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Wastelands Rehabilitation and Management in India

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Abstract **-- India's total land area is around 329 million hectares. Of this, the government classifies 90 million hectares as "wasteland" i.e. non-productive land. Wasteland is a degraded land that can be brought under vegetative cover with reasonable effort and that is currently under utilized and land that is deteriorating for lack of appropriate water and soil management or on account of natural causes.Wastelands are the degraded and unutilized lands except current fallows due to different constraints. The wastelands formed due to anthropogenic activities are of particular concern as the decreasing productive land area decreases the agricultural and vegetative productivity. India has only 2.4 per cent of the worlds' geographical area but supports over 16 per cent of the world's population. Local people should be involved and decentralised farmer's nursery should be promoted, thus generating employment to the locals in the forestation programmes. There is a felt need for a policy shift from the colonial categorization of landscapes to one that values land intrinsically, and does not see it purely from a "taxable revenue generator" prism. It all goes back to a name. The rich diversity of the Indian landscape deserves better than the pejorative tag of "wasteland".**

Keywords-- **Waste Lands, Causes, Consequences, Reclamation and Management**

I. INTRODUCTION

Land is the most precious resource on this planet earth that supports life. Land is the natural home for most of species of plants, animals, microbes etc. The primary sources of food for the lives on land come from the plants growing naturally of specifically grown for the purpose. With advancement humans and technology, domestication of plants in the form of agriculture started. The agriculture products now provide the raw materials for most of the human needs. The land available on the earth is not uniform and differs geologically, geographically, environmentally, climatically etc. The different land masses on the different parts of the earth have been created through different geological processes and differ in their physical, chemical, geological composition etc. Depending on the soil composition, fertility, availability of water, climatic and edaphic conditions, specific adaptations, different land forms support different type of vegetation.

The Indian Space Research Organization produced, at the expense of considerable resources, a Wasteland Atlas of the country that classified such land in various categories: waterlogged areas and marshes, mountains under permanent snow, savanna grasslands and pasture lands, deserts, sand dunes, rocky outcrops and plateaus. One of the recent initiatives by the Government of India is the Green India Mission. The aim is to fight climate change by increasing the forest cover of India by 5 million hectares. And then there is Compensatory Afforestation Programme and Management Authority (CAMPA). For any land that is given out for mining in India, an equivalent amount of land area has to be afforested (Forest Research Institute, 1988)

However, all the land forms do not naturally support vegetation or life (productive) due to climatic and edaphic conditions. But many landforms which were naturally productive have become unproductive owing to various anthropogenic activities. The barren lands whether natural or anthropogenic in general are called wastelands. Such unproductive land or wastelands formed due to anthropogenic activities are of prime concern as the decreasing productive land area decreases the agricultural and vegetative productivity. Moreover, the ever increasing human population explosion adds woes to their survival owing to decrease in productive land forms. Thus, it is the need of the hour for managing as well as reclaiming the wastelands to productive land forms. The present paper appraises the definition of wastelands, their types, causes of formation and methods of their reclamation (Mazzucato, M. and Niemeijer, D., 2001).

Nature is our friend and thus there is a dire necessity of conserving and preserving it at its best. All major steps to prevent the nature from getting destroyed or damaged have to be taken. As humans, it is the primary duty to save nature and take preventive steps. There are several steps initiated for management of wastage, rather it has been garbage or it has been soil. There are new techniques invented for reusing the things and make the environment cleaner. With rapid urbanization, countries are facing a massive problem of wasteland management. There are major steps taken by the government and the people to increase awareness about wasteland management.

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The soil is one of the precious and natural wealth of any country. It takes thousands of years to produce a rich soil that is most essential for environment. Nature usually takes a lot of time for producing the things at its best. With primary concern and human urge, it is quite essential for saving the land from it being wasted for the betterment of our future. The soil is the primary source of many primary things either directly or indirectly and needs to conserve to satisfy needs for food, fuel, and other things.

