Compiled and Circulated by Prof. Subhasis Das, Assistant Professor,
Department of Geography, Narajole Raj College

Systems approach in hydrology- hydrological cycle

1. Definition of hydrology: Hydrology is the science that encompasses the occurrence, distribution, movement and properties of the waters of the earth and their relationship with the environment within each phase of the hydrologic cycle.

The water cycle or hydrologic cycle is a continuous process by which water is purified by evaporation and transported from the earth's surface (including the oceans) to the atmosphere and back to the land and oceans. All of the physical, chemical and biological processes involving water as it travels its various paths in the atmosphere, over and beneath the earth's surface and through growing plants, are of interest to those who study the hydrologic cycle.

2. The system approach: A system as a set of components and relationships between them, functioning to act as a whole, has been detectable in science and in thinking about landforms for more than a century. The system has ecological function, provides ecosystem services.

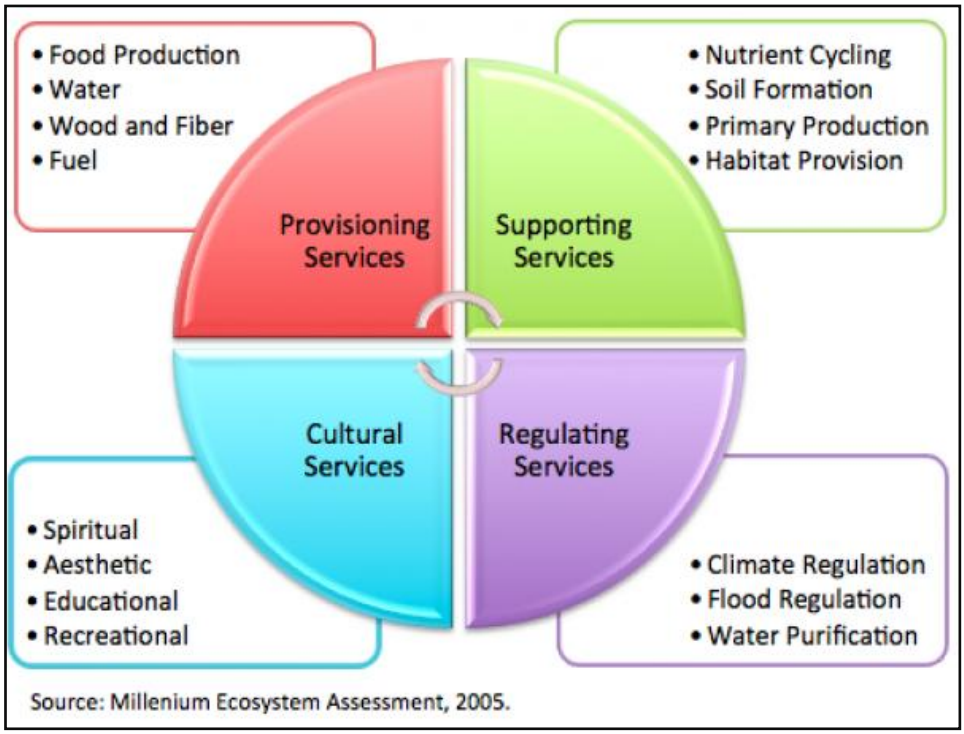

Fig. 1. Types of ecosystem service.

3. Hydrological cycle: The hydrological cycle is a continuous movement of water within the earth's hydrosphere, and is driven by solar radiation.

This includes the atmosphere, land, surface water and groundwater. As water moves through the cycle, it changes state between liquid, solid, and gas phases. Water moves from compartment to compartment, such as from river to ocean, by the physical processes of evaporation, precipitation, infiltration, runoff, and subsurface flow.

