

Aquatic ecosystems

1- Fresh water ecosystems

2- Lotic ecosystems

The **lotic** or flowing water habitats include all flowing inland water bodies such as **creeks, brooks, streams, rivers**, etc. The most outstanding features of such habitats is the continuously flowing water which molds the characteristics of the water bed and influences the distribution of organisms within.

Lotic ecosystems have two main zones, rapids and pools. Rapids are the areas where the water is fast enough to keep the bottom clear of materials, while pools are deeper areas of water where the currents are slower and silt builds up.

The ecology of flowing water is unique in many ways and is often shaped by the nature and behavior of the flowing water. A river, for example, is a flowing water body, usually unidirectional, with a source and an end. It is usually in constant physical change. At the source of the river, it is narrower in size, cold, fast-flowing, and rich in oxygen. Down to the end, it is usually wide in size, less oxygen, slow-moving, and warmer. That means life forms in a lotic system is not the same, as it depends on the following:

1. The nature and behavior of flowing water

- *The chemical makeup such as oxygen, pH, and alkalinity

- *The temperature of the water, depth of the water and how much sunlight can penetrate it, and so on

- *The velocity of the water

- *The stage of the river in its course. Flowing water at its source tend to flow very fast, while water at its end tend to flow very slowly with a lot of nutrients and particle deposition

- *The topography of the land (slopes, highlands, and lowlands)

2. The adaptation of its living organisms

With the above picture of flowing water in mind, how are living organisms (plants and animals) adapted to survive in these flowing water bodies?

Organisms in these waters have suckers and hooks that help them stick to the water-bed, rocks, or plants. Some of them also have a streamlined body that helps them swim against water currents. Plants such as diatoms, moss, and sponges attach themselves firmly with the substratum.

3. The living structure along the flowing water

Some other plants and animals do not live in the water but are a part of the ecosystem that exists in that flowing water. Small plants, insects, frogs, birds, and other animals that feed off the plants from the flowing water, in turn, provide organic material for life forms in the water. The trees provide shelter for the birds and animals and also provide shade for slowing down evaporation. Some plants and their root systems also filter the water from pollutants.

2.1. River

In order to differentiate between the lotic and lentic habitats let us see how rivers (lotic habitats), differ from lakes that represent the lentic habitat.

- 1-The rivers have a continuous - one directional flow with the entire volume of water flowing unidirectionally. In large rivers. the flow may be from one climatic zone to another.
- 2-The volume of river water keeps changing, causing variation in its velocity.
- 3-The water level of the rivers exhibit wide range of fluctuations.
- 4-Generally as a rule the depth of rivers is small as compared to lakes.
- 5-River waters usually flow in a narrow channel, though occasionally their channels may expand, to form river lakes.
- 6-The physical, chemical and biological conditions of the river gradually change with distance along the main channels in a definite direction.
- 7-The material transported or eroded by the rivers at any point. Is transported by them downstream with no supporting for return, thus causing their permanent removal.
- 8-In rivers prolonged stagnation is absent. Rivers in comparison to lakes depend more on the surrounding land for nutrients, manufacturing little basic food materials themselves.

What is a river?

A river forms as water moving from a higher elevation to a lower elevation, all due to gravity. When rain falls on the land, it either seeps into the ground or becomes runoff, which flows downhill into rivers and lakes, on its journey towards the seas. In most landscapes the land is not perfectly flat—it slopes downhill in some direction. Flowing water finds its way downhill initially as small creeks. As small creeks flow downhill they merge to form larger streams and rivers. Rivers eventually end up flowing into the oceans. If water flows to a place that is surrounded by higher land on all sides, a lake will form. If people have built a dam to hinder a river's flow, the lake that forms is a reservoir.