II. Wasteland – Indian Scenario

India is a country having wide variation in geography, geology and climatology from North-south and East –West. On extreme north are located snow mountainous deserts with cold climate while southern region is dominated by oceans and maritime climate. On the east side are dry deserts and the west side is covered by the Himalayan hills. Hence, the lands in India have also very wide variety. India has only 2.4 per cent of the worlds' geographical area but supports over 16 per cent of the world's population. Further, India has only 0.5 per cent of the worlds grazing lands but supports over 18 per cent of world's cattle population. This tremendous pressure on land due to ever increasing human and domesticated animal population has led to conversion of productive lands into wastelands.

Deserts, ravines, snow-clad areas and uncultivable land are among the wastelands which abound across the Indian states (Toulmin, 1993 and 1995). Different agencies have made different assessments regarding wastelands in India. The difference is mainly due to use of different methodologies for estimation, changes with time period, use of different wasteland classification systems etc. India has 329 M.Ha of the geographic area where 167 M.Ha is polluted with different kinds of degradation, water erosion, wind erosion, salinity and alkalinity, and flooding. Owing to many misuses and deforestation, we have been degraded every year with 2.1 M.Ha land. With an increasing population, there is a need for land which is suitable for cultivation. Hence there is a need for understanding the concept of Wasteland Management and ways to prevent it.

III. Causes Of Wasteland

Wasteland is caused due to many factors. Areas which are damaged by water logging, ravine, gully erosion, riverine lands, salinity, and alkalinity, shifting and sand dunes, wind erosion, extreme moisture deficiency, overexploitation or natural resource, a dump of industrial and sewage wastes, soil erosion, deforestation are some of the causes of wasteland.

Water, wind, man and other source are causing agents for wasteland. There are two factors of wasteland – utilisable waste land and unutilizable waste land. Utilisable wastelands include marshy lands, saline lands, and undulating lands. Rocky land, Glacier Land and Deserts are part of unutilizable wasteland.

Causes of Wasteland Formation

- Deforestation
- Over-cultivation
- Over grazing
- Unskilled irrigation
- Improper developmental activities such as dumping of wastes, mine wastes

IV. Classification Of Wetlands

Wastelands are the degraded and unutilized lands except current fallows due to different constraints. Poor land practices have led to malnutrition and decline in production capacity of the soil. It is estimated that in wastelands the biomass production is less than 20% of its overall potential. It includes areas affected by water logging, ravine, sheet and gully erosion, riverine lands, shifting cultivation, salinity and alkalinity, shifting and sand dunes, wind erosion, extreme moisture deficiency, coastal sand dunes etc. These degraded lands are ecologically unstable with almost complete loss of top soil and are unsuitable for cultivation due to decline in their quality and productivity. These can be categorized as:

i. Non-forest public degraded lands

These are not lawfully defined as forest or which have not been legally included in government records. These are registered by different names in the revenue records. Ownership of these lands is vested with the government, such as revenue department, public works department, Railways etc. These lands may be under the control of the village panchayat and are meant for common use and no individual can occupy them for private use through encroachment (Agarwal, A. and Narain S., 1990).

ii. Degraded forestlands

These are legally constituted as forest and include reserved, protected or undefined forest. These are either completely devoid of trees and/or other vegetation, or contain trees in very low densities, or are simply shrubs.

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iii. Private degraded lands

These are private marginal agricultural lands on which economic agriculture is not possible as productivity does not commensurate with labour employed. These lands may be subjected to heavy erosion and the soil is infertile. Due to lack of irrigation or unfavourable climate, some lands are not cultivated and are categorized as either culturable or unculturable wastelands. Culturable wastelands include gullied and/or ravenous land, undulating upland, surface waterlogged land and marsh, salt affected land, shifting cultivation area, degraded forest area, degraded non-forest plantation, sandy area, mining and industrial wasteland, and pasture and grazing lands. Compared to this, unculturable wastelands include barren, rocky, stony wastes, sheet rock area, steep sloping area and snow covered and/ or glacial area.

