IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

PHYTO-RECLAMATION OF SPREADING DESERTS IN SOUTHERN HARYANA: STRATEGIES AND CHALLENGES OF ECOLOGICAL RESTORATION.

Dr. Ved Parkash
Associate Professor
Government College of Education, Bhiwani

Abstract

Desertification and desert spreading are two different terms. Desertification refers to the degradation of land in arid, semi-arid, and dry sub-humid regions caused by climatic variations and human activities while the desert expansion is the process of expanding the existing deserts in the adjoining areas due to the activities of strong winds and deforestation. In Haryana, particularly its southern and south western districts, faces increasing desert expansion due to ecological degradation, groundwater depletion, mining, deforestation, and climate change. The winds coming from adjoining State Rajasthan are loaded with sand which get settled in districts of southern Haryana resulting in spread of deserts. District Bhiwani,Charkhi Dadri and Hisar are most affected districts.

Desert spreading in the study area is due to eco-degradation of the Aravalli hills, overgrazing and unsustainable land-use practices. The Aravalli range functions as a natural ecological barrier against the eastward expansion of the Thar Desert.Rapid environmental degradation has weakened the protective protective role of Aravalli Hills. **Phyto-reclamation** is the process of reclaiming degraded, sandy, saline, or deserted land/or the lands prone to desertification by growing trees, shrubs, grasses, and other plants as per the stage of plant succession stages in the area. It is an environment friendly method to restore soil fertility, stabilize sand dunes, and prevent further desert spreading. Phyto-reclamation is the process of ecological restoration of the degraded lands. It is emerging as low or no cost technique to reverse the process of desert spreading.This paper examines the causes of desert expansion in Southern Haryana, evaluates phyto-reclamation strategies, and discusses challenges associated with ecological restoration. The study highlights the importance of native drought-resistant species like Acacia, kair, Janti, grasses etc., agro forestry and community participation in restoring degraded landscapes. The paper also address the challenges faced in preventing the desert spreading.

Keywords: Phyto-reclamation, desertification, desert expansion, ecological restoration, agro-forestry, hardy, native Species.

Introduction

Desertification and desert spreading are two different terms. Desertification refers to the degradation of land in arid, semi-arid, and dry sub-humid regions caused by climatic variations and human activities while the desert expansion is the process of expanding the existing deserts in the adjoining areas due to

the activities of strong winds and deforestation. Desertification is one of the most significant environmental challenges facing semi-arid regions of India. Southern Haryana lies along the ecologically sensitive Aravalli landscape that serves as a natural barrier against the spreading of the Thar Desert. Historical studies have documented progressive land degradation and dune movement in the northeastern Aravalli region, indicating an increasing risk of desertification and desert spreading. The degradation of vegetation cover , illegal mining, urban expansion, and climate change have accelerated this process. Phyto-reclamation involves the reclamation of degraded land using vegetation capable of improving soil quality, stabilizing dunes, enhancing biodiversity and restoring ecological functions. In dry land ecosystems, phyto-reclamation is considered as one of the most cost-effective and environmentally sustainable restoration approaches.

Desert Spreading in Southern Haryana

Geographical Background of Southern Haryana

Southern Haryana forms part of the northern extension of the Aravalli range. These hills reduce wind velocity, trap sediments, support groundwater recharge, and prevent the eastward spread of desert conditions. Southern Haryana includes districts such as Gurugram, Nuh, Rewari, Mahendragarh, Charkhi Dadri, and parts of Bhiwani. The region lies in the transition zone between the fertile plains of northern Haryana where the underground water is not saline and the arid lands of Rajasthan where the underground waters are generally saline. It is dominated by undulating plains and low rise rocky hills. The ancient Aravalli Hill Range extends through parts of Gurugram, Nuh, Charkhi Dadri, some parts of Bhiwani and Mahendragarh. Sand dunes and sandy plains occur in western and south-western areas especially in Charkhi Dadri, Mahendergarh, Siwani and Bhiwani. The climate is semi-arid to arid, hot summers with temperatures often exceeding 45°C in months of May and June and scanty rainfalls. Winters are cool and temperature sometimes dropping below 5°C. Average annual rainfall ranges from about 300–600 mm, mostly received during the southwest monsoon (July–September) seasons. Sand storms are very common during May and early June. Due to sandy soils, evaporation rates are very high making soils highly deficit of water. Only deep rooted trees and shrubs are able to tolerate hot summers and drought conditions. Native trees are deforested at a very higher rate due to anthropogenic activities thus decreasing the total forest cover.