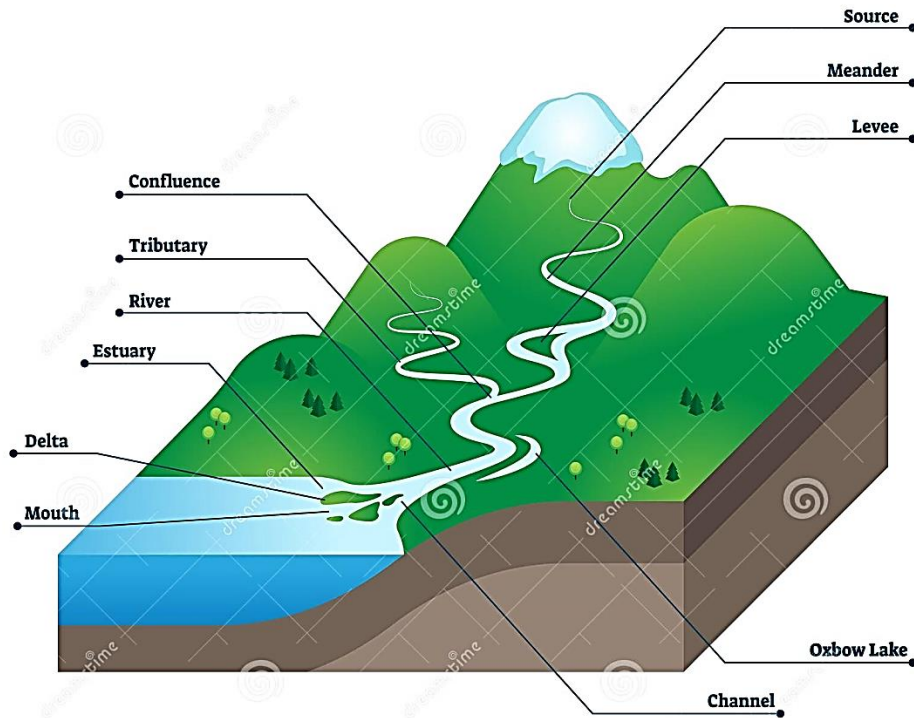
The two most important points are that :

- 1) Rivers are open or heterotrophic systems whereas lakes are closed or self-contained systems except for some gains or losses from inflowing or outflowing streams; and
- 2) Nutrients in a lake may be used several times whereas in rivers. At any point, plants and animals must avail of temporarily available nutrients.

Characteristics of River Systems

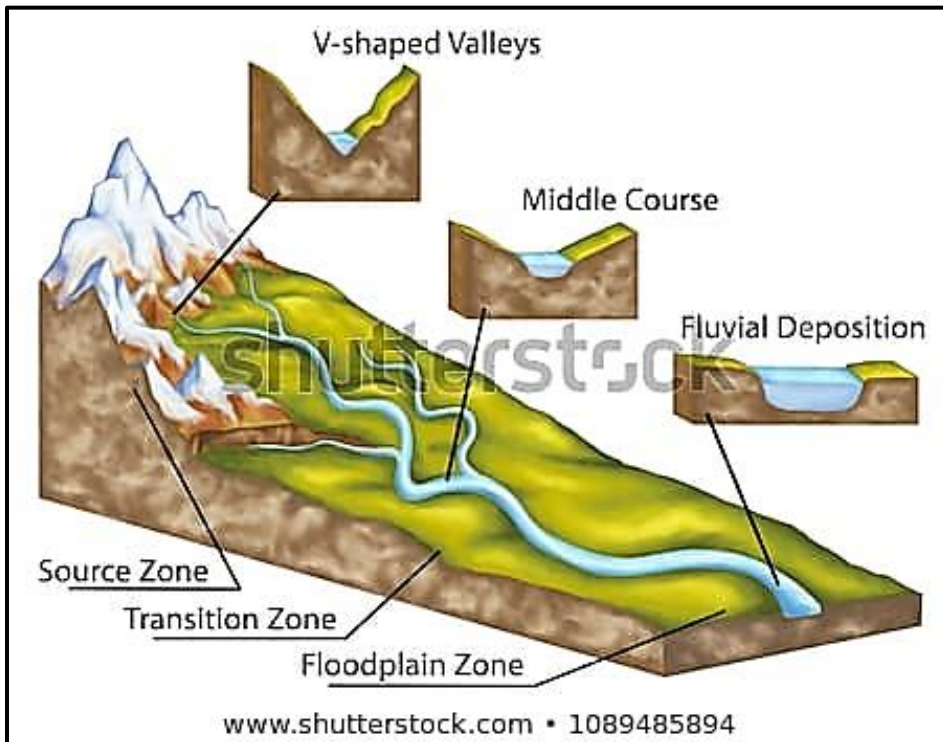
The basic function of the rivers is to convey surplus rain water from land to sea. Annually the rivers carry fresh water, equivalent to 25 cm of rain, evenly distributed over the whole land surface. The point of origin of the river is the '**source**'; the path it takes, is the '**course**'; the streams which join it along the course are the '**tributaries**'; and the channel within which it flows is the '**bed**'. Its point of entry into the sea or lake or estuary is called its **mouth**.