V. Rehabilitation Of Degraded Lands

Around 6,000 million tonnes of fertile soil containing 5 million tonnes of NPK nutrients are displaced each year**.** Some of the degraded lands in the catchment of major irrigation reservoirs (Cauvery, Krishna etc.) and hydro electric reservoirs (Uttara Kannada, Shimoga districts) are causing rapid sedimentation. Studies in Sharavathi river basin reveal the existence of streams with perennial water supply in watersheds with good vegetation of evergreen to semi-evergreen species, while degraded lands on the eastern side of the river basin are with seasonal streams ***(***http://ces.iisc.ernet.in/energy***).*** The outcome of these analyses highlights the need to maintain vegetation of native species in order to ensure perennial water supply in streams and to meet the bio-resource demand. The rehabilitation of degraded lands through the management of soil and vegetation would minimise siltation and enhance the water yield in the catchment. It depends on soil capability, climatic conditions, plant species, infrastructure, and local policies etc.

Species selection is based on local conditions, survival, adaptability and productivity. Thus, genetic quality of native species to withstand adverse environment becomes important for the growth and adaptability to soils with different depth and water retention capacities. The plant establishment primarily depends upon the development of good root system. The inherent characteristics of a species to propagate or regenerate itself vegetatively such as, by root suckers, when damaged, are also important for survival. The basic parameters for selection of species for wasteland adaptability can be:

- Survival at nursery and transplantation level on site.
- High establishment rate
- Good root and growth system.
- High reproductive fertility.
- Enhancement of soil nutrient status.
- Good regeneration.
- Recovery from damage through vegetative propagation or seed.
- Meet the local requirement of fuel, food and fodder.

The decisive factors in species selection for degraded land rehabilitation are:

- Site-specific local species.
- Silvicultural characteristics of the species.
- Utilization potential of species.
- Exotic species should be avoided as far as possible and be considered only when the indigenous species are unable to thrive in a degraded ecosystem.
- Afforestation should involve a multi-species approach. This would be more advantageous from the point of resistance to pest and diseases, and more efficient utilization of environmental resource. This can also serve as a better cover to the soil (Khan,1987),

Wasteland Reclamation

It is the process of turning barren, sterile land into fertile land suitable for agriculture or vegetation and cultivation. Reclamation means recovering physical structure of land to rebuild the ecosystem. These lands can be reclaimed by three methods:

i. Topography and Soil Management
ii. Water Management
iii. Crop Management

Soil Management: The soil management can be done with following:

- *Filling of Gullies and Leveling:* This can be done by filling stones in gullies, followed by compacting after placing soil over it. The leveling of land should be done to reduce water erosion. Further changing course of water or small check dams are also useful for the purpose. Planting grasses and bushes along the water course also help to stop soil erosion.