Difference between Desert Spreading and Desertification

The desertification is degradation of fertile land into desert-like conditions while the desert spreading refers to the expansion of an existing desert into nearby areas. Desertification results in loss of land productivity and vegetation while the desert spreading results in increase in the size of existing desert. Main causes of desertification are overgrazing, deforestation, poor farming practices, drought, and climate change while that of desert spreading are climate change, drought, high speed winds and loss of vegetation near desert boundaries. Desertification generally leads to desert spreading. When land around a desert becomes degraded/deserted and loses vegetation, it may eventually become part of the desert resulting in the desert expansion.

Review of Literature

Various studies has been done by botanists and geographer in the study area. Some the reviewed literature is as below

Raghav et al (1988) explained that land degradation in North-Eastern Part of the Aravalli zone is driven by a combination of natural geomorphic processes and human activities**,** leading to gradual transformation of semi-arid landscapes into more desert-like conditions.

Mishra et al (1994) concluded that the Aravalli region near the Thar Desert is undergoing measurable environmental degradation, characterized by loss of vegetation plus water bodies and expansion of barren/saline land, detectable effectively through remote sensing techniques.

Goel et al (2022) concluded that Asola Bhatti Wildlife Sanctuary represents a successful but ongoing ecological restoration project, where degraded mining land is being converted into a functioning semi-arid forest ecosystem through combined plantation, regeneration, and management strategies.

Dhanwantri et al (2023) investigated how human activities (anthropogenic drivers) affect the ecological resilience of the Tropical Dry Deciduous Forest (TDDF) ecosystem in the Aravalli region of Haryana and nearby urban–peri-urban zones. The study concludes that the Aravalli dry deciduous forest ecosystem is under continuous anthropogenic stress, and its long-term resilience depends on stronger environmental governance , controlled urban expansion , restoration-based management (including regeneration approaches) and integrated landscape planning.

Jinger et al. (2023) reviewed agroforestry-based rehabilitation of degraded lands in India and concluded that agroforestry systems offer significant potential for restoring soil health, reducing erosion, sequestering carbon, and enhancing livelihood security. The authors emphasized that agroforestry can play a critical role in reclaiming degraded arid and semi-arid landscapes, although adoption remains constrained by institutional, technical, and economic barriers.

Gupta et al (2024) concluded that halophyte-based agro-forestry is a practical, ecosystem-friendly strategy for restoring salt-affected soils while maintaining productivity and rural livelihoods**.**

Causes of Desert Spreading

1. Degradation of the Aravalli Ecosystem

The Aravalli hills have undergone extensive ecological degradation due to excessive cutting of trees and infrastructure expansion. Recent studies indicate accelerated soil degradation and loss of vegetation cover throughout the Aravalli Mountain System has resulted in exposure of upper soil surface prone to erosion. Mining activities in the area are also one of the major challenges of desert spreading.

2. Climate Change

Increasing temperatures, erratic rainfall, and prolonged drought periods reduce soil moisture and vegetation regeneration capacity, making ecosystems more vulnerable to desertification.

3. Overgrazing and Agricultural Pressure

Excessive grazing removes protective vegetation especially the small plants and exposes soil to erosion. Unsustainable agricultural practices further accelerate land degradation.As a result the desertification process is accelerated.

4. Groundwater Depletion

Due to excessive irrigation practices in the region and change in crops pattern has resulted in declining of groundwater levels which reduces the survival rate of native vegetation.Native vegetation act as an ecological support system.

5. **Cutting of Native Tree Species:**

Native tree species are well adjusted in climate of south west Haryana. They have deep root system with large canopy. They bind the soil, decrease wind speeds and thus prevent desert spreading.

