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# Watershed Management- Principles, Limitations and Process

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**ABSTRACT**

A watershed is made up of its physical and hydrological natural resources as well as human resources. Watershed management is the process of guiding and organizing land use and use of other resources in the watershed to provide desired goods and services without adversely affecting soil and water resources. For identification of Water shed Silt Yield Index is explained in the paper. An effort has been made to explain the principles, limitations and process of Water Shed management.

**KEYWORDS** watershed, principles, Identification

**INTRODUCTION OF WATER SHED**

Watershed is a geo-hydrological unit, which drains at a common point. Rain falling on the mountain starts flowing down into small rivulets. Many of them, as they come down, join to form small streams. The small streams form bigger streams; and finally the bigger streams join to form a ***nullah*** to drain out excess water from a village. The entire area that supplies water to a stream or river, that is, the drainage basin or catchment area, is called the watershed of that particular stream or river.

**Identification of Watershed**

All the watershed programme executing agencies work hard to identify a watershed which may be taken up on priority for development. In the absence of any clear-cut parameters, the identification of the watersheds for development is done on parameters like approach, cooperation of the villagers, etc. It is a matter of concern that in certain watersheds more than 10 agencies are working and in some none. There is no doubt that every watershed has to be taken up for development and a watershed developed today may be needing further management/development after a lapse of 10-15 years. However, there is a need of selecting a watershed for development on priority.

As of today, the Silt Yield Index (SYI) is recommended as the parameter to decide the prioritization of the watershed. The watershed which is observed to yield maximum yield is taken first for development followed by the one which is next to yield the silt and so on.

The SYI is computed using the following

$YI = Sum (A_i * W_i * D_i) * 100/A_w$

Where,

$A_i$ = Area of ith Erosion Intensity Mapping Unit (EIMU) $_i$ =1 to n

$W_i$ = Weightage value of ith EIMU

$D_i$ = Adjusted delivery ratio assigned to ith EIMU

N = No. of mapping units

$A_w$ = Total area of the watershed

However, the above procedure is not being used by common people and is limited to few very skilled and experienced people dealing with the subject. It is worth to note that this procedure was primarily recommended to prioritize a watershed under River Valley Project (RVP) and Flood Prone River (FPR) projects.

With the present emphasis on participatory approach in watershed management programmes, we need to introduce some proper parameters to prioritize the watersheds keeping in view the core parameter of water and soil. These may be as:

- Silt yield index
- Existing water resources
- Water quality
- Fertility of the soil
- Existing employment opportunity
- Availability of basic amenities viz, transport, school, hospital (for both human and animal), post office, bank, co-operative societies, marketing and communication
- Adoption of the village by other agencies
- Considering the above parameters, a watershed should be selected for treatment.

**Focus and Principles Of Water Shed Management**

Watershed degradation in the third world countries threatens the livelihood of millions of people and constrains the ability of countries to develop a healthy agricultural and natural resource base. Increasing populations of people and livestock are rapidly depleting the existing natural resource base because the soil and vegetation system cannot support the present level of use. In a sense, the carrying capacity of these lands is being exceeded. As the population continues to rise, the pressure on forests, community lands and marginal agricultural lands leads to inappropriate cultivation practices, forest removal and grazing intensities that leave a barren environment yielding unwanted sediment and damaging streamflow to down stream communities

**The focus of watershed development:**

- Village common lands as well as private lands
- Institutionalized community participation
- Sustainable rural livelihood support system
- Capacity building
- Decentralized planning and decision-making
- Ridge to valley treatment approach
- Integrated and holistic development of the unit
- Protecting natural resources through stakeholders' participation
- Provides best unit for planning a development programme
- Principles of Watershed Management

**The main principles of watershed management are:**

- Utilizing land according to its capacity.
- Putting adequate vegetal cover on the soil.
- Conserving as much rainwater as possible at the place where it falls both at farmlands and common property resources: In-situ conservation.
- Draining out excess water with a safe velocity and diverting it to storage ponds and storing it for future use.
- Avoiding gully formation and putting checks at suitable intervals to control soil erosion and recharge ground water.

- Maximizing productivity per unit of area, per unit of time, and per unit of water.
- Increasing cropping intensity and land equivalent ratio through intercropping and sequence cropping.
- Safe productive utilization of marginal lands through alternate land use system.
- Ensuring sustainability of the eco-systems benefiting the man-animal-plant-land-water-complex in the watershed.
- Maximizing the combined income from the interrelated and dynamic crop-livestock-tree-labour-complex over the years.