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- *Terracing:* In this the earth is shaped in the form of small leveled terraces to hold soil and water. The terraces are given inward slope to increase infiltration of water. The banks of terraces are made firm and compact by placing stones and planting grasses over the sides.
- *Scraping:* This technique is used for soils covered with 2-3 cm thick layer of salts over it. This layer can be removed by scraping using spade. This is possible only at small scale and may not be possible at large scale.
- *Flushing:* It is used for lands where water soluble salts accumulate over land surface due to evaporation of water. To remove these salts, the area is first filled with water and allowed to remain there for few days. The water is checked for its conductivity so as to find that how much salts are dissolved. The water is then flushed off. Water should not be made to stand for long as salts can leach down to the sub soil.
- *Deep Ploughing:* Fallow lands i.e. *land* that is normally used for farming but that is left with no crops for long time become hard due to trampling by animals, settling of soil particles and lack of vegetation. To recover such lands, ploughing should be done deep so that soil is opened to absorb moisture from rain. This also removes weeds, stones and pebbles etc.
- *Drainage:* Waterlogged soils are improved by this method. There are 2 types of drainage systems, Sub-surface drainage and Underground drainage.
- *Addition of Green Manure and Soil Amendments:* The method is used to reclaim the soils low in organic matter, nutrients and alkaline or acidic in nature. In this method legume crops or nitrogen fixing plants are cropped on the land and ploughed down in the soil when they are soft and without flowers. They fix atmospheric nitrogen and add organic matter to soil. The chemicals like calcium carbonate, gypsum, fly ash and farm yard manure are added to the soil to increase the nutrient level and lime is added to reduce the soil acidity.
- *Wind Breaks:* The method is used in areas having loose dry sandy soil and high intensity of speedy winds leading to movement of soil with wind. To reduce soil erosion due to high speed wind, row of fast growing trees are plated on boundaries of wastelands and banks of water courses. The trees species commonly used as wind breaks are Poplar, Neem, Shesham Bamboo and fruit trees like, Ber, Jamun Mango. .
- *Silt Trapping Dams:* When the water flowing from uplands cause soil erosion and siltation, to check the movement of eroded soil, big or small dams of reasonable height can be constructed against the course of water flow. Water is made to stand near these traps for a while and silt particles settle down thus reducing soil erosion.
- *Contour Furrowing and Bunding:* The method is adopted for sloppy wasteland. The contours or furrows are made to allow water to remain in contour or to move at a slow speed and hence reduce soil erosion by water. This increases Infiltration of water leading to water conservation.
- *Mulching:* It is used to conserve soil moisture during droughts and when there are no rains. Mulches of dry grass, polythene, chemical mulch etc. are used to cover the soil surface. Mulching also check soil erosion and suppresses emergence of weeds.

ii) Water Management: Consists of three options:

- Addition of water-Irrigation
- Conservation of water- Protection
- Removal of excess of water- Drainage

Addition of water-Irrigation

The addition of water to agriculture of vegetation is called irrigation. Irrigation or soil moisture is most important to provide water to the plants and maintain land productivity. Various methods are used for irrigation depending on the soil type, crop/vegetation type, water availability etc. Mainly following techniques are used for irrigation. Furrow or channel- Used where land is leveled and water is in plenty.

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- *Flooding*-Water is allowed to flow over the field. It is used where water is in plenty.
- *Sprinkler* – Used where less but frequent water is required. It is very useful as no soil erosion, no loss of nutrients and water saving.
- *Ring or basin method*-Used for irrigating fruit and other trees, individual tree is given water at a time. No loss of nutrients, no soil erosion but time consuming and laborious method.
- *Drip irrigation/Trickle irrigation method*- This is relatively modern irrigation technology. In this, water is made to trickle down near root zone. Trickling of water drops is slow, underground and continues. There is no run-off of water, evaporation loss, no leaching down of water.
- *Conservation of soil Moisture:* **It** includes all the policies, strategies and activities to sustainably manage and conserve the soil moisture. It can be conserved by already discussed methods of terracing, mulching, wind barriers, silt trapping dams etc. Some other methods used for the purpose are:
- *Graded bunds*– These are simple earthen embankments constructed across the slope/ contour of the area are called contour bunds. When these are constructed at pre-determined longitudinal grade, they are known as ***graded bunds***. These are constructed where rainfall is more than 600 mm per year. The run-off from upper bund is retained in the lower bund and again the surplus water passed on to the next bund and in this way water is conserved in the soil.
- *Water Storage in Ditch* – During rainy season, water is collected in ditches made at regular intervals depending upon soil type and amount of water to be handled. The water stored in ditches and can be used during water scarcity. Evaporation losses are overcome by covering the top of ditches.
- *Drainage:* This is the method of removal of excess of water from soil/sub soil. The most common method used is pumping out the water with mechanical methods. On sloppy lands channels are laid down and water flows down by gravity.
- *Crop Management:* Growing suitable crops and their management is another approach to reclaim wasteland**.** Those crops selected for wastelands should have characteristics like drought tolerant, minimum rate of transpiration, less nutrient requirement etc. Growing leguminous crops and ploughing them young in the soil. Multiple cropping, mixed cropping and crop rotation is done.
- *Aonla and Jatropha Plantations:* The Aonla commonly called Amla is a minor sub-tropical deciduous tree. It can withstand drought conditions and can grow in neglected regions owing to its hardy nature. The fruit of the tree is in high demand due to its nutritional values. Similarly, another plant preferred to reclaim waste lands is Jatropha. It can grow on degraded soil and can resist drought conditions. The Seeds have high oil content which can be used for bio diesel production.
- *Fuel Wood Plantations on Wastelands:* The land which cannot use for agricultural purposes can be planted with fast growing species of trees having rotation cycle of 4-7 years .It can provide fuel wood and fodder for cattle. Hence, it reduces excessive pressure on pasture lands.

