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- To View the presentation as a slideshow with effects select "View" on the menu bar and click on "Slide Show."
- To advance through the presentation, click the right-arrow key or the space bar.
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- From the Chapter menu screen click on any lesson to go directly to that lesson's presentation.
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End Of Slide

Resources

Chapter Presentation

Visual Concepts

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Standardized Test Prep

Brain Food Video Quiz

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End Of Slide

Objectives

- **Outline** the stages of the water cycle.
- **Describe** factors that affect a water budget.
- **List** two approaches to water conservation.

End Of Slide

Movement of Water on Earth

water cycle the continuous movement of water between the atmosphere, the land, and the oceans

- More than two-thirds of Earth's surface is covered with water.
- In the atmosphere, water occurs as an invisible gas. This gas is called *water vapor*. Liquid water also exists in the atmosphere as small particles in clouds and fog.
- Earth's water is constantly changing from one form to another.

End Of Slide
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Resources

Movement of Water on Earth, *continued*

Evapotranspiration

evapotranspiration the total loss of water from an area, which equals the sum of the water lost by evaporation from the soil and other surfaces and the water lost by transpiration from organisms

- Each year, about 500,000 km^3 of water evaporates into the atmosphere. About 86% of this water evaporates from the ocean.
- Water vapor also enters the air by *transpiration*, the process by which plants and animals release water vapor into the atmosphere.

End Of Slide

Movement of Water on Earth, *continued*

Condensation

condensation the change of state from a gas to a liquid

- When water vapor rises in the atmosphere, it expands and cools.
- As the vapor becomes cooler; some of it condenses, or changes into tiny liquid water droplets, and forms clouds.

End Of Slide
Chapter menu
Resources

Movement of Water on Earth, *continued*

Precipitation

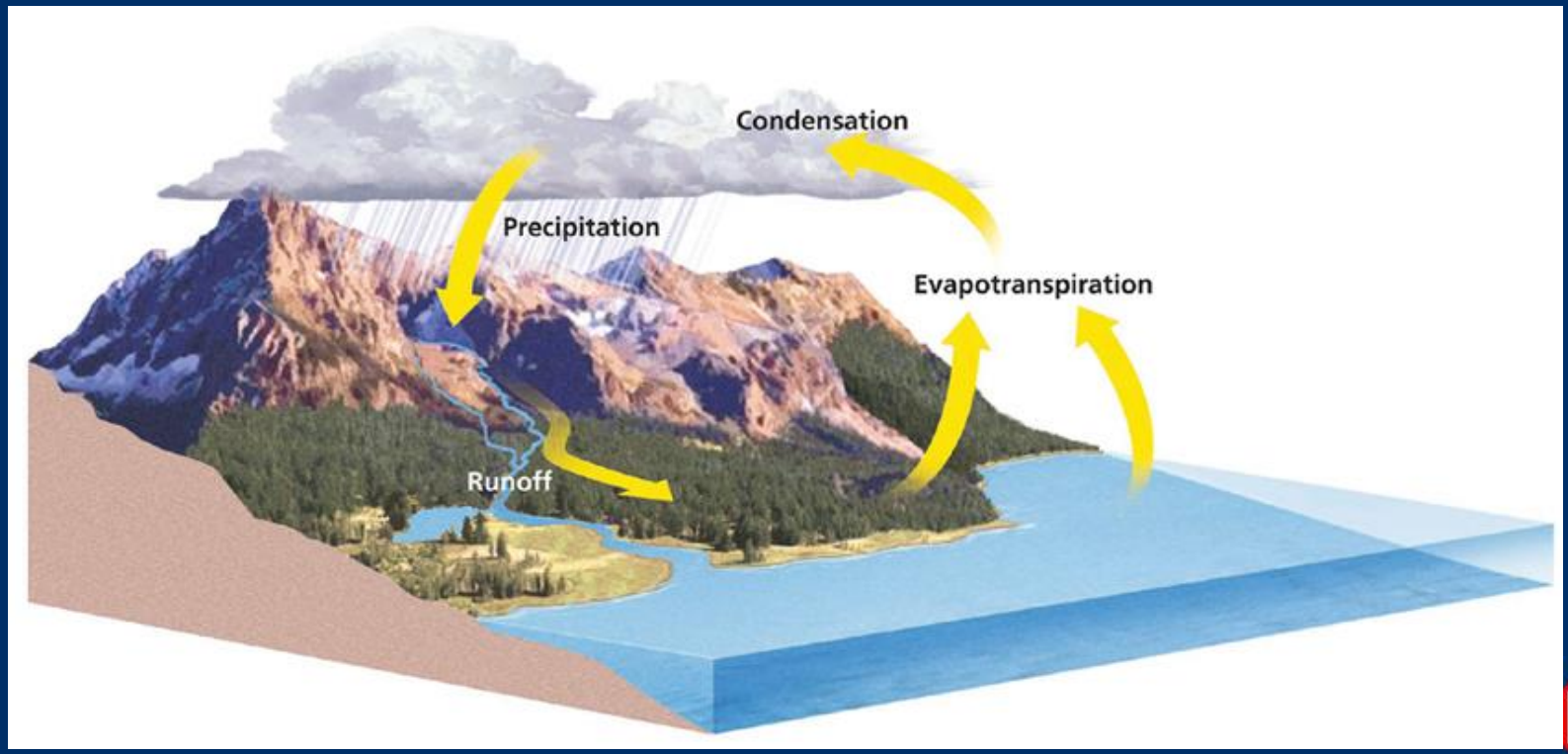
precipitation any form of water that falls to Earth's surface from the clouds; includes rain, snow, sleet, and hail

- About 75% of all precipitation falls on Earth's oceans. The rest falls on land and becomes runoff or groundwater.
- Eventually, all of this water returns to the atmosphere by evapotranspiration, condenses, and falls back to Earth's surface to begin the cycle again.

End Of Slide

Movement of Water on Earth, *continued*

The image below shows the water cycle.



End Of Slide
Chapter menu
Resources

Reading check

List the forms of precipitation.

End Of Slide

Reading check

List the forms of precipitation.

Precipitation is any form of water that falls to Earth from the clouds, including rain, snow, sleet, and hail.

End Of Slide

Water Budget

- In Earth's water budget, precipitation is the income. Evapotranspiration and runoff are the expenses.
- The water budget of Earth as a whole is balanced because the amount of precipitation is equal to the amount of evapotranspiration and runoff.
- However, the water budget of a particular area, called the *local water budget*, is usually not balanced.

End Of Slide
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Resources

Water Budget, *continued*

Factors That Affect the Water Budget

- Factors that affect the local water budget include temperature, vegetation, wind, and the amount and duration of rainfall.
- The factors that affect the local water budget vary geographically.
- The local water budget also changes with the seasons in most areas of Earth.

End Of Slide

Water Budget, *continued*

Water Use

- On average, each person in the United States uses about 95,000 L (20,890.5 gal) of water each year.
- As the population of the United States increases, so does the demand for water.
- About 90% of the water used by cities and industry is returned to rivers or to the oceans as wastewater.
- Some of this wastewater contains harmful materials, such as toxic chemicals and metals.

End Of Slide

Water Budget, *continued*

Conservation of Water

- Scientists have identified two ways to ensure that enough fresh water is available today and in the future.
- One way is through conservation or the wise use of water resources.
- A second way to protect the water supply is to find alternative methods of obtaining fresh water.

End Of Slide

Water Budget, *continued*

