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ECOSYSTEM APPROACH TO SUSTAINABLE MANAGEMENT OF DEGRADED LAND –with Special Reference to South Delhi

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Abstracts—*Land degradation is a global concern for sustainable development, conservation of biodiversity and mitigating and adapting to climate change. Nearly 30 per cent of India is degraded or facing desertification whereas 40-70% was reported in eight States encompassing Rajasthan, Delhi, Goa, Maharashtra, Jharkhand, Nagaland, Tripura and Himachal Pradesh. Ecosystem based approaches work with nature to provide solutions to environmental and development challenges which may include integrated water resource management (IWRM) and Forest Landscape Restoration (FLR). Delhi, the capital city spread over an area of 1483 square kilometre. It is located at the center of the Indian subcontinent, amidst the ranges of Himalaya and the Aravalli. South Delhi is situated on the rocky land with low water table and limited local flora eg. Acacia, Tamarind, Neem , Shisham, wild Baugainvillea etc. Location and flora needs to preserve the buffer zone through sustainable eco system through advance modern irrigation system.*

Keywords*: Ecosystem, Degraded Land, Sustainable Management, Topography*

1. INTRODUCTION

Located on the western fringes of the Gangetic Plains, the metropolis of Delhi is part of the National Capital Territory of Delhi, adjacent to the Punjab region. The greater sprawl of metropolitan Delhi consumes an area of 1,438 square kilometres, an expanse flanked by the rocky hills of the Aravalli Range and the Yamuna River. The Aravalli hills from Rajasthan enter Delhi on the southern border and extend into an elongated ridge of 5–6-km width along north to north-east and south to south-west. These are separated by flat lands and depressions filled with alluvial material. Neighboured by the territories of Uttar Pradesh and Haryana, Delhi is a largely dry zone, with significantly hot summers, transitioning into a monsoon season with the most of the city's annual rainfall recorded before winter begins. The common trees are babul (*Acacia nilotica*), Palas (*Butea monosperma*), Shisham (*Dalbergia sissoo*), Banyan (*Ficus bengalensis*); Pipal (*Ficus religiosa*); Ber (*Zizyphus jujuba*) and Neem (*Azadirachta indica*). North-western and southern parts of Delhi are found to have major problems of degraded and wastelands. About 19% of the TGA of Delhi is affected by water erosion. South-West Delhi is worst affected (11 thousand ha), followed by North-West Delhi (6 thousand ha), South Delhi (5 thousand ha) and North Delhi (3 thousand ha with minor salinity problems.

Increasing land degradation is a fundamental threat to agriculture as it reduced carbon storage in soil and vegetation and drive the loss of biodiversity and climate change. land degradation is defined as a reduction in actual or potential uses of land Nearly 30 per cent of India is degraded or facing desertification whereas 40-70% was reported in eight States encompassing Rajasthan, Delhi, Goa, Maharashtra, Jharkhand, Nagaland, Tripura and Himachal Pradesh. Ecosystem based approaches work with nature to provide solutions to environmental and development challenges. South Delhi is situated on the rocky land with low water table and limited local flora eg. Acacia, Tamarind, Neem, Shisham, wild Baugainvillea etc. Location and flora needs to preserve the buffer zone through sustainable eco system through advance modern irrigation system. There is wide array of problems faced by urban centers urging the need for creating efficient sustainable plans to overcome the challenges.

2. CHALLENGES

2.1 Poor Water Table

Water Table falls by 1.7 to 2 metres per year in areas of South and South-West Delhi. Aquifiers in Tughlaqabad and Pushp Vihar where water is extracted to as deep as 80m turns critical and it is alarming that in many of these areas, the water table continues to deplete rapidly and the government hasn't taken any substantial step to reverse the trend. Central Ground Water Board (CGWB) also reported over

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extraction led dropping of water table by 7 metres in Satbari village in the past five years, by 5m in Gadaipur, 3m in Asola and Sultanpur and 2m in Bhatti. Water tables in urban areas are declining because of the reduction in recharge areas as a result of the construction of roads, buildings and pavements. The quality of water is deteriorating due to the mixing of sewerage water through unlined open drains, leakage from cesspits and septic drainage tanks, and contamination from industrial waste.

2.2 Erodic rocky land / Harsh climate

This area has hard pan with rocky land and extremes of weather during summer and winter become bottleneck for survival of natural flora of this region.

2.3 Hard Pan

Formation of an impervious pan forms a barrier difficult to penetrate by both water and roots leading to poor plant growth. Hardpans near the surface reduce the usable soil depth and enhance the tendency of soil to waterlog in heavy rains and fall below the permanent wilting percentage under drought conditions. Limiting root growth to surface layers also influences nutrient access.

