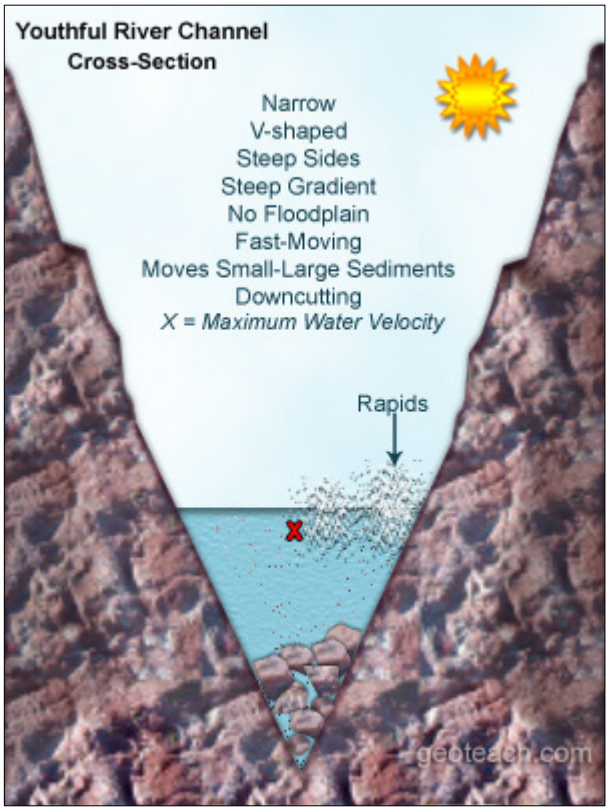
Young Rivers



Classifying Rivers

Rivers are classified into 3 distinct "life stages": Young (Youthful) Rivers, Mature Rivers and Old Age Rivers. What follows is a list of distinct characteristics that set an Young River stage apart from that of a Mature River or Old Age River.

The Young River

Exciting and dynamic are 2 words one might use to describe a river in its early stages. Rafters seeking an exciting ride will surely gravitate towards a young river for their recreational thrills.

Characteristically youthful rivers are found at higher elevations, in mountainous areas, where the slope of the land is steeper. Water that flows over such a landscape will flow very fast.
Youthful rivers can be a tributary of a larger and older river, hundreds of miles away and, in fact, they may be close to the headwaters (the beginning) of that larger river.

Upon observation of a Youthful River, here is what one might see:

1. The river flowing down a steep gradient (slope).
2. The channel is deeper than it is wide and V-shaped due to downcutting rather than lateral (side-to-side) erosion.
3. Its velocity is fast and strong which is...
4. Capable of moving all sediment sizes from ions in solution, to silts and clays, also cobbles and boulders.
5. Steep sided cliffs flank the river.
6. A floodplain does not exist. There are no grassy areas beside the river where a person can walk.
7. Rapids may be present due to the water velocity and the presence of boulders in the channel. Waterfalls are also a feature of a young river.
8. Erosion is prominent over deposition.

Erosion and Young Rivers

River velocity is strong and rivers swiftly run their course. Erosion is primarily down rather than side-to-side. Rivers downcut into hard bedrock below, deepening their channels into a V-shape.

Steep walls of rock rise up on each side of the river and, in many cases, there is no land beside the river on which one could even take a walk. Floodplains are absent.

The photo to the left shows the Arkansas River as it travels through the Royal Gorge in Cañon City, Colorado. The river has downcut a gorge that is approximately 1,053 feet deep. There is a very narrow area next to the river where the Royal Gorge Train Route parallels the water but, in one location, the river bottom is so narrow that a *hanging bridge* was constructed where the train passes *over* the river water. Looking up, from the bottom of the gorge, the suspension bridge that traverses the river is visible.

The Exciting and Dynamic Side of Youthful Rivers

The presence of boulders on the streambed, combined with the swift water velocity, creates an exciting scenario for those who enjoy river rafting trips.

There are no dangerous waterfalls present along this section of the Arkansas River but waterfalls are not uncommon in Youthful Rivers are sometimes part of the excitement.

The photo to the left was taken in October, 2005 and the river's discharge was fairly low at the time. The Arkansas River, which is fed by spring snowmelt, runs more swiftly in the spring and early summer.

Greatest Velocity in a River Cross-Section

The Red "X" in the Diagram:

The **red "X"** in the large Young River illustration at the top of this page *marks the location where the river water flows the absolute fastest.* Despite whatever overall speed a river may be maintaining, in a cross-sectional consideration of river velocity, the water molecules are not all moving at the same speed. This is mainly due to *frictional drag*.

When a moving object comes in direct contact with another object, friction tends to slow down movement, reducing speed. At all locations where the river water comes in contact with the sides and bottom of the stream channel, there is frictional drag. Also, where the surface of the water comes into contact with the air, there is frictional drag.

The fastest moving water within the channel is located: dead center and just below the surface.

This area is as far away from contact with land surfaces as possible, yet removed from contact with the air.

How do Young Rivers Transport their Sediments?