RIVER SYSTEMS



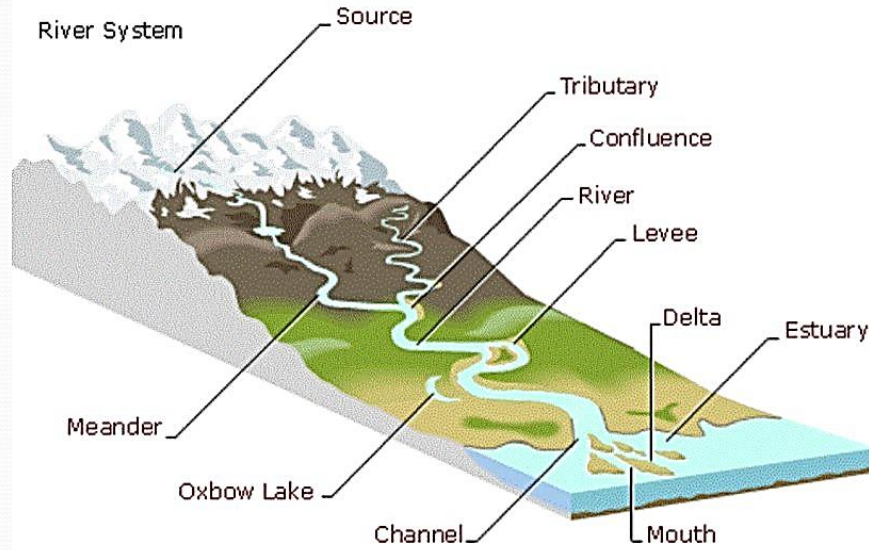
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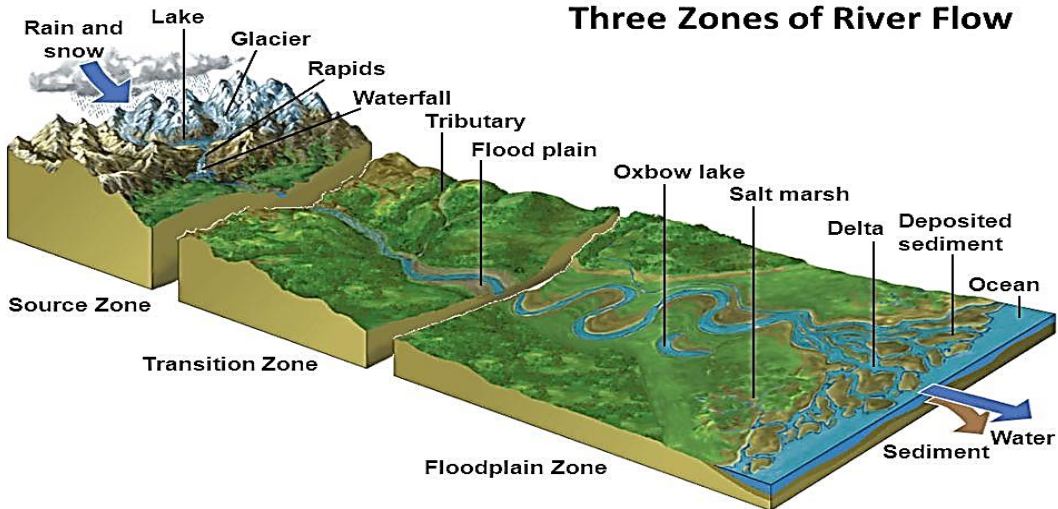


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River Systems



Three Zones of River Flow



Stepped Art
Fig. 8-18, p. 183

Classification of the river zones

Classification of the river course on basis of physical characteristics

The river is divided into three parts

- i) The upper or mountain course :** Here the water is fast flowing and runs through a 'V' shaped valley with unstable banks. The fast flowing water has great erosive powers, particularly after rains, being able to move large stones and roll them along. Angular stones washed into the river are rubbed against one another, to form rounded pebbles.