2.4 Problems of Water Supply

Delhi receives its water from 3 sources viz., Surface Water: 86% of Delhi's total water supply comes from surface water, namely the Yamuna River, which equals 4.6% of this resource through interstate agreements, Sub-surface water: Rainey wells and tube wells. This source, which is met through rainfall (approx. 611.8 mm in 27 rainy days), and unutilized rainwater runoff, is 193 MCM (million cubic meters). There is water wastage and loss while transportation from other states in canals which use the river Yamuna as the source. Loss of water in transmission and distribution, unauthorized use of water and unmetered water supply has contributed towards water shortage in the area. Covering soil prevents water peculation to these underground reservoirs in the city. Poor water treatment and dependence on secondary sources for water, lack of a proper pricing system for water which would prompt a judicious use of the resource calls for immediate attention.

3. CRITICAL ISSUES

3.1 Preserving flora and fauna

Major focus should be given to preserve natural flora and fauna to maintain ecosystem.

3.2 Maintenance of forest ecosystem health and vitality

The maintenance of forest health and vitality is dependent upon the ability of the ecosystem's functions and processes to recover from or adapt to disturbances. While many disturbance and stress events are natural components of forest ecosystems, some may overwhelm ecosystem functions, fundamentally altering their patterns and processes and reducing ecological function. Decline in forest ecosystem health and vitality may have significant economic and ecological consequences for society including a loss of forest benefits and the degradation of environmental quality.

3.3 To sustain endangered plant species

About 60,000 out of 2,87,655 species of plants known in the world are facing the threat of extinction. Australian Kiker (*Acacia*), *Butea monospermum*, Shisham etc. were in danger of extinction. The Botanic Gardens (BG) and other plants conservation centres in the world thus play a very crucial role as centres for rescue, recovery and rehabilitation of rare, endangered and extinct prone species of plants and other valuable plant genetic resources. The BGs also play important role in education and as a centre of training in areas such as horticulture, gardening, landscaping, ex-situ conservation and environmental awareness. For populations of individual rare or threatened species, particular management prescriptions may be necessary.

4. STRATEGIES

4.1 Preservation of Native Plant Species

Existing plant species should be preserved by preventing cutting of trees. Delhi Preservation of Trees Act, 1994 was passed in order to save the trees planted in the National Capital of India from getting depleted due to human activities. The act aimed at keeping a check on cutting of trees by the owners of the trees on their land. The act gave birth to Tree Authority in the National Capital region of India for the preservation of trees.

4.2 Avoid Urbanisation and rapid destruction of eco system

Due to rapid urbanisation, the green area is diminishing everyday. Reserve forest and green pockets in the heart of the city should be preserved to save the environment.

4.3 Plant native species

When water has become scarce and bought at high cost in urban areas and developing low-water-use garden utilising aesthetically appealing, and drought-tolerant native plants is the best measure to conserve water. Many native shrubs and trees produce showy flowers and brilliant foliage and some of the deciduous species if planted in gardens may turn evergreen due to lesser competition and more care when compared to their natural dry habitat. Native plants can be easily propagated through seeds and are hardier and live longer. Hence careful selection of hardy native plants which can withstand the vagaries of urban environment is needed for various situations and locations like polluted areas, rocky and shallow soil conditions, and shaded places. *E.g., Cassia fistula* (Amaltas), *Nyctanthes arbor-tristis* (harshingar), *Neolamarckia cadamba* (kadamb/kadam), *Acacia*

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auriculiformis, (Earpod Wattle), *Morus alba, Plumeria obtusa , Prosopis Juliflora etc*

4.4 Drip irrigation system

Drip irrigation eliminates the changes of runoff and leaching and at the same time delivers the appropriate amount of water to the plant part where it is actually required. It is the controlled application of water and fertilizer to the root zone of the plant through a network of valves, pipes, tubing and emitters. This will help in water conservation by reducing evaporation and deep drainage as water is precisely applied to the plant roots.

4.5 Broad casting of seeds in ridge area during monsoon

This also help to create natural ecosystem in the difficult area like JNU campus, Sanjay Van, Army Cantonment area, Bhatti mines and Aravali Hills**.**

4.6 Promote hardy plants/crop/grass species tolerant to drought and salinity

There is a need is to regulating the use of fertilizers and promote species which are prone to drought and salinity should be selected. Moderately salt tolerant fruits are fig, pomegranate, guava etc. (Singh *et. al.,* 1994). Grasses for soil conservation are Dallis grass *(Paspalum dilatatum*), Dropping wheat grass, *(Agrophyron semi-costatum),* Large canary grass *(Phalaris tuberosa),* Napier grass, *(Penisetum purpureum) etc.* Grasses, legumes, shrubs and trees should be established and maintained. If cutting and grazing are prohibited, the land may slowly recover on its own and may eventually even become productive. The selection of species for special purposes is based on the urgency of the need, priorities and the condition of the soil. The also should be able to accumulate nutrients, change the structure of soil and toxicity levels. On some types of soil, the conditions are so harsh that only hardy, quick-growing and suitable species have to be chosen for immediate success and to create conditions for succession.