Young Rivers are able to transport sediments in all of the ways listed in the next section.
Should their water velocity increase, such as after spring snowmelt and/or periods of heavy precipitation, young rivers are capable of transporting very large boulders downstream.

In any river stage, sediments are carried in the following ways:

Pebbles, Cobbles and Boulders *(Bedload):* Travel by rolling, sliding and bouncing along the streambed.
Sand-Sized Particles *(Bedload)**:*** Move by *Saltation*. Small grains bounce along the river bottom, as if in a "colliding and jumping" motion.
Silts and Clay *(Suspended Load)**:*** These are carried in *Suspension*.
Salts and Ions *(Dissolved Load)**:*** These particles are carried in *Solution*.

Sediment Speed

- Sediments *never* travel faster than the river water itself.
Dissolved salts travel at the same speed as the water.
- Bedload and suspended sediments always travel slower than the river water.

Velocity, Sediments, Erosion & Deposition - Saying it Simply

The faster the water velocity, means the more sediments and also the larger sediments a river can transport:

- **Increased River Velocity = Larger Sediments + Increased Volume of Sediments + Increased Erosion**
- **Decreased River Velocity = Smaller Sediments + Decreased Volume of Sediments + Increased Deposition**

For ***an excellent animation*** showing **Sediment Transport** you can visit the following webpage: **Observe how sediment is transported by flowing water**.

Vocabulary that Relates to Rivers

Bank: as in River Bank: The margins of a channel. Banks are called right or left as viewed facing in the direction of the flow.
Bedload: The larger heavier particles that are being transported by a stream. Instead of being dissolved or suspended, these are being rolled or bounced along, spending at least part of their time in contact with the stream bottom.
Bedrock: Solid rock present beneath any soil, sediment or other surface cover. In some locations it may be exposed at Earth's surface.
Channel (watercourse): An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water.
Delta: A deposit of sediment that forms where a stream enters a standing body of water such as a lake or ocean. The name is derived from the Greek letter “delta” because these deposits typically have a triangular shape in map view.
Deposition: The settling from suspension of transported sediments. Also, the precipitation of chemical sediments from mineral rich waters. In a river system, deposition is found on the inside curves where water velocity is slowest.
Discharge: The volume of water in a flowing stream that passes a given location in a unit of time. Frequently expressed in cubic feet per second or cubic meters per second. Calculated by the formula Q = A x V where Q is the discharge, A is the cross sectional area of the channel and V is the average velocity of the stream.
Downcutting: Refers to river erosion that cuts down into the bedrock below. Such erosion deepens channels, creating a V-shape.
Erosion: A general term applied to the wearing away and movement of earth materials by gravity, wind, water and ice. In a river system, erosion is more active on outside curves where water velocity is fastest.
Flood Plain: An area of alluvium-covered, relatively level land along the banks of a stream that is covered with water when the stream leaves its channel during a time of high flow.
Headwater(s): The upper portions of a drainage basin where the tributaries of a stream first begin flow.
Lateral Erosion: is common to mature and old age rivers where meanders erode the sides of a river's channel, widening the channel while creating an ever-widening floodplain during intermittent periods of flooding.
Levee: A long continuous ridge built by people along the banks of a stream to contain the water during times of high flow. Natural levees can also be built along the banks of a stream. When the flood water decelerates upon leaving the channel, sediments quickly drop out of suspension and build a ridge over time.
Meander: The bend in a stream.

Meandering Stream: A stream that has many bends (meanders). This type of drainage pattern usually develops on a nearly level landscape and where the banks of the stream are easily eroded.
Mouth: The lower portion of a drainage basin where a river ends and deposits its bedload in a lake or ocean.
Old Age: A stage in the development of a landscape when streams have a low gradient (slope) and meander back and forth across broad floodplains. The landscape is marked by meander scars, oxbow lakes, levees, point bars and swamps. Its course is graded to base level and running through a peneplain, or broad flat area.
Oxbow Lake: A crescent-shaped lake that forms when a meandering stream changes course. Such changes in course frequently occur during flood events when overbank waters erode a new channel.
Peneplain: A nearly flat land surface representing an advanced stage of erosion
Point Bar: A sand bar that develops on the inside curve of a meander bend due to the slowing of river velocity on the inside curves and resulting loss of a portion of bedload (sediments).
Sediment: A loose unconsolidated deposit of weathering debris, chemical precipitates or biological debris that accumulates on Earth's surface.
Swamp: Seasonally flooded land; A lowland region saturated with water.
Streambed: A channel occupied (or formerly occupied) by a stream
Tributary: A stream or river that flows into a larger river.
Yazoo Stream: A tributary that parallels the main channel for a considerable distance. Joining of these streams is normally blocked by a natural levee along the larger stream.
Youthful River: The earliest stage in the development of a landscape. During this stage streams are actively downcutting and flowing straight for long distances with frequent waterfalls and rapids. The valleys are typically steep sided and v-shaped.

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Science in Your Watershed, General Introduction and Hydrologic Definitions, W. B. Langbein and Kathleen T. Iseri, Manual of Hydrology: Part 1. General Surface-Water Techniques, USGS, 1872, 1995
The Free Dictionary.Com

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