- ii) The middle course :** The middle course of the river occurs over the foothill belt where the velocity of water is comparatively less which moves a little slowly. However, the waters are still fast enough to transport sand, silt and mud in suspension, and to roll pebbles along its bed. In this part of the river course, the valley is broad with stable sides, so that the river cannot erode the land, as much as it does in the mountain course. Most of the transportation of silt is achieved by this part of the river.

- iii) The lower course :** The lower course of the river occurs in the plains, across which it meanders or zigzags slowly. The river here loses much of its velocity and thus much of its ability to carry heavier sand and silt in suspension. It, therefore, deposits part of its silt load as sand banks or shingle beaches and builds up large flat plains by spreading alluvium over a wide flood plain or delta.

Three aquatic life zones, each with different conditions, can be identified along stream flow.

1. **The source zone (headwater streams):** Often begins as springs or snowmelt, is narrow and fast moving. The water here cold, clear, carries little sediment and contains relatively few nutrients. It dissolves large amounts of oxygen from air, and most plants are attached to rocks. Light is available, but is not very productive. channels usually narrow, current is swift and substrate is rocky.

2. **The transition zone:** forms wider, deeper streams that flow down gentler slopes and the streams join to form tributaries, The water is warmer, less clear due to it carries more sediment. On the other hands, water with more nutrients, which supports more producers, but has slightly lower dissolved oxygen, substrate begins to accumulate silt.

3. **The floodplain zone:** Tributaries join to form rivers, it has wider, deeper rivers which empty into oceans at estuaries. Water temperature is warmer; less dissolved oxygen is present and flow is slow. Water is murky (dark) and turbid due to carries substantially more sediment, contains substantially more nutrients, channels wider, wide

mouth, current relatively slow, substrate silty from deposition of sediment. There may be fairly large numbers of producers such as algae, cyanobacteria and rooted plants.

Biota of Rivers

The biota of both the rapidly flowing and the slowly flowing sections of the river are very distinct and so studied separately. Let us study the biota characteristic of each

1) RAPIDLY FLOWING WATERS

In the rapidly flowing section of the river, the water current is the dominant feature. Everything that is not attached or weighed is swept away, including organisms and sediments alike. The substratum tends to be either gravel or rock whose fragments are smoothed and rounded by the water. The habitat itself is diverse, as different microhabitats occur here:

- a) on the surface of rock fragments
- b) between rock fragments and
- c) beneath rock fragments.

The differences in these microhabitats are due to the differences in the force of water currents occurring in each of them. As a result each microhabitat houses different types of organisms.

a) **Animals** : In the exposed rock surface habitats only those organisms are found which have an efficient mechanisms for staying in one place. In fact despite adaptations for staying put, many individuals of species do get swept away. Animals found here include fresh water limpet, larvae or water penny (riffle beetles), fresh water sponges and caddis flies, all specially adapted to this environment.

The microhabitat formed in the spaces between rock fragments is slightly sheltered. Here occur the stone fly and dragonfly both of which are flattened and have behavioral adaptations to hold them in place. In addition to these, the larvae of insect hellgrammite is found here, which avoid being swept away by being large and covered with spines.

In the Microhabitat beneath rocks, where current is weak, occur animals which though they have basic adaptations for staying in the rapidly flowing water, are not as highly adapted as members of the two other microhabitats. Animals found here are annelids, flatworms, clams, some snail species and other insect larvae.

In the rapidly flowing habitat, nekton occur only in areas where current is not too strong and include cold water fish species such as trout or salmon. In areas where the current is very strong nekton are absent.