VI. Waste Land Management

In simple terms Waste Land Management refers to land that is not used due to any obstruction is considered as Waste Land. Land that can either be cultivable or non-cultivable falls under this category of wasteland. Managing these lands for proper use or re-use it for different purposes is known as wasteland management. With the upcoming technology and advanced procedures, we can contribute towards utilizing the land to its full potential. There are many factors that are responsible along with technology like climate, topography and soil properties that make it suitable for land to be used or reused. It is estimated that the biomass production in the wasteland is below 20% due to which it is not considered suitable for use. If a land does not yield anything even if rectified properly is a wasteland. A land that does not serve any purpose for cultivation falls under this category (Roy, A. K. and Verma, SK., 2001).

Management of wasteland includes the appropriate method of reclamation that should be adopted.

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- ❖ It is necessary that new strategies should be accepted which include voluntary of people along with government officials.
- ❖ Additional strategies should be initiated for increasing agricultural productivity and improving the condition of wastelands by planting more trees.
- ❖ Each district or state should be aware of technological causes supporting wasteland and various reclamation measures should be taught.
- ❖ There should be a programme started for the greening of wastelands which carries advanced methods for reclamation (reusing) of wastelands along with the structure of planting high-quality seeds.
- ❖ Farmers should be encouraged to adopt different ways and techniques to improve wasteland by growing crops of contour ploughing.

Mode of Improving Wasteland

- Afforestation on large scale helps to maintain the richness of the soil.
- Soil lacks moisture, so deep irrigation can be made for conserving it.
- Control the water of a river.
- Prohibit grazing or overgrazing.
- Conserving of soil and water by a method of ploughing.
- Reforestation can be done where the lands were destroyed due to fires, overgrazing and excessive cutting.
- To prevent the soil erosion, it is better to leave crop residue.
- Running water down the hill erodes and carries the soil with it. It can be reduced by Strip Farming, Terracing, contour ploughing.
- To avoid the salinity on affected land, the leaching with more water can be done.
- Crop rotation and cropping of different plants can be done to improve the fertility of the soil.
- Redevelopment of the ecosystem also helps in reclaiming the minerals back to the wasteland.

Beyond prevention and causes, it is important for planning the management of wasteland.

VII. Conclusion

Wastelands are the degraded and unutilized lands except current fallows due to different constraints. The paper highlights the need for an integrated ecosystem approach in wasteland management considering all components to maintain sustainability. This would help in combating desertification. Rehabilitation of the degraded land through the sustainable management of soil and vegetation would - minimise siltation and enhance the water yield in the catchment. Multispecies approach with native species in afforestation would be more advantageous from the point of resistance to pest and diseases, meeting the local demand, perennial water source and more efficient utilization of environmental resource. This serves as a better cover to the soil and aids in regeneration of soil. Due to large number of anthropogenic and natural activities, the land degradation has increased. In order to support the ever increasing population of humans and domesticated animals, there is utmost need to reclaim the waste lands. Programmes are run to reclaim the wasteland to show positive results. The mapping of wastelands after regular intervals is dire necessary and immensely important to keep an eye on their status.

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