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Watershed management – objectives and approaches of watershed management



Introduction

- ✓ Soil, water and vegetation are the three important natural resources.
- ✓ As these resources are interdependent there is a need to have a unit of management for most effective and useful management of these resources.
- ✓ In this context, watershed is an important unit for the management of the natural resource.



Concept of watershed management

- ✓ A watershed is defined as any spatial area from which runoff precipitation is collected and drained through a common point or outlet. In other words, it is a geo-hydrological unit the water of which flows to a common outlet.
- ✓ It is defined as unit of area, which covers all the land, which contributes runoff to a common point. It is synonymous with a drainage catchment area.
- ✓ The basic unit of development is a watershed, which is a major hydrological unit. The watershed is also known as ridgeline in U.K.



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Watershed management

- ✓ Watershed management implies the wise use of soil and water resources within a given geographical area so as to enable sustainable production and to minimize floods.
- ✓ Watershed management is the rational utilization of land and water resources for optimum production with minimum hazard to natural resources.



Watershed management programmes

- ✓ The Drought Prone Area Development Programme (DPAP) and the Desert Development Programme (DDP) adopted watershed development approach in 1987.
- ✓ The Integrated Watershed Development Project (IWDP) taken up by the National Wasteland Development Board (NWDB) in 1989 also aimed at development of wastelands on watershed basis.
- ✓ The fourth major programme based on watershed concept is the National Watershed Development Programme for Rainfed Areas (NWDPA) under the ministry of Agriculture.
- ✓ The ministry of Rural development funds watershed development schemes under DDP, DPAP and IWDP



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Principles of watershed management

- Utilizing the land based on its capability
- Protecting the fertile top soil
- Minimizing the silting up of the reservoirs and lower fertile lands
- Protecting vegetative cover throughout the year
- In situ conservation of rain water
- Safe diversion of surface runoff to storage structures through grass water ways
- Stabilization of gullies and construction of check dams for increased ground water recharge.
- Increasing cropping intensity through inter and sequence cropping.
- Alternate land use systems for efficient use of marginal lands



Cont..

- Water harvesting for supplemental irrigation
- Ensuring sustainability of the ecosystem
- Maximizing farm income through agricultural related activities such as dairy poultry, sheep, and goat farming
- Improving infrastructural facilities for storage transport and agricultural marketing
- Setting up of small scale agro industries and
- Improving socio-economic status of farmers.



The objectives of watershed management programme can also be described in symbolic form by the expression:

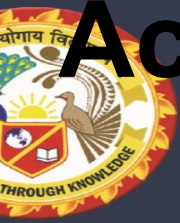
- P = Production of food-fodder-fuel-fruit-fibre-fish-milk combined on a sustained basis
Pollution control
Prevention of floods
- O = Over exploitation of resources to be minimized by controlling excessive biotic interferences like over grazing
Operational practicability of all on farm operations and follow up programme including easy approachability to different locations in watershed
- W = Water storage at convenient locations for different purposes
Wild animal and indigenous plant life conservation at selected places
- E = Erosion control
Ecosystem safety
Economic stability
Employment generation



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Cont..

- R = Recharge of ground water
Reduction of drought hazards
Reduction of siltation in multipurpose reservoirs
Recreation



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Action plan for watershed development

(steps in watershed management):

1. Identification and selection of watershed
2. Description of watershed.
3. Analysis of problems and identification of available solutions
4. Designing the technology components
5. Preparation of base maps of watershed
6. Cost-benefit analysis
7. Fixing the time frame
8. Monitoring and evaluation
9. On-farm research
10. Organizational requirement



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Components of watershed management programme and land capability classification

The main components of watershed programme are:

1. Soil and water conservation
2. Water harvesting
3. Crop management and
4. Alternate land use systems



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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
 - ✓ a. Permanent treatments (Hardware treatments)
 - ✓ b. Semi permanent treatments (medium software treatments) and
 - ✓ c. Temporary treatments (software treatments).



a. 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 waterway for safe disposal of runoff water.
- Bunds: contour bunds – Suitable for low rainfall areas (< 600 mm) and for permeable soils having slope up to 6%.
- Graded bunds – Suitable for high rainfall areas (> 600 mm) and for permeable soils having 2-6% slope and for soils having crust.



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b. Semi permanent measures:

These are usually interbund treatments where field sizes are less than 1 ha in conventionally bunded area. They are adopted to minimize the velocity of overland flow. These measures may last for 2 to 5 years.

i. Small section / key line bunds: A small section bund may be created across the slope at half of the vertical bund spacing, which needs to be renovated at an interval of 2-3 years.

ii. Strip Levelling: Levelling of about 4 to 5 m strips of land across 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.

iii. Live beds: One or two live beds of 2-3 m width on contour or near grade also serve the purpose. The vegetation on the beds may be annual or perennial or both.

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



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c. Temporary measures

- ✓ These are simple treatments for in situ moisture conservation and need to be remade or renovated every year. Such practices like contour farming, compartmental bunding, raised bed and furrows, dead furrows, tillage and mulching have gained wide acceptance in the recent past.



Crop management

- ✓ Location specific package of practices for dryland crops have developed by dryland research centres and state agricultural Universities for all the crops and cropping systems which include.
- ✓ Selection of crops and cropping systems to suit length of growing season
- ✓ b) Optimum sowing time
- ✓ c) Fertilizer schedules and balanced use of plant nutrients for crops and cropping systems
- ✓ d) Weed management and package of practices for aberrant weather
- ✓ e) Contingent cropping