

# Introduction: Watershed, Principles of Watershed Management

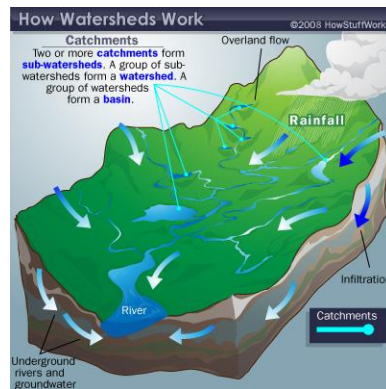
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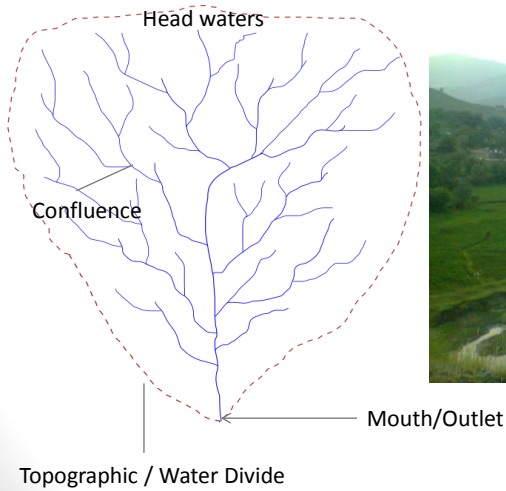
International workshop on  
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## Watershed: The Basic Hydrologic Unit

- *“Watershed is defined as a delineated area with a well defined topographic boundary and water outlet.”*
- The terms watershed, catchment and basins are usually used interchangeably
- A Complex of Biological and Physical Components: Soils, Landforms, Water, Vegetation, Land Uses, Groundwater etc



# Typical Watershed



# Drainage Patterns

## Dendritic drainage pattern

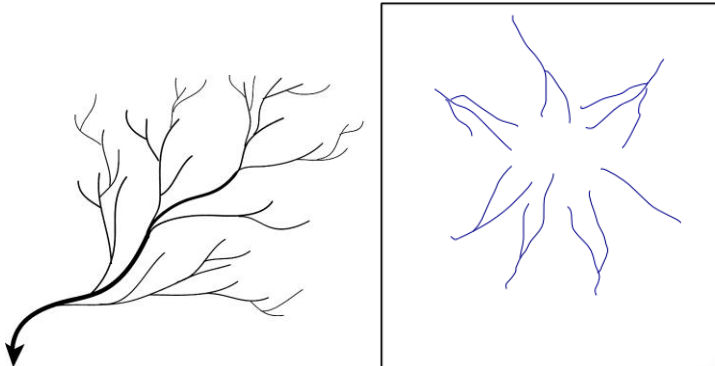
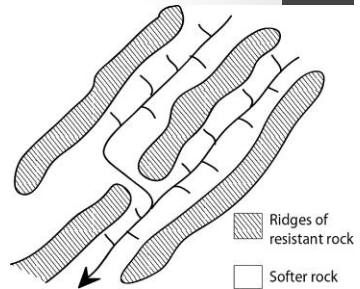
- Is characterized by the fact that tributaries flow in the same direction as the main stream, joining at an acute angle

## Trellis drainage pattern

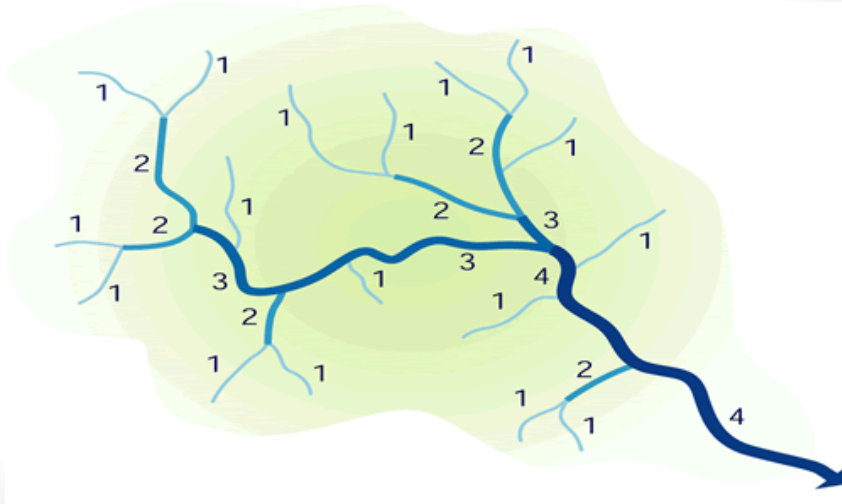
- It develops in area where softer and harder rocks alternate with one another or where folding and faulting results in the formation of structures that control the development of river system

