Lec.13 WASTELAND DEVELOPMENT

Definition (NRSA)

Wasteland is that land which is presently lying unused or which is not being used to its optimum potential due to some constraints.

Classification

National wastelands development board classifies wastelands into two categories:

1. Cultivable wastelands
2. Uncultivable wastelands

The cultivable wastelands have been classified into

a. Gullied and/or ravenous lands
b. Undulating land without shrubs
c. Surface waterlogging land and marsh
d. Salt affected land
e. Shifting cultivation area
f. Degraded forestland
g. Degraded pasture / grazing land
h. Degraded forest plantations
i. Strip lands
j. Sand dunes
k. Mining / industrial wastelands

Uncultivable wastelands which cannot be used for vegetation are classified as

a) Brown rocky / stony / shut of rocks
b) Steep sloppy areas
c) Snow covered and / or glacier lands

Extent of Wastelands

NRSA estimates put wastelands at 16.21% of the total land area of the country. Of this, 16.74% is culturable and rest 4.47% is unculturable. The wastelands are found maximum in Jammu and Kashmir 60.10%.

Total wastelands in India: 129.57mha

Category-wise wastelands of India

Category	Area (sq km)	% of total geographical area covered
Gullied and/ or ravinous land	20553.35	0.65
Land with or without scrub	194014.29	6.13
Waterlogged and marshy land	16568.45	0.52
Land affected by salinity/alkalinity-coastal/inland	20477.38	0.65
Shifting cultivation area	35142.20	1.11
Under-utilized/degraded notified forest land	140652.31	4.44
Degraded pastures/grazing land	25978.91	0.82
Degraded land under plantation crop	5828.09	0.18
Sands-Inland/coastal	50021.65	1.58
Mining/industrial wasteland	1252.13	0.04
Barren rocky/stony waste/sheet rock area	64584.77	2.04
Steep sloping area	7656.29	0.24
Snow covered and/or glacial area	55788.49	1.76
Total wasteland area	638518.31	20.17

Causes of Wasteland Formation

a) Deforestation
b) Over-cultivation
c) Over grazing
d) Unskilled irrigation
e) Improper developmental activities such as dumping of wastes, mine wastes

Choice of Species and Planting Technique for Problem Soils

More than timber of land in our country is affected by varying degrees of salinity and alkalinity and it is further estimated that fertile lands are fast becoming problematic at the rate of 10,000 ha/year. In Tamil Nadu alone 0.04 lakhs Ha of land is affected by saline and alkaline condition.

a) Saline Soil

Saline soils have high content of soluble salt usually more than 0.2%, impossible for the plant to absorb water from saline soils. The soil pH value is generally between 7.3 and 8.5.

b) Non-Saline Alkaline Soils

They are also called as sodic soils. They have more than 15% of their iron exchange sites occupied by Na^+ ions. They do not contain any appreciable quantities of soluble salts. PA ranges from 8.5 – 10.0.

Suitable Species

Prosopis juliflora	*Tamarix articulata*
Prosopis spiagere	*Tamarix aphylla*
Acacia nilotica	*Casuarina equisetifolia*
Butea monosperma	**Leucaena leucocephala**
Azadirachta indica	*Eucalyptus* hybrid
Melia azadirach	*Pongamia pinnata*

c) Alkali Soils

These soils have sufficient exchangeable sodium to interface with the growth of crops with or without appreciable quantities of soluble salts, mostly associated with ‘kankar pan’ in sub soil.

Choice of Species

The selected species should be able to produce prolific root system and be able to resist salt content and through well under condition of arid climate with low moisture. The species should be drought resistant.

Soil working in these soils should aim at maximum retentivity and utilization of moisture in all times and reduction of salt content in the active root zone. The tolerance of a species to high percentage of absorbed Na is modified by pH of the soil the accumulation of $CaCO_3$.

d) Laterite and Lateritic Soils

These soils are dominated by complete minerals and are dominated by hydrous oxides of Fe and Al. The humus is absent and it is also poor in N, P, K, Ca and other nutrients.

Afforestation of these lands require soil and moisture conservation techniques besides application of fertilizers and selection of suitable species.

About 12 m ha of area in eastern, central and southern states of India are covered by laterite of lateritic soils. They occupy high ridges and plains in the high and low rainfall areas. The annual rainfall varies from 750 – 3750 mm.