6. High Speed Wind Erosion:

The region of South-west Haryana suffers from strong winds coming from adjoining deserts of Rajasthan. Strong winds remove topsoil, especially in dry regions with little or no plant cover. This creates conditions for desert spreading.

7. **Unsustainable land use**:
Human activities such as excessive mining, removal of Sand dunes for building of roads, urban expansion for industry and colonization, and poor farming methods can degrade the natural ecosystem rendering it prone to desert spreading.

Concept of Phyto-Reclamation

Phyto- reclamation is a branch of ecological restoration that uses plants to reclaim degraded lands by stabilizing soil and sand dunes, increasing organic matter content due to leaf fall, enhancing microbial activity, improving water retention and restoring biodiversity. As a result the process of desert spreading is slowed down.

Native vegetation acts as a biological barrier against desert expansion while improving ecosystem productivity. Phyto-reclamation is closely associated with phyto-remediation and ecological engineering approaches. Phyto-reclamation not only prevent desertification, it also prevent desert expansion.

Phyto-reclamation Strategies for Southern Haryana to Prevent desert Expansion

Plants play a major role in preventing **desert spreading (Expansion)** by stabilizing soil, reducing wind erosion due to high speed winds, conserving moisture, and improving soil fertility. Following phyto-reclamation strategies to reclaim the spreading deserts are as follows:

1. **Aforestation using native speciesand Grassland Restoration**

Restoration programs should prioritize indigenous drought-resistant species adapted to semi-arid climate of the study area. These species are well adapted in drought conditions and can tolerate high speed winds due to small compound leaves. Some of these native plant species are Khejri (*Prosopis cineraria*), Babool (*Acacia nilotica*), Desi Neem (*Azadirachta indica*), Ber (*Ziziphus mauritiana*), kair/Tint (Capparis deciduas), Akk (Calotropis procera) etc. Native grasses strongly bind the upper soil layer and prevent desertification and ultimately prevent the desert spreading. Recent Aravalli restoration initiatives recommend native species plantations to improve ecosystem resilience and biodiversity. Knowledge of plant succession is very important in restoration of natural ecosystem of the study area.

Khejri is a drought-resistant tree scientifically known as Prosopis cineraria and is commonly known as Golden tree of deserts. It is highly valued in the arid and semi-arid regions of south-western Haryana. It can survive in very dry conditions and extreme heat. Has deep roots that help it access underground water. It can effectively reduce soil erosion.It is of great economic and cultural value. It is commonly found in South Haryana, Rajasthan and Punjab. It is worshiped by many Hindu communities.

Babool is a thorny tree Botanically known as Acacia nilotica however, its currently accepted scientific name is *Vachellia nilotica*. It is medium sized tree with large crown. It is highly adapted to dry and semi-arid climates. It is commonly found in Haryana, Rajasthan, Punjab and Gujarat. It is of great ethno botanical value to the local people. It helps to control soil erosion thus preventing desert spreading.

Kair is a thorny desert shrub botanically known as Capparis decidua. It is commonly found in the arid and semi-arid regions of northwestern India, especially in the Thar Desert and many parts of the study area. It has green branches without leaves. Green stem branches perform photosynthesis. It effectively prevents desert expansion and is of great ethno botanical value.

Ber is a hardy fruit-bearing tree botanifically known as Ziziphus mauritiana. It is widely grown in arid and semi-arid regions of south Haryana. It is a small sized tree having deep roots. It can tolerate high temperature and plays significant role in preventing desert expansion and spreading. Its fruit are good source nutrition to birds and other animals.

Akk commonly called akta by common people of the study area is a hardy shrub botanically known as Calotropis procera. It is commonly found in arid, semi-arid, and wasteland areas in wild. It is a perennial shrub with thick, grey-green leaves. It is highly drought-resistant and grows well in poor soils.

2. **Agro forestry Systems**

Agro forestry combines trees with agricultural crops and livestock systems. Research demonstrates that agro forestry improves carbon sequestration, soil fertility, and drought resilience while providing economic benefits to farmers. Desertification is often driven by overgrazing, deforestation, poor irrigation practices and climate fluctuations. Agro-forestry helps to reverse these processes by planting hardy vegetation that can survive in arid conditions and gradually improve the microclimate of the soil. Agro-forestry helps reclaim deserts by Soil stabilization, increasing organic matter in the soil, improving microclimate of the soil. Trees are grown in lines along with the cultivated crops.

