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LECTURE NO. 12

WATERSHED – COMPONENTS



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Components:

1. Soil And Water Conservation Measures
2. Water Harvesting
3. Crop Management
4. Alternate Land Use System
5. Biomass Management
6. Land Use Classification



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12.1 Soil and water conservation measures

These measures coupled with water harvesting help to improve the moisture availability in the soil profile and surface water availability for supplemental irrigation. Based on the nature and type of hydraulic barriers and their cost the conservation measures in arable lands can be divided into three categories:

- 1. Permanent treatments (Hardware treatments)**
- 2. Semi permanent treatments (medium software treatments) &**
- 3. Temporary treatments (software treatments).**



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Permanent measures: These measures are provided for improvement of relief, physiography and drainage features of watershed, aimed at controlling soil erosion, regulating surface runoff and reducing peak flow rates. Bunds, terraces and waterways are the permanent measures in watershed management project.

Waterways: both with and without vegetation- grassed waterways for safe disposal of runoff water.

Bunds: Contour bunds - For low rainfall (< 600 mm) and in permeable soils having slope up to 6%.



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Graded bunds – Suitable for high rainfall areas (> 600 mm) and for poor permeable soils having 2-6% slope and for soils having crust like Chalka soils of Telangana region of **A.P.**

Terraces: Bench terracing: suitable for soils having slopes 16 to 33%. Bench terraces reduce both slope length and degree of slope. At Ootacamund erosion rate decreased from 39 t/ha to less than 1.0 t/ha on 25% sloping land by bench terracing.



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- b. Semi permanent measures:** They are adopted to minimize the velocity of overland flow. These measures may last for 2 to 5 years.
- **Small section / key line bunds:** A small section bund may be created across the slope at half of the vertical bund spacing.
 - **Strip Levelling:** Levelling of about 4 to 5 m strips of land above the bund across the major land slope help in reducing the velocity of surface flow. Strip levelling can be done by running blade harrow at an interval of 2 to 4 years.
 - **Live beds:** One or two live beds of 2-3 m width on contour or on grade also serve the purpose. The vegetation on the beds may be annual or perennial or both.



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Vegetative or live barriers: One or two barriers of close growing grasses or legumes along the bund and at mid length of slope can filter the runoff water or slow down over land flow. Khus grass is widely recommended as vegetative barrier.

c. Temporary measures (Software treatments): These are simple treatments for in situ moisture conservation and needs to be remade or renovation every year. Simple practices like contour farming, compartmental bunding, broad bed and furrows, dead furrows, tillage and mulching have gained wide acceptance in the recent past.



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12.2 Water Harvesting

- The process of runoff collection during periods of peak rainfall in storage tanks, ponds etc., is known as **water harvesting**. It is a process of collection of runoff water from treated or untreated land surfaces/ catchments or roof tops and storing it in an open farm pond or closed water tanks/reservoirs or in the soil itself (in situ moisture storage) for irrigation or drinking purposes.

Methods of Water Harvesting

- The different methods of water harvesting that are followed in arid and semiarid regions are discussed separately.



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Arid Regions

- ❑ Water Spreading
- ❑ Micro catchments
- ❑ Traditional water harvesting systems
- ❑ Tanka is an underground tank
- ❑ Nadi or village pond
- ❑ Khadin



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Semiarid Regions

- Dug Wells
- Tanks
- Percolation Tanks
- Farm Ponds



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12. 3 Crop management

- The land management refers to keep all those properties of land in proper order, which likely to affect the soil yield potency. The land characteristics such as terrain, slope, formation, depth, texture, moisture, in-filtration rate and soil capability are the main to consider under land management activities for watershed development. This includes following activities:
 - a. Vegetative measures
 - b. Structural measures
 - c. Production measures &
 - d. Protection measures.



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- a. Vegetative measures:** These are the primary land management measures. These measures are very effective to check the **soil erosion**, along with less cost expensive and easily practicable for the farmers.
- The practices such as development of vegetative cover, plant cover, mulching, vegetative hedges, grassland management, agro-forestry etc., are also included under this kind of measures.
- b. Structural measures:** These include mechanical conservation measures such as bunding, terracing, check dams etc., are used at the steep lands for controlling the soil loss, especially when vegetative measures are ineffective.
- These structures offer their immediate effect on soil erosion/soil loss check, but very cost expensive requires, proper site selection, design and construction.



