

Earth Science

Chapter 15 – River Systems

Section 2 – Stream Erosions

STANDARDS:

SES1. Students will investigate the composition and formation of Earth systems, including the Earth's relationship to the solar system.

e. Identify the transformations and major reservoirs that make up the rock cycle, hydrologic cycle, carbon cycle, and other important geochemical cycles.

SES3. Students will explore the actions of water, wind, ice, and gravity that create landforms and systems of landforms (landscapes).

a. Describe how surface water and groundwater act as the major agents of physical and chemical weathering.

SES6. Students will explain how life on Earth responds to and shapes Earth systems.

a. Relate the nature and distribution of life on Earth, including humans, to the chemistry and availability of water.

b. Explain how geological and ecological processes interact through time to cycle matter and energy, and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion).

Objectives

- **Summarize how a river develops.**
- **Describe the parts of a river system.**
- **Explain factors that affect the erosive ability of a river.**
- **Describe how erosive factors affect the evolution of a river channel.**

Parts of a River System

tributaries - a stream that flows into a lake or into a larger stream

watershed the area of land that is drained by a river system

- **A river system is made up of a main stream and tributaries.**
- **The ridges or elevated regions that separate watersheds are called *divides*.**
- **The relatively narrow depression that a stream follows as it flows downhill is called its *channel*.**
- **The edges of a stream channel that are above water level are called the stream's *banks*.**
- **The part of the stream channel that is below the water level is called the stream's *bed*.**
- **A stream channel gradually becomes wider and deeper as it erodes its banks and bed.**

Channel Erosion

- **River systems change continuously because of erosion.**
- **In the process of *headward erosion*, channels lengthen and branch out at their upper ends, where run off enters the streams.**
- **In the process known as *stream piracy*, a stream from one watershed is "captured" by a stream from another watershed that has a higher rate of erosion.**
- **The captured stream then drains into the river system that has done the capturing.**

Stream Load

stream load - the materials other than the water that are carried by a stream

- **A stream transports soil, loose rock fragments, and dissolved mineral as it flows downhill.**
- **Stream load takes three forms: suspended load, bed load, and dissolved load.**

Stream Discharge

- discharge the volume of water that flows within a given time
- The faster a stream flows, the higher its discharge and the greater the load that the stream can carry.
- A stream's velocity also affects how the stream cuts down and widens its channel. Swift streams erode their channels more quickly than slow-moving streams do.

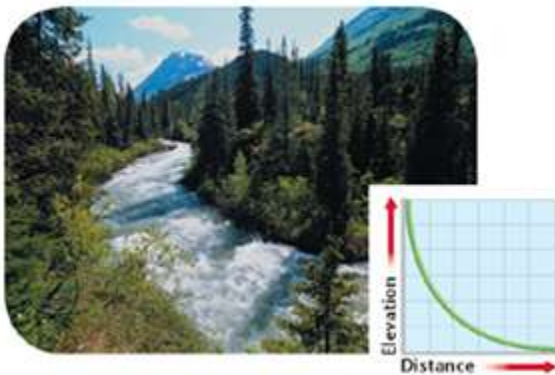
Stream Gradient

gradient - the change in elevation over a given distance

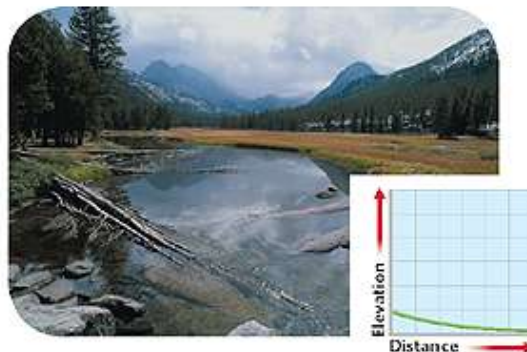
- Near the *headwaters*, or the beginning of a stream, the gradient generally is steep. This area of the stream has a high velocity, which causes rapid channel erosion.
- As the stream nears its *mouth*, where the stream enters a larger body of water, its gradient often becomes flatter.

The image below shows stream gradients and channel erosion.

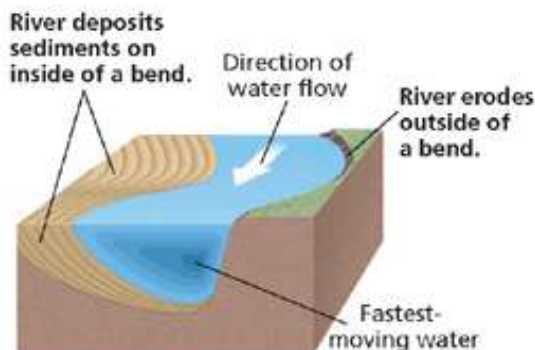
Steep-Gradient Stream



Low-Gradient Stream



Channel Erosion



Evolution of River Channels

Meandering Channels

Meander - one of the bends, twists, or curves in a low-gradient stream or river

- When a river rounds a bend, the velocity of the water on the outside of the curve increases. However, on the inside of the curve, the velocity of the water decreases.
- This decrease in velocity leads to the formation of a *bar* of deposited sediment, such as sand or gravel.
- As this process continues, the curve enlarges while further sediment deposition takes place on the opposite bank, where the water is moving more slowly.
- Meanders can become so curved that they almost form a loop, separated by only a narrow neck of land.
- When the river cuts across this neck, the meander can become isolated from the river, and an *oxbow lake* forms.

READING CHECK

How would you describe the gradient of a river that has meanders?

A river that has meanders probably has a low gradient.

Braided Streams

braided stream - a stream or river that is composed of multiple channels that divide and rejoin around sediment bars

- Braided streams are a direct result of large sediment load, particularly when a high percentage of the load is composed of coarse sand and gravel.
- Although braided streams look very different from meandering streams, they can cause just as much erosion.