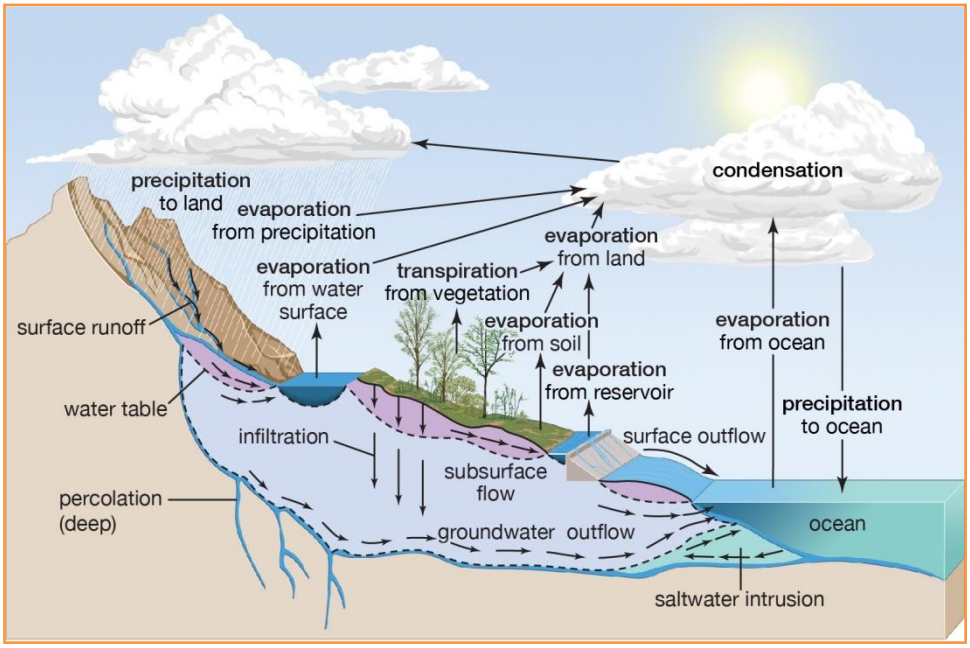

Fig. 2. Hydrological Cycle.

3.1. Elements of Hydrological Cycle:

a) **Evaporation:** Hydrological cycle begins with evaporation. The watery vapour is the reservoir of hydrological cycle. By the rays of the sun, the waters of the ocean, rivers, canals etc. evaporate and it is mixed with the atmosphere. The process by which water evaporates is called evaporation. The water-vapours are lighter than often elements and So, they rise above easily and speedily — and then, they get cool and condensed and create the sprays of water. At present, with the rise of heat in the atmosphere the amount of evaporation is getting increased.

b) **Condensation:** The water vapour rises above and gets condensed turning ultimately into drops of water or ice. This process is known as condensation. Again the amount of the

water vapour in the atmosphere and the warmth are closely related with each other. How much water vapour resides in how much warmth determines the relative moisture of the air. When the relative moisture rises up to 100% it comes down in the form of rain that means this time floating particles of vapour get bigger and assumes the form of rain and it is quite impossible for the atmosphere to carry them and they fall down on earth as rain-drops.

c) **Precipitation:** When the condensed water-vapour of the atmosphere turns hard or liquid, and falls to the ground by gravitation, it is called precipitation. The water-vapour of the atmosphere, fog or frost does not belong to precipitation. The rainwater, ice-fall and hail-storm do certainly belong to precipitation.

d) **Evapo-transperation:** Plants suck salty mineral water from the earth through principal roots. After Carbon assimilation, when the extra-water is emitted through the pores of the leaves, it is called evapo-transperation. This vapour adds additional vapour to the atmosphere and increases the moisture of it. So in the regions thick with trees and bushes, it rains more heavily than in other regions.

e) **Capillary Action:** The rain water enters into the ground by leaching process. The moisture of the earth and the water underground — both increase by degrees. Though the surface of the earth gets dry by the rays of the Sun, the water underground rises above through the pores of the soil and returns to the atmosphere in the form of invisible vapour. This is called capillary Action. In the Hydrological Cycle, Thus supplies water-vapours to the atmosphere and helps in the process of condensation.

f) **Interception storage and Evaporation:** At the time of raining, the whole amount of rain does not reach the earth directly — for, the vegetable world; atmosphere and the sun-rays evaporate some amount of rain. When it rains, it is obstructed by so many things. This is called interception, by which though some amount of water gets evaporated, the rest flows over the surface of the earth and augments the volume of external water – level.

g) **Absorption:** Some amount of rain-water enters underground and is absorbed and wets the soil and it is called the moisture of the each. This process sometimes fails to wet the earth completely. Very after water level under-ground rises and wets the soil and as a result beyond the monsoon, the soil is found wet in other seasons too.

h) **Infiltration:** In some regions of the World, the water flowing over the earth and the ice-born water control the deposit of water underground. The process through which meteoric water by capillary strength enters underground is regarded as infiltration. The infiltration of water underground depends on natural characteristics. As for example the entrance of water into the deep recesses of stones, the blowing of wind underground, the amount of rain, the change of seasons and the nature of the plants etc. Directly or indirectly control the amount of water deposited on the surface of the earth.

i) **Soil-water:** When the rain-water mixes with the particles of dust and the soil gets wet through Capillary Action, the water of the earth is formed. The main source of the soil water is the rains. Some amount of this rain-water is deposited in the ocean as it flows over the surface of the earth; some amount gets evaporated and the rest enters underground through percolation.

j) **Ground Water:** The water deposited upon the impassable layers of the rocks underground is called ground water. This ground water is formed out of the entrance of water inside the ground. Infiltration of water increases during the monsoon and the water-level on the earth's surface rises and in dry seasons, it decreases and the water level goes downwards. The number of springs or fountains and the volume of the water are controlled by the upward rise and down-ward descent of the ground water. When the surface of the ground water remains above the surface of the river water. The supply of water happens in the riverbed and the river water increases. So during the dry seasons, the flow of ground water helps in maintaining the volume of river water. The flow of ground water happens in a very slow manner unlike river water and passing through rivers, ultimately falls into the seas. In the Hydrological Cycle, the ground water assumes a vital role.