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- c. **Production measures** for land management include the practices such as mixed cropping, strip cropping, cover cropping, crop rotations, cultivation of shrubs and herbs, contour cultivation, conservation tillage, land leveling, use of improved variety seeds, horticultural practices etc.
- d. **Protective measures** Adoption of these measures depends very much on the land characteristics.
- e. Selection of crops and cropping systems to suit length of growing season
- f. Optimum sowing time
- g. Fertilizer schedules and balanced use of plant nutrients for crops and cropping systems



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12.4 Alternate land use systems:

Definition: A pattern of land use that is different from the existing or the conventional can be described as an alternative land use system.

Agroforestry: Agroforestry may be defined as an integrated self sustained land management system, which involves deliberate introduction/retention of woody components with agricultural crops including pasture/livestock, simultaneously or sequentially on the same unit of land, meeting the ecological and socio-economic needs of people.



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The different agroforestry systems are:

1. Agri-silviculture – Arable crops+Trees

Eg: *Leucaena leucocephala* + Sorghum

2. Silvi-pastoral system – Trees + Grasses

Eg: *Acacia* + *Cenchrus* + *Stylosanthus*

3. Agri-silvi-pastoral system – Arable crops+ Trees + Grasses

4. Agri - horticultural system – Arable crops+Fruit trees

5. Horti - pastoral system – Fruit trees + Grasses

Alley cropping/hedgerow intercropping or avenue cropping.





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Advantages of alley cropping are:

- ❖ Provision of green fodder during lean period of the year
- ❖ Higher total biomass production per unit area than arable crops alone Efficient use of off-season precipitation in the absence of a crop
- ❖ Additional employment during off-season
- ❖ It serves as a barrier to surface runoff leading to soil and water conservation.

Tree farming

Trees can flourish and yield abundantly where arable crops are not profitable.



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Timber-cum-fibre system (TIMFIB)

It involves growing trees and perennial fibre crops together on the same piece of land.

Ex: Subabul intercropping with agave

Ley farming

This system involves rotation of legume forages with cereals.

11. 5 Land use classification (land capability classification)

Land capability classification is grouping of soils into different classes according to their capability for intensive use and treatments required for sustained use. It emphasizes the need for using the land only for what it is suited best to realize optimum returns, without land degradation.



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Land capability classification system developed by USDA is useful for Agriculture. Eight land capability classes are recognized and designated by Roman numerals from I to VIII. The Roman numerals indicates increasing limitations and fewer choices for practical field crop use.

Land capability classes from **I to IV** are suitable for **arable crop production**

Land capability classes from **V to VIII** are suitable for **alternate land use systems**

CLASS I: This group of soils has **few limitations** on their use. They are deep (> 90cm), well drained and nearly levelled. They are suitable for intensive cultivation. This group of soils is represented by **light green colour** in land use maps



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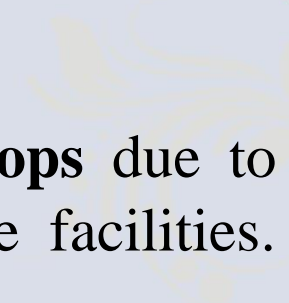
CLASS II: Soils have **moderate limitations** such as gentle slope, moderate erosion problem, inadequate depth (22.5–45cm), slight salinity and alkalinity and relatively restricted drainage. They are represented by **yellow colour** in land use maps.

CLASS III: Soils have **moderate to severe limitations**. The soil erosion, shallow water permeability, low moisture retentively, moderate salinity and low fertility are the limitations for their use. Smothering crops such as legumes are more ideal than row crops. They are represented by **red colour** in land capability maps.

CLASS IV: These soils will have **very severe limitations** that reduce the choice of crops. These lands should be used for close growing crops or grasses with special soil conservation practices.



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CLASS V: These soils generally **not suitable for grain crops** due to limitations such as rocky soil, faded areas with no drainage facilities. Pastures can be improved on this class of land.

CLASS VI: These soils are **suitable for growing grasses** and forest trees. Limitations are same as those for class V but they are more rigid. Their use may be restricted to woodland or wild life.

CLASS VII: These have **severe limitations even for growing grass and forest trees**. They are steep soils of extremely shallow depth, used for woodlands and wild life.

CLASS VIII: **Not suitable for forest trees and grasslands** as they are steep, rough stony mountains. **Land use is restricted to recreation, watersheds and wild life** etc.,



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THANK YOU