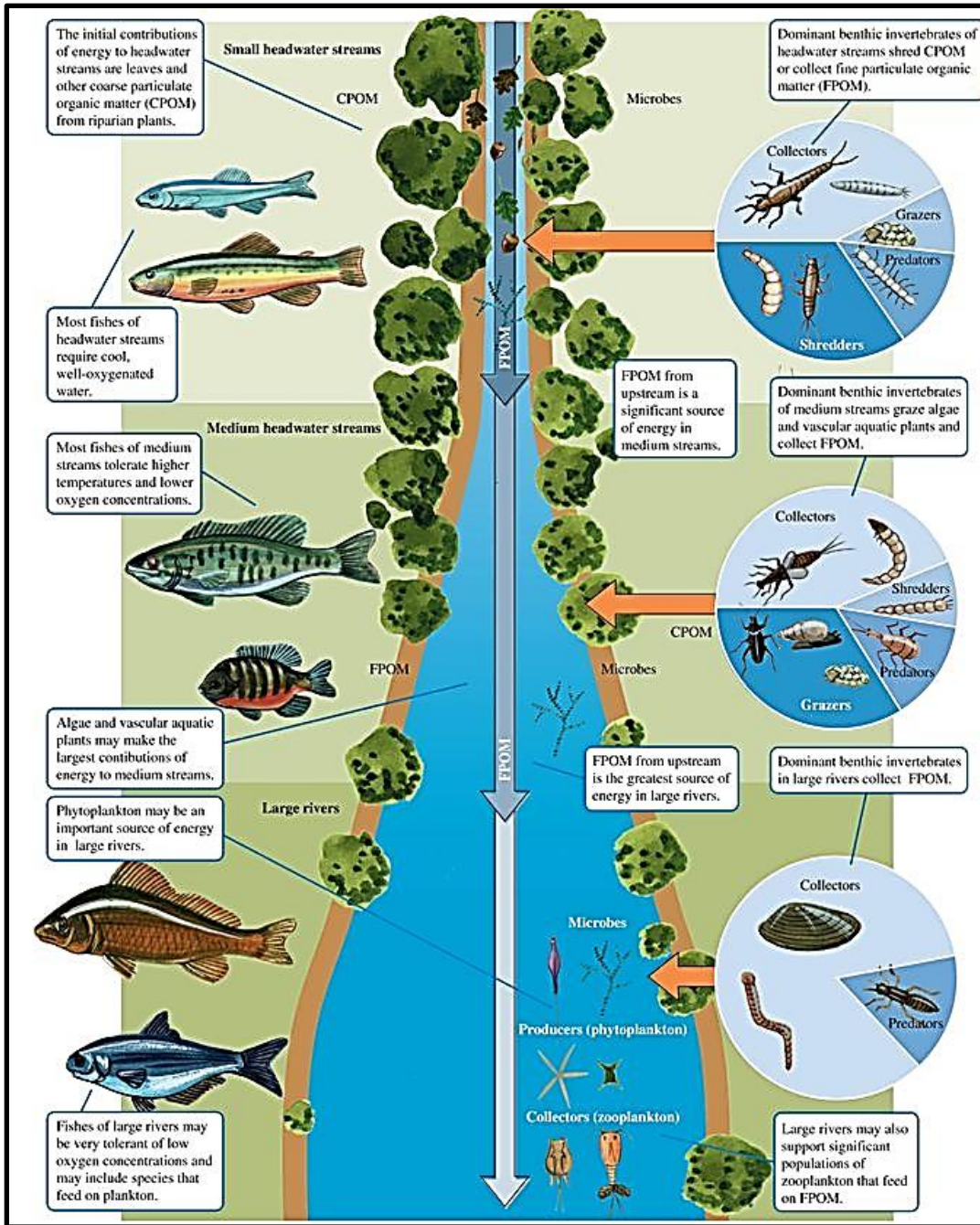
b) **Plants** : Among the plants only small, well attached forms, such as sessile algae can survive here. Thus, due to the presence of only a few plants, the nutrient base for animals here is organic detritus washed into the river from the drainage area.

2) SLOW MOVING WATERS

a) **Animals** : Zooplankton are common here and include an assemblage of protozoa and smaller crustacean, such as water flies, and copepods. Neuston occurring here are several insects such as water striders, water boatman and backswimmers, all of which spend most of their time at the surface of the stream. The nekton are numerous and include large crustaceans like the fresh water shrimp and many types of insects and fishes such as catfish all of which are different species from those of the fast water regions. The benthos here include the snow bugs, mayfly naiads and dragonfly naiads which occur on the surface of the benthic region and the tubeworms, naiads of burrowing mayflies and rotifers which bury into it.

b) **Plants** : Plant life is abundant in this habitat and includes rooted vascular plants such as pond weeds and grasses, firmly attached aquatic mosses and multicellular filamentous algae. Minute floating plants such as duck weeds may cover most of the surface of the slow moving streams especially in the slowest backwaters.

Motile algae, such as diatoms and flagellates may abound in the open water. As plants are more in this habitat the productivity is comparatively higher than that of the rapid waters and so the community here is relatively less dependent on nutrients from outside.



What are the types of Rivers?? (Homework)