Suitable Trees for Lateritic Areas

Acacia auriculiformis *Albizia lebbeck*
Bambusa arundinacia *Holoptelia integrifolia*
Pterocarpus marsupium *Dendrocalamus strictus*
Madhuca longifolia *Shorea robusta*
Dalbergia latifolia

Dry areas	**Sandy soils**	**High altitude areas**
Acacia tortilis	*Acacia auriculiformis*	*Acacia mearnsii*
Eucalyptus camaldulensis	*Anocardium occidentalis*	*Ailanthus excelsa*
Leucaena leucocephala	*Dalbergia sissoo*	*Rohinia pseudoceae*
Prosopis juliflora	*Dendrocalamus strictus*	*Grevillea robusta*
Zizyphus maurtiana		
Acid soils	**Marshy soils**	**Alkaline soils**

Albizia procera	*Acacia auriculiformis*	*Acacia nilotica*
Derris indica	*Bambusa* spp.	*Acacia tortilis*
Glyricidia sepium	*Terminalia arjuna*	*Ailanthus excelsa*
Gmelina arborea	*Thespesia populnea*	*Prosopis juliflora*
Tamarindus indica		

Afforestation for Sand Dune Stabilization

The English word 'Dun' means, hilly topographical feature. The send dunes are formed by wind. Movement of sand and deposition is most important reason for degradation of otherwise productive lands. As much as 58% of western Rajasthan is covered by moving of semi – stabilised sand dunes.

These sand dunes are distributed almost all the parts of desert, coastal sands and inland riverine areas. In India 11.996m ha lands of Rajasthan and 1.47 mha of Coastal regions are facing serious wind erosion problems.

Classification

a) Based on existence of Vegetation

1. Sand dunes of old system

These are almost stable stand dunes or partially stabilised sand dunes. Only the part of their exists and plants are active due to the biotic stress.

CHOICE OF SPECIES

a) GRASSES

Saccharum spontaneum

S. mungi

Cenchrus ciliaris

b) SHRUBS

Calotropis procera

Dodonia viscoa

Cassia auriculata

c) TREES

Acacia arabica

Prosopis spicigera

Prosopis juliflora

Dalbergia Sisoo

Tamarind auriculata

Eucalyptus spp.

2. Sand dunes of New system

The Barehan & shrub coppiece dunes all the most dominant formation in this new system. The are devoid of nutrients but they are ri ch in moisture.

b) General classification

1. Active dunes

This include all dunes of edifues madeup of Acolian matured regardless of particle size of microralogical nature.

2. Fixed dunes

The edifies are formed by the pavement composed of send particles with grain sizes greater than those which are mobilized by trade winds are termet as joined dunes.

Afforestation of Sand dunes

The different steps included are

a) Protecting of shifting sand dunes against biotic interference.

Species found in sand dune ecosystem

Prosopis cineraria

Tecomella undulata

Acacia senegal

Zizyphus spp.,

Acacia jacquemonti

Tecomella stans

Tamarindus indica

Suitable tree species for sand dune stabilization according to rainfall pattern

a) Rainfall 150-300mm : *Acacia tortilis, A. senegal, Prosopis chilenis, Prosopis cineraria,Tecomella undulata*

b) Rainfall 300-400mm: *Acacia tortilis, A. senegal, Prosopis chilenis, Prosopis cineraria,Tecomella undulate, Acacia nilotica, Eucalyptus camaldulensis, Parkinsoniaaculeata, Zizyphus sp*

c) Rainfall 400mm and above: *Albizia lebbeck, Ailanthus excelsa, Azadirachta indica, Acacia nilotica*

b) Erection of micro windbreaks for treating dunes.

c) Forestation of sand dunes by direct sowing or transplanting.

d) Planting of grass skips or seeds of grasses, castor seeds duly treated with sodium alginate to protect.

e) Continuous and proper management

Criteria for Choice of species

* They should be highly drought resistant
* Should have property of fast development of fibrous root system
* Capable of deep vertical penetration into soil to reach lower, moisture regime of the soil
* Should have sufficient capacity to sustain high wind velocity.
* Net exacting in moisture of nutrients
* Capable of multiple benefit.

Role of trees in soil and water conservation

The establishment of a vegetative cover is one of the most effective means of soil and water conservation. When the protective cover of vegetation on the soil is removed, the structurally unstable tropical soils are exposed to the beating action of rains. Losses due to

erosion immediately after land clearing are normally alarmingly large.

The potential role of trees in reducing run-off and erosion losses is well appreciated and understood. Natural forest communities provide a multilayer defence against the impact of raindrops. The different state of canopy progressively reduces the force of rain, thereby reducing the adverse effect of its impact on the soil. Further more the litter and the humus layers on the soil surface act as a cushion against erosion.

The soil conservation is particularly important in highlands with undulating topography and steep slopes, which are increasingly being brought under cultivation.

