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A Concept on Watershed Development and Management

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Abstract
Watershed is not only the hydrological unit but also socio-political-ecological entity. This plays an important role in determining food, social, and economical security and provides life support services to the rural people. Watershed size selection depends on the objectives of the development and terrain slope. A large watershed can be managed in plain valley areas or where forest or pasture development is the main objective. In hilly areas or where intensive agriculture development is planned, then the size of watershed small id preferred.

Keywords: Watershed, consortium, community, water, livelihood.

I. Introduction

The term 'watershed' implies to an area which has well defined hydrological as well as geographical boundaries from where the entire runoff drains towards a single outlet. A watershed captures precipitation, filters and stores water and determines its release. A watershed also includes groundwater aquifers that discharge to and receive discharge from other streams.

Watershed management can be defined as "Rational utilization of land and water resources for optimum and sustained production with minimum hazard to natural resources. It essentially relates to soil and water conservation in the watershed which means proper land use, protecting land against all forms of deterioration, building and maintaining soil fertility, conserving water for farm use, proper management of water for drainage, flood protection, sediment reduction and increasing productivity from all land uses.

Watershed Characteristics:

- Watersheds divide the landscape into hydrological defined geographic areas.
- Watersheds integrate all environmental functions.
- Physical, chemical, biological, human use and management determine water qualityand water flow.
- Each watershed has a unique combination of inherent conditions, use, and management, thus response to water quality and flow is variable and complex.

II. Methodology

The paper examines the importance of watershed development & management Programmes in arid zone in India. The paper based on secondary data which is available by government research institutes, journals, books etc. Conservation measures for arable lands as well as Conservation measures for Non arable lands have been discussed.

Conservation measures for Arable lands:

Contour Farming

Contour farming is helpful on all slopes where line sowing is adopted. All ridges and rows of plants are placed across the slope to form a continual series of miniature barriers to water and offer maximum opportunity for infiltration.
Contour operations reduce the power of the water to erode, suspend and carry away soil particles and increase the moisture storage.

Contour Bunding

Contour bunds are base trapezoidal earthen embankment on contour, varying 1.5 to 2 m wide, constructed across the slope to act as barriers to runoff, to form water storage area on their upslope side and to break up a long slope into short segments. Contour bunds are not suitable for shallow soils having depth less than 7.5 cm.

Contour Vegetative Barriers

Contour vegetative barriers are hedgerows of perennial grasses or shrubs planted at a regular interval on contours for conserving soil and water in sloping lands. Suitable grass species are grown

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along contours at suitable vertical interval to intercept part of runoff and to control erosion in agricultural fields having flat to slight undulating topography. The contour vegetative barrier moderates the velocity of overland flow and traps silt at low cost. It augments production of food, fuel and fodder or fibre from lands by growing suitable vegetation species. Contour vegetative barriers may be easily established across a wide spectrum of soil-climatic conditions.

Graded Bunds

Graded bunds are used to dispose off safely the excess water from the agricultural fields to avoid water stagnation. Graded bunds are suitable in areas where annual rainfall is 500 mm and if the soils are highly impermeable. Graded bunds usually have wide and shallow channels and earthen bund laid along a predetermined longitudinal slope. As graded bunds are essentially means for the safe disposal of excess water from cropped lands, suitable outlets are required to be constructed on graded bund. Draining of excess water from one plot to another through outlets provided in the bund require special attention as considerable amount of soil is lost through these outlets. Provision should be made to arrest the silt and allow only clear water to flow away.

Grass Waterways

Grass waterways are developed for safe disposal of excess water from agricultural fields. These may be natural or manmade courses protected against erosion by suitable grass cover. Grass waterways are also used for channelizing and regulating runoff flows for water harvesting purposes. The best location for waterways is a natural depression or along valley line. These may also be constructed along field boundaries for safe disposal of excess rainfall from agricultural fields. Vegetative waterways may be located in all classes of lands except hard rocks, where construction may be difficult.

Shelterbelts

In arid zones, the harsh conditions of climate and the shortage of water are intensified by the strong winds. Living conditions and agricultural production can often be improved by planting trees and shrubs in protective shelterbelts which reduce wind velocity and provide shade. Shelterbelts are barriers of trees or shrubs that are planted to reduce wind velocities and, as a result, reduce evapotranspiration and prevent wind erosion; they frequently provide direct benefits to agricultural crops, resulting in higher yields, and provide shelter to livestock, grazing lands, and farms.