3. **Assisted Natural Regeneration**

Assisted Natural Regeneration (ANR) is a low-cost ecological restoration approach where you do not plant new trees and shrubs; instead you help the existing natural vegetation to recover by its own. Protection from grazing and anthropogenic disturbance allows natural vegetation recovery at lower costs than plantation-based restoration. Local communities can play significant role in eco restoration.

4. **Aravalli Restoration Initiatives**

The Aravalli reclamation initiatives refer to efforts to restore and protect the degraded parts of the Aravalli Range, especially in Haryana, Rajasthan, and around the National Capital Region. The Aravalli hills faced excessive mining, deforestation ,loss of biodiversity and expansion of desert conditions. The Government of Haryana has initiated large-scale Aravalli restoration programs targeting more than 37,000 hectares of degraded landscapes. These programs emphasize, native species plantation, rainwater conservation, removal of invasive species and community participation. Similarly, the Aravali Green Wall Project aims to restore ecological integrity and prevent desert expansion through landscape-scale restoration measures.

5. **Shelter belts:**

Shelter belts are rows of trees and shrubs planted in a straight line to protect land from strong winds and soil erosion. This is an important method used to prevent desert spreading especially in dry regions like southern-western Haryana. Trees are generally planted as social forestry concept along the canals, roads and borders of wetlands.

Challenges of Phyto-reclamation

Despite its high abilities to restore the degraded ecosystems , phyto-reclamation has several important challenges. Some of these are water scarcity, suppression of natural vegetation growth by invasive species, illegal sand mining, climate changes, slow process of recovery, limited number of suitable plant species and overgrazing are some of the challenges in preventing the expansion of deserts.

Conclusion

The spread of desertification in Southern Haryana poses significant ecological, economic, and social challenges. The degradation of the Aravalli ecosystem has threatened the region and decreased its capacity to resist desert expansion and maintain environmental stability. Phyto reclamation technique offers a significant tool and sustainable strategy for ecological restoration through native afforestation, grassland rehabilitation, agro-forestry. However, successful implementation requires addressing challenges related to water scarcity, invasive species, mining pressure, and governance. Special attention should be given in areas adjoining the already existing deserts. Rain water conservation practices should be promoted to reclaim the underground waters.Long-term ecosystem restoration in Southern Haryana will depend on integrating ecological science with community participation and policy support.

References

1. Raghav, K.S. (1988). "Desertification Process in the North-Eastern Part of the Aravalli Mountains Fringing the Thar Desert, India." Annals of Arid Zone,27(3–4). DOI: 10.56093/aaz.v27i3&4.64272.
2. Mishra, J.K., Joshi, M.D., & Devi, R. (1994). "Study of Desertification Process in Aravalli Environment Using Remote Sensing Techniques." International Journal of Remote Sensing,15(1), 87–94. DOI: 10.1080/01431169408954052.
3. Goel, V., & Rath, R. (2022). "Asola Bhatti Wildlife Sanctuary: A Case Study of Ecological Restoration." Vantage: Journal of Thematic Analysis, 3(2). DOI: 10.
4. Dinesh Jinger et al. (2023). Degraded land rehabilitation through agroforestry in India: Achievements and prospects. Frontiers in Ecology and Evolution. https://doi.org/10.3389/fevo.2023.108879652253/vjta.2022.v03i02.09.
5. Dhanwantri, K., Yadav, K.K., Dhote, M., & Rajendra, K. (2023). "Anthropogenic Determinants and Ecological Resilience of Aravalli: A Tropical Dry Deciduous Forest Ecosystem in India." Research Square Preprint. DOI: 10.21203/rs.3.rs-3344537/v1.
6. Gupta, S.R., Dagar, J.C., & Sharma, H.R. (2024). "Halophytes and Agroforestry in the Restoration of Salt-Affected Landscapes in Changed Environment." Journal of Soil Salinity and Water Quality, 16(2). DOI: 10.56093/jsswq.v16i2.156303.