Integrated Strategies for Conservation of Geodiversity and Biodiversity – Implications for Restoring Ecosystem in Western Thar Desert, India

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1. The arid **Thar Desert** is the world's **SEVENTH largest desert** on the **subtropics**.

2. Ecosystems are key components of **dryland environment**, used extensively by pastoralists for livestock production.

3. **Over grazing and Irrigated Cultivation - disturbance of ecologically fragile landscape in hot desert setting** has exposed soil to **enhanced wind erosion, soil salinity and water logging** and allow shrubs and alien species to invade, displacing native vegetation and affecting fauna/flora.
Geodiversity – Abiotic elements of Nature – Earths Surface Features

- Rocks - Minerals, Fossils, Soils and Landforms and Landscapes
- **Active Geomorphic and Geological Processes** – Erosion and Deposition, Geohydrological systems, Salinity and Hardpan formations

- Biodiversity is the variety of life - all living things; the plants, animals and insects. Flora and fauna are building blocks of biodiversity –
- Geodiversity underpins it – in the natural world, geodiversity and biodiversity are intricately interlinked.

- In recent decades there has been ever increasing human – landscape interactions within interdisciplinary domain of Earth Surface Science.
- Integrated management of living (biotic) and non-living (abiotic) components of the ecosystem will give people and nature a sustainable future, adoption of integrated approaches for conservation of both geo- and bio-diversity are essentials.
JURASSIC PARK- DINO FOOT-PRINTS, Fossils
THAIYAT RIDGE Jaisalmer and Desert landscapes, dunes and traditional rural settlements
GEODIVERSITY: Akal Fossil Wood Park, Jaisalmer, Thar Desert, once hosted luxuriant forests in a tropical climate, bordering the sea some 180 m.y. ago,
The Great Indian Bustard in Thar Desert

DESERT NATIONAL PARK

Fig. 1.34. Unusual animal species in Thar: Great Indian Bustard
Ecosystems Traditionally to Availability of Water & Livelihoods Security in the Thar Desert

To create a community-driven framework for water and natural resource management, thereby reducing vulnerability to climate change to improve access of Indian communities—especially women and disadvantaged groups—to safe drinking water, sanitation, and sustainable livelihood opportunities.
Indira Gandhi Nahar Pariyojna - Main Canal

Indus Water Treaty-1960; Stage-I & II, starts from Harike Barrage a few kilometres below the confluence of the Satluj and Beas Rivers in the Indian State of Punjab - 649 km long up to Mohangarh [204+256=460km of the Indira Main Canal, entirely within Rajasthan, Stage-1 completed in 1983] 43m wide at top, tapers to 35m at 6.4m depth
IMPORTED HIMALYAN WATER THROUGH INDIRA GANDHI CANAL IN WESTERN THAR DESERT
WATERLOGGED AREAS AS WETLAND ALONG IGNP IN Western Thar Desert, Rajasthan
Diggi construction in levelled dunes to store IGNP distributary water Mohangarh area

Laser based levelling of dunes by tractors: a common practice in Thar nowadays
EMERGING ISSUES AND CHALLENGES

1. Destruction of desert landscape through LU changes and mechanical levelling
2. Intensification of Geomorphic processes of erosion and deposition, etc.
3. Degradation of ecosystem and loss of native fauna and flora
4. Presently natural perennial surface water drainage courses are absent in Dryland environment of Thar, Poor internal drainage – hard pans
5. Excessive irrigation: Rise in perched Water-Table Land consolidation/subsidence
6. Water-logging, increased Soil Salinity, Compaction/Submergence/ Subsidence
7. Lack of water use efficiency, conservation and Recycling-reuse of water/ inadequate Sewerage treatment
8. Untreated discharge /disposal of urban and industrial waste water
9. Waste disposal - Dryland Cities [Jaisalmer and Jodhpur]
1. There is an urgent need to enhance water-use efficiency - Emerging Technology driven, INNOVATIVE and INTEGRATED PARTICIPATORY APPROACH needs to be adapted for ecosystem restoration in dryland en

2. Coordinated efforts are required for sustainable utilisation of available water resources through efficient irrigation techniques and conjunctive utilisation of water resources.
Conjunctive use of water resources

- **Conjunctive use** of groundwater along with the supply surface water is also suggested through application of vertical drainage – i.e., pumping of groundwater and throwing it back to the surface canal network.

- There is need to encourage bio-drainage and launch studies on pilot project basis for monitoring water balance estimation, surface and sub-surface water losses through evaporation and applying modern technology: solar powered micro-sprinkler and drip irrigation in covered green-houses.
Integrated network of drip irrigation with technology driven monitoring of supply of nutrients needed on Pilot Project basis.

Re-using treated sewage for farming,
Finding and fixing leaks early, engineering crops to thrive in onerous conditions,
Discouraging gardening, making efficient toilets mandatory, and Pricing water to discourage waste.
ECOSYSTEM RESTORATION AND WATER CONSERVATION MEASURES

3. Remedies and R&D areas may include:

• Online monitoring of water quality, water budgeting on a pilot project and adoption of solar/ wind energy powered micro-sprinkler and drip irrigation technology.

• Application of modern emerging technology [IoT & ML] and geoscience for development of smart rural settlements in dryland of western Thar Desert will boost implementation of Pradhan Mantri Krishi Sinchayee Yojna (PMKSY) to achieve efficient use of land and water resources

• The supply of domestic use to growing dryland cities of Jodhpur and Jaisalmer without adequate measures for discharge and disposal of waste water also affect the overall water regime.
Conjunctive use of water, referred to generally as Diggis = “water banking”

Construction of Diggis on dune levelled agricultural lands

- WATER BANKING arrangements provide ability to store surplus water when it is available,
- providing water supply reliability in dry lean period

• Need systematic hydrologic data for planning of conjunctive water management systems,
Concluding Remarks on Ecosystem Restoration in Thar

- Dryland environments are transforming rapidly with adverse ecological impact owing to the multitude of natural and human factors.
- Adaptation of the holistic approach towards natural diversity that includes both Geodiversity and Biodiversity, for meeting challenges and technological applications.
- Ecosystem restoration and conservations demands a suitable combination of traditional wisdom and modern technology.
- Emerging technological new age solutions and thought process with objective to reach diverse sections of the society on both global and local scale will help us to devise both proactive and reactive approaches to revive our ecosystem and build resilient communities in case of potential disasters.
- There needs to be a bottoms-up approach for better and long-term community involvement. The role of Public-Private-Partnership be encouraged.