**LIMITATIONS OF WATER SHED MANAGEMENT**

- Limited success of watershed programme indicates that it was mainly due to:
- Inadequate analysis of physical and socio-economic environment;
- Indifference to farmers' circumstances;
- Strong bias towards crop production;
- Lack of farmers' involvement; and no flexibility in the technological options to suit farmers' needs and their resources.
- Lack of continuation of the soil and water conservation measures up to the point of financial support;
- Poor acceptance of contour-based water conservation measures due to their disregard to ownership boundaries;
- Antipathy of farmers to maintain structures like diversion drains, which cost money and resources to some farmers but benefited others;
- Inadequate arrangement on social fencing to protect forestry and pasture lands;
- Lack of focus to address the problems of livelihoods of landless laborers;
- Disregard to indigenously known and practiced methods of soil and water conservation; and
- Lack of clear arrangements and understanding on sharing of the harvested water.

**WATER SHED MANAGEMENT PROCESS**

The collection, inventorization and documentation of the resources required for water shed management is known as benchmark survey. The benchmark survey on one hand provides requisite information for suitable watershed planning and on the other hand helps in estimating the effect of watershed management works through evaluation and monitoring. The various resources can be collected, inventoried and documented through the following surveys.

**1. Demographic Survey**

The demographic survey consists of documentation of human and cattle population, wild animals, etc. for better planning. Our basic aim for the development of the watershed is to develop the socio-economic condition of the habitant of the area, hence the related information on these aspects is very necessary.

**2. Vegetation**

The information on type of vegetation, its status, present yield, agronomical practices, etc. helps in identifying the gaps with respect to expected optimum, that is, sustained production. The gap in present and optimum yield of all the vegetation is very important to identify proper control measures.

**3. Soil-cum-Land Capability Survey**

The information on soil (both chemical and physical properties) including geology, drainage, etc. coupled with topographical and hydrological survey helps in preparation of land capability classification map of the watershed which is the of top sheet, revenue map and other suitable instruments/equipments.

**4. Engineering-cum-Topographical Survey**

The topographical survey basically consists of demarcation of hillocks, ridges, valleys, depressions, streams, land slope (both degree and length), etc. in order to know the extent of degree of risk and ease of planning. The engineering survey consists of mapping the existing structural measures of erosion control in the watershed viz. dams, culvert, retaining walls, terracing, bonding, trenching, water harvesting structure, etc. It also provides the opportunity for identification of problem area.

**5. Hydrological and Water Resources**

This basically helps in estimating the water balance of the watershed for crop production. The information on precipitation and other agro climate logical parameter is generally collected from the meteorological observatory already existing in the watershed or from the nearby area. The information on existing water resources, that is, water bodies, viz. reservoirs, ponds, lakes, wells (both shallow and deep), stream flow, etc. is collected by surveying the watershed.

Now as on today, the thrust has shifted from Watershed Management to Integrated Watershed Management.

The emerging issues or new paradigms of Integrated Watershed Management are:

1. Participation
2. Equality (gender issue, legal issues and policies, landless economically weaker section)
3. Equitability
4. Common property resources
5. Societies, associations
6. Employment generation
7. After care and maintenance
8. Responsibilities
9. Monitoring and evaluation

- Crop yield
- Cropping intensity
- Cropping sequence and rotation
- Ground water level
- Water resources
- Flora and fauna
- Land development index
- Low flow index
- Fertilizer intake index
- Micro-climate
- Runoff and soil loss

10. Partial area concepts

**Conclusion**

Watershed is a geo-hydrological unit, which drains at a common point. Rain falling on the mountain starts flowing down into small rivulets. Many of them, as they come down, join to form small streams. The small streams form bigger streams; and finally the bigger streams join to form a ***nullah*** to drain out excess water from a village. The entire area that supplies water to a stream or river, that is, the drainage basin or catchment area, is called the watershed of that particular stream or river. The Silt Yield Index (SYI) is recommended as the parameter to decide the prioritization of the watershed. The watershed which is observed to yield maximum yield is taken first for development followed by the one which is next to yield the silt and so on. A proper watershed management plan can be termed as one, which provides sustained production from the watershed without further deteriorating the environment and is limited to the resources of the watershed.

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