threats - Accelerated by destruction of the Aravali ranges, rainfall variability, spread of sand dunes, and unscientific land-use practices.

Technological and Methodological Approach to Desert Soilification

Soilification Technique - Desert sand is converted into productive soil using bioformulations and polymers.

Functions of Bioformulations -

1. Enhance water retention in sandy soils.
2. Promote cross-linking of sand particles to improve soil structure.
3. Stimulate beneficial microbial activity, boosting crop stress resistance.

Objectives - Convert arid desert lands into cultivable land. Demonstrate a scalable, sustainable method for food security.

Case Study - Wheat Cultivation Experiment

Location - Banseli village near Pushkar, Ajmer district (edge of Thar Desert).

Crop & Scale - Wheat-4079 indigenous variety; 13 kg seeds sown over 1,000 sq. m in November 2024.

Irrigation Efficiency - Required only 3 irrigations versus 5–6 in normal conditions.

Yield - Harvested in April 2025, producing 26 kg wheat per 100 sq. m.

Seed-to-Harvest Ratio - 1 - 20, double compared to normal arid zone cultivation.

Institutional Support - Krishi Vigyan Kendra (KVK) and State Horticulture Department facilitated the project.

Significance -

1. Converts barren desert into cultivable farmland.
2. Demonstrates high water-use efficiency.
3. Offers a sustainable biotechnological solution to desertification.
4. Potentially scalable for other crops like millet and green gram.

Policy and Institutional Measures in India

National Programs

NAPDLDD (2001) - Provides framework for sustainable land use, soil conservation, afforestation, and drought management, in line with UNCCD commitments.

National Afforestation Programme (NAP) - Large-scale tree plantations to restore degraded lands and enhance carbon sinks.

Soil Health Card Scheme (2015) - Advises farmers on soil nutrient status and fertilizer use to maintain

soil fertility.

National Watershed Development Project for Rainfed Areas (NWDPRA) - Focuses on soil and water conservation, rainwater harvesting, and moisture management.

Pradhan Mantri Krishi Sinchai Yojana (PMKSY) - Improves irrigation efficiency under "Per Drop More Crop" to prevent salinity, waterlogging, and land degradation.

Technological Support

ISRO Desertification and Land Degradation Atlas (2016 & 2021) - Provides satellite-based mapping for monitoring degraded land and planning interventions.

International Commitments

India is a signatory to the UN Convention to Combat Desertification (UNCCD, 1994).

UNCCD COP-14 (New Delhi, 2019) - India pledged to -

1. Achieve Land Degradation Neutrality (LDN) by 2030.
2. Restore 26 million hectares of degraded land by 2030.

Key Takeaways

1. Desert soilification is a practical and scalable solution to combat desertification in India.
2. Integrates biotechnological tools, water management, and microbial enhancement for sustainable agriculture.
3. Aligns with India's policy frameworks and international commitments to land restoration.
4. Demonstrates a successful model for improving agricultural productivity, water efficiency, and food security in arid ecosystems.