For example, in South-East Asia, there is a long tradition of planting *Leucaena leucocephala* in contour hedgerows for erosion control and soil improvement. These countour rows of leucaena survive through the long dry season because of their long taproots, which can reach water deep in the ground. Loppings and prunings from the hedgerow species also provide mulch to aid in preventing sheet erosion between trees. Removal of vegetative cover from the soil generally results in an increase in bulk density, a decrease in porosity and reduction in infiltration rates.

The use of trees and other woody perennials to protect agricultural fields from these adverse effects is a widespread practice. Trees acting as windbreaks and shelter belts also assist in regulating the ecoclimate within the tree stands. These also reduce evaporation and temperature.

The clearing of vegetation affects not only the farmlands in the immediate vicinity, but also destroys the water catchment areas causing flooding of rivers and rapid silting of dams.

Different vegetative methods for soil and water conservation

1. **Strip planting:** In this method, erosion permitting and erosion resisting crops are alternatively raised at right angle to the slope of the land to retard the velocity of rain water
2. **Rotational cropping :** In this method, either grain crops grasses or legumes along with trees are planted in the field . This will help to improve and maintain soil fertility.
3. **Cover cropping:** Trees and grasses are grown to cover the earth's surface. Trees like *Acacia nilotica, Azadirachta indica, Eucalyptus tereticornis,* silk cotton, teak and casuarinas can be planted to arrest erosion along with trees.*Agave americana* can be planted for stabilization of gullies.*Acacia nilotica and Azadirachta indica* can be planted on the banks of rivers, percolation ponds, lakes to strengthen the bunds and to prevent erosion.

Mine burden reclamation

In mined out areas, the soil is turned over from the bottom and the lower and upper horizons are completely mixed altering the physical and chemical properties of the soil to a level of unsuitability for cultivation. Water holding capacity of such soil is poor.

Planting technique

Before undertaking plantation , it is necessary to level the area with the help of bulldozer. Pits of $60cm^3$ are dug and then filled with fertile soil. Additon of farmyard manure at the rate of 0.50 kg / pit has been found useful. Container raised seedlings of 9 to 12 months old are to be planted .

Suitable tree species

Acacia auriculiformis

Dalbergia sissoo

Eucalyptus camaldulensis

Grevillea robusta

Albizia lebbeck

Cassia siamea

Afforestation in Coastal and Hilly areas

Afforestation in coastal areas

Coastal land occupy an area of about 8.4mha in India in the form of a narrow strip along the eastern and western coasts of the country. The soil is generally alkaline in reaction and the salt content is high . The soil is poor in nutrients and low water holding capacity . The water table is high .The texture of the soil is mostly sandy. Sea water causes a high concentration of sodium salts.Lime deposition is also common at many places.

The urgency of afforestation of coastal areas has been felt due to the continuous occurrence of cyclones. The role of the forest as a moderator of the effect of a cyclone is well

known. It has been suggested that 1 to 2 kilometre wide forest belt is necessary for moderating the effects of cyclones all along the coastal areas of the country.

In areas with high salinity, it is necessary to leach the salts and plant the trees on ridges. Plantations of *Casuarina equisetifolia* have been raised successfully on a large scale in coastal areas. Where the water table is high , plantations are done on raised mounds and where it is low, in pits.In the first 2 years, irrigation is necessary to save the plants from physiological drought.

Cocos nucifera and *Borassus flabellifer* have been successfully planted in certain areas of Orissa.Other species which have been successful are *Pongamia pinnata,Avicennia officinalis, Acacia auriculiformis, Eucalyptus tereticornis, Salvadora persica, Salvadora oeoides, Simarouba galuca,Prosopis sp.*

Afforestation in Hilly areas

The hills have been denuded by unrestricted fellings associated with excessive grazing and frequent fires. In some areas, due to the growth of grasses, the erosion has been less damaging . But in most cases the surface soil has been eroded. In many areas, even subsoil has disappeared, leaving no soil material. The soil is generally poor in moisture and nutrients.

When soil is present in the area , contour trenching may be done as it helps in soil and water conservation. When the slopes are steeper, digging of trenches may not e possible and in such cases, preparation of pits for planting may be adopted.

Suitable tree species for hills in temperate region: *Pinus roxburghii, Pinus wallichiana, Cedrus deodara Acacia dealbata,Ailanthus altissima, Cupressus torulosa,Morus sp, Juglans regia, Robinia pseudoacacia, Populus spp.*

Suitable tree species for hills in subtropical region: *Eucalyptus globulus,Eucalyptus grandis,Eucalyptus tereticornis, Acacia mearnsii, Acacia decurrens, Acacia dealbata, acacia melanoxylon,Pinus roxburghii.*