## Radial drainage system

- it is made up of a pattern of stream flowing outward, down the slopes of a dome or cone-shaped up land



## Stream Order

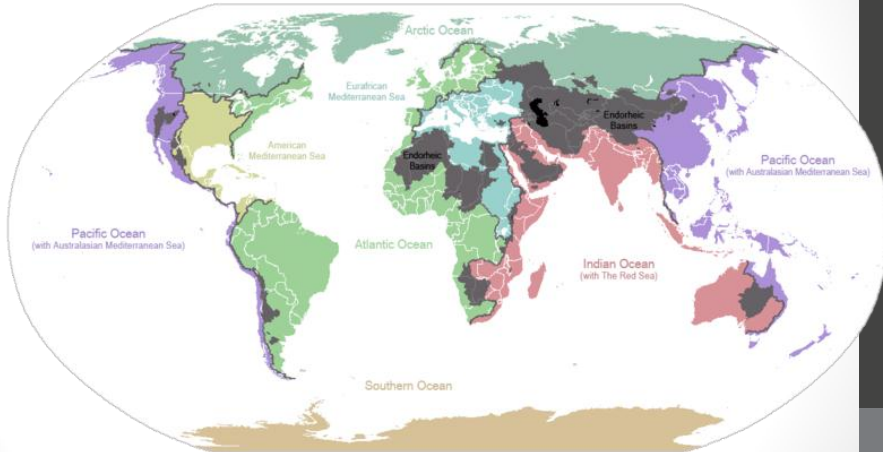


## Closed and Open Drainage Basins

- Watersheds that drain in to the ocean / river are known as Open Drainage Basins.
- Watersheds that do not drain into an ocean / river are known as closed or terminal drainage basins. (Endorheic Basins)
- Sistan Basin is an endorheic basin occupying most of the NW Afghanistan and NE Iran.



## Major Drainage Basins of the World



## Watershed: Important parameters

<i>Characteristics</i>	<i>Basic parameters on which the characteristics are studied</i>	<i>Importance of characteristics regarding watershed management</i>
1. Physiographic	Slope	Runoff rate and sediment yield, susceptibility to erosion hazards
2. Geomorphology	Genesis of land-form types	Identification of active processes of erosion in relation to land-form types.
3. Geology	Type and structure	Erosion susceptibility, infiltration of surface water, runoff, seepage etc.
4. Soil	Type and structure	Productive potential of land, susceptibility to erosional hazards
5. Drainage	Pattern and density	Runoff rate and volume, sediment yield and ground water targetting
6. Land cover	Type and density	Runoff rate and volume, sediment yield, susceptibility to erosional hazards etc.
7. Shape	Shape index	Runoff rate and rate of flood rise
8. Size	Sq. km or hectare	Runoff volume
9. Orientation	Storm path	Runoff rate
10. Climate	Rainfall/Temperature and aspects	Runoff rate and volume, sediment yield, susceptibility to erosional hazards, productive potential of the land etc.
11. Degree of Development	Cultural details	Runoff rate and volume, sediment yield etc.
12. Ground water	Depth and quality	Productive potential

Source : Behera (1986)

## Why Manage Watersheds?

- *Each and every one of us live in a unique watershed, with interrelated natural processes that impact our lives.*
- *Watershed management is a key step for water resources management, flood hazard reduction, clean water supply for drinking, agriculture, forestry and soil conservation.*
- Un-managed watersheds may lead to the loss of precious resources and contamination of water supplies.
- Climate Change

## Principles of watershed Management

### 1) Watershed as natural system that we can work with.

- A system can be defined as complex whole formed from related parts or a combination of related parts organized into a complex whole.
- Similarly, watershed can be regarded as a complete system and it entails several components. Entities that define the system may include products or outputs leaving the system, inputs coming to the system and interaction (+, -) between its components.
- The various parts of the watershed are physically and operationally linked i.e. the various resources are linked not only spatially but also functionally, and the potential benefit from integrated use can be large.