4.7 Group plantation, climbers, shrubs and tree climbing varieties

Plant specific group plantation will help to preserve the ecosystem. Many climbers like Baugainvillea can be promoted to sustain green and colourful surroundings in the campus.

4.8 Amendments

Good Earth with micorrhiza can be imported in rocky area to sustain new plantation

4.9 Grow more plant to save the environment –

Awareness should be made among the public. Free saplings were distributed during monsoon by Delhi Parks and Garden Society, Environment Department, Resident Welfare Association etc.. Species of plants should be such that the demand for inputs is the least and attention needed is negligible. They should have deep and large root system and preferably be hardy, fast-growing and suckering. The trees should be coppicing, pollarding, and encouraging the growth of grasses and weeds under their canopy, besides being economically useful. Such species help in reconstructing the lost topsoil and bring the much needed rest and respite to the soil from the forces of erosion. Once the seedlings start rooting, the land becomes more and more hospitable and becomes porous, absorbs water and retains it. This encourages better and greater growth and over the years it is easier to establish vegetation, leading to dramatic changes. When mulch is present, the topsoil forms, and the microflora, insects, birds and animals return, leading to an improved ecological balance. Such situation defmitely improves underground aquifers, and dried-up springs may reappear. When more tolerant species are planted on degraded soils, they create better conditions in due course of time for less-tolerant species to adapt to alkaline, saline, waterlogged or sandy soils. Bamboo, Cassia, Tamarind, Delonyx, Papdi (Karanj), Jacaranda etc should be promoted in the area of habitate

4.10 Participatory programme of students

NSS and Participatory programme of students for rapid plantation in rainy season in JNU. Basic information should be given in institution to create interests among the students

4.11 Watershed Management

Develop water bodies through water harvesting and collection of run off water. Water can be recycled for use in irrigation. Proper watershed management is needed to keep soil erosion at check. Roots of plants/trees act as tiny dams to help water storage and percolation in soil and binds soil to check erosion.

4.12 Pitcher System

Pitcher irrigation entails burying an unglazed, porous clay pot next to a seedling. Water poured into pot seeps slowly into the soil, feeding the seedling's roots with a steady supply of moisture. The 'pitcher' system saves water up to 98 per cent as compared to flood basin irrigation system.

4.13 Develop Eco-Tourism

Ecotourism,focused on the enhancement or maintenance of natural systems through tourism. Ecotourism itself is meant to be a sustainable form of natural resource-based tourism.It aims to manage tourism and conservation of nature in a way so as to maintain a fine balance between the requirements of tourism and ecology on the one hand and needs of the local communities on the other. Ecotourism offers benefits for local residents, conservation, development and educationalexperiences. Ecotourism is a sustainable form of natural resource-based tourism. It focuses primarily on experiencing and learning about nature, its landscape, flora, fauna and their habitats, as well as cultural artefacts from the locality (Dowling,1997; Fennell, 1999).Emphasis should be given on local and exotic species could along with water

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channels and other water bodies. Ecotourism destinations are always environmentally sensitive because ecotourism activities directly involve various environmental phenomena including bird watching, trekking, mountaineering, horse riding and elephant riding within the forest wilderness trail, staying in natural caves, studying about flora and fauna, simple bush walking, fishing, animal behavior study, ecological studies (Rahman,2010).

4.14 Hydrogel

The gel, Pusa Hydrogel, a semi-synthetic super absorbent polymer, has been developed by the Indian Agriculture Research Institute (IARI). It is mixed with the soil on which the seeds are sown. The gel then absorbs water and expands to 300 times its original size. It sticks to the roots of the plants and when the soil moisture falls as the temperature rises, the gel sheds water to nourish the crop.

5. CONCLUSION

Improvements in sustainable land use and development impinge on the interests of all stakeholders—both individuals and groups. Therefore, a multi-level stakeholder approach for the planning process is essential to obtain socially balanced results in which the economic and ecological objectives are both given due weightage. All stakeholders such as farmers/conservationists, owners/ tenants, individuals/communities as well as administrators, planners, governments, etc. should participate in problem analysis, express and evaluate their needs, interests and aims, and then negotiate options and priorities for action.

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