Conservation measures for Non arable lands:

Non-arable lands do not fulfill life sustaining potential. These result from inherent / imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints.

Contour Furrowing

Contour furrowing is the most effective measure to reduce runoff and soil loss, increase yield and is commonly adopted in grasslands and forestlands. In very sandy soils or soils with heavy clay pan area, its benefit is limited. Contour furrows varies from 30-60 cm wide and 10-25 cm deep. The shape varies from “V” to square, rectangular, or parabolic. The cross section and depth of furrows mainly depend on soil and equipment used for making them.

Contour Trenches

A contour trench is a useful practice in forestry areas. This practice is adopted in area which is unsuitable for cultivation but suitable for forestry. Normal standard size of a trench is 60 cm x 30 cm x 60 cm depth with an unexcavated portion 1.5 m after every 50-75 cm. Length spacing or vertical interval depends on the slope of land. Spacing may vary from 30-60 m. After the trenches are excavated to correct size, they are refilled partially, and stocking the remaining excavated material as a small bund on the down stream side.

Gradonies

Gradonies are steeply inward-sloping narrow bench terraces constructed on contours. Usually, gradonies are suitable for afforestation in uniformly steep sloping lands. Based on the steepness of slope, vertical interval is kept from 1.0 to 1.5 m. The width of gradonies also varies from 1.0 to 1.5 m.

Gully Control measures:

Gullies are a symptom of functional disorder of the land, improper land use and are the most visible result of severe soil erosion. They are small drainage channels, which cannot be easily crossed by agricultural equipment.

Anicut/Check-dams

Check-dams are masonry overflow barriers (weirs) constructed across seasonal streams. A check-dam as such has a relatively

limited storage capacity but a large volume of water can still be pumped from such storage as the stream continues to flow and the check-dam serves the purpose of an ideal intake structure. It creates flooding of upstream area, which requires surplusing arrangements at suitable intervals to drain water.

Gabionic Check-dams

Gabionic check-dams are useful in a locality where stones are readily available and their irregular shape makes them unsuitable for making loose stone check-dams. If the expected water velocity is very high, gabion is recommended in place of loose rock dams. A gabion is a rectangular shaped cage made of galvanized wire, which is filled with locally available boulders, rocks or stones etc

Loose Stone/Dry Stone Masonry Check-dams (LSCD)

These structures are effective for checking runoff velocity in steep and broad gullies. These are suitable at upper reaches of the catchment. They have a relatively longer life and, usually require less maintenance. The bed of the gully is excavated to a uniform depth of about 0.3 m. Stones are then hand packed from the foundation level.

Brushwood Check-dams

Check-dams are constructed by using locally available brushwood and supported by wooden stakes which is used in the small gully heads not deeper than 1 m. Check- dams are of two types; single row post brush dam and double row post brush dam. Brushwood check-dams are constructed in areas where wooden posts, brushwood, etc. are available in plenty. These check-dams can only be used in the small gully heads not deeper than 1m.

Rain Water Harvesting for Arid lands:

Primary source of water in arid zone is rainwater, therefore improvement in availability of water, catchment conditions become very crucial. Catchment is the base for harvesting rainwater in form of runoff. Runoff is highly dependent on catchment's shape, size, slope, and type etc. beside rainfall characteristics.

Techniques for Enhancing Runoff from Catchments

1. Simple earth smoothing and compaction helps increasing runoff from catchment areas.
2. Small amounts of sodium salts - NaCl, $NaHCO_3$ applied to desert soils where vegetation has been removed - causes dispersion of the surface soil, reducing infiltration and increases runoff.
3. Removal of stones and boulders and unproductive vegetation from catchment helps in uninterrupted flow, enhances runoff to collection site.
4. Land shaping into roads and collection of water in channels.
5. Sandy soils have low water holding capacity. Spreading of clay blanket to the soil surface reduces the infiltration and consequently accelerates runoff.
6. Chemical treatments like wax, asphalt, bitumen and bentonite prevent downward movement of water, which augments runoff.

III. Conclusion:

The increased population pressure has stressed the limited natural resources of this fragile eco-system Good lands are already under intense cultivation so focus has been shifted towards arid zone for the crop production. The scientific approach towards understanding the problems and constraints of arid region and adoption of proper watershed management technology can greatly help in achieving the goal of meeting the aspiration of its dwellers on sustainable basis.

A successful application of any soil and water conservation measures for improving production requires an integrated watershed approach. All the watershed technologies discussed above s need to be integrated as a holistic approach to maximize production on sustainable basis.

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