## Principles of Watershed Management

### 2) Watershed management must be participatory

- Participatory means involving the community is motivated to function and contributes as a group to perform various tasks.
- The adequacy of planning depends on the human element and not only on physical or technical aspects. Therefore, planning must start from people living on the land. The watersheds communities must involve in all stages of implementation of watershed development activities.



## Principles of watershed management

### 3) Is a continuous process and shall follow a multi-disciplinary approach

- Watershed management is interdisciplinary approach. Watershed planning is a coordinated analysis by a team of scientists representing various disciplines like environment, hydrology, geology, engineering, soil science, forestry, agronomy, and economists.
- Watershed Management is a continuous cyclic process.



## Principles of watershed management

### 4) Watershed management must be gender sensitive:

- Women are the most affected by environmental hardships. For example, they need to walk long hours to fetch increasingly scarce water, firewood and animal dung in addition to attending livestock, to name a few.
- Their involvement in watershed development planning, implementation and management is the key to ensure that they equally benefit from the various measures



## Principles of Watershed Management

### 5) Watershed management plan shall focus on local experience, strengths and weaknesses.

- Local knowledge is essential to improve the existing technologies, to adopt new ones and to manage natural measures once they are introduced and established
- Local Wisdom helps in identifying the most pertinent problems.
- Social attitudes and socio-economic conditions may limit the adoption of a plan.

## Principles of Watershed Management

### **6) Watershed management must be realistic, integrated, productive and manageable.**

- It must be realistic based up on local capacity, available resources and of government and partner support. Integrated conservation and development base is the guiding principles of watershed management.
- The watershed activities must be tangible and quick benefits the households. The measures must accommodate both production and conservation. Management is not only for the sake of conservation it must include both conservation and production.

## Principles of Watershed Management

### **7) Watershed management must be flexible at different level**

- Flexibility is needed during the selection of community based, their size (slightly smaller or flexibility or higher than the ranges indicated), and clustering and during the steps of the producer. Flexibility is also essential when considering the choice and design of measures with in agreed criteria of quality and integration

### **8) Watershed management must be cost-sharing and empowerment/ownership building**

- Cost-sharing by stakeholders contributes to the sustainability of the projects for establishing the responsibility of various stakeholders in the management of the resource. Various forms of local contributes are possible upon social networks and groups formation mechanisms.



## Principles of watershed management

### 9) Watershed management must be complementary to food security and rural development mainstream (like HIV, health, education and others)

- Watershed deployment planning should incorporate additional elements related to basic services and social infrastructure.

### 10) Flexible approach is always need

- One should never look for a rigid, step-by-step "cookbook recipe" for watershed management. Different regions have watershed that function in very different way, and even neighboring watersheds can have major differences in geology, land use, or vegetation that imply the need for different management strategies.
- Different communities vary in benefits they want from their watersheds. Therefore, watershed management is a dynamic and continually readjusting process that is build to accommodate these kinds of changes.

## Principles of Watershed Management

### 11) Watershed management framework shall support partnerships, using sound science, taking well-planned action, and achieving results

- A strong watershed framework uses sound science, facilitates communications and partnership, fosters actions that are well planned and cost effective.
- Among the three common elements of successful watershed management framework, Geographic management units (the watershed itself) is the first one, which agreed up on by partners to provide a functional, practical basis for integrating efforts.
- Secondly, stakeholders (anyone who can impact or is impacted by decisions in the watershed are involved through the processes, with clearly defined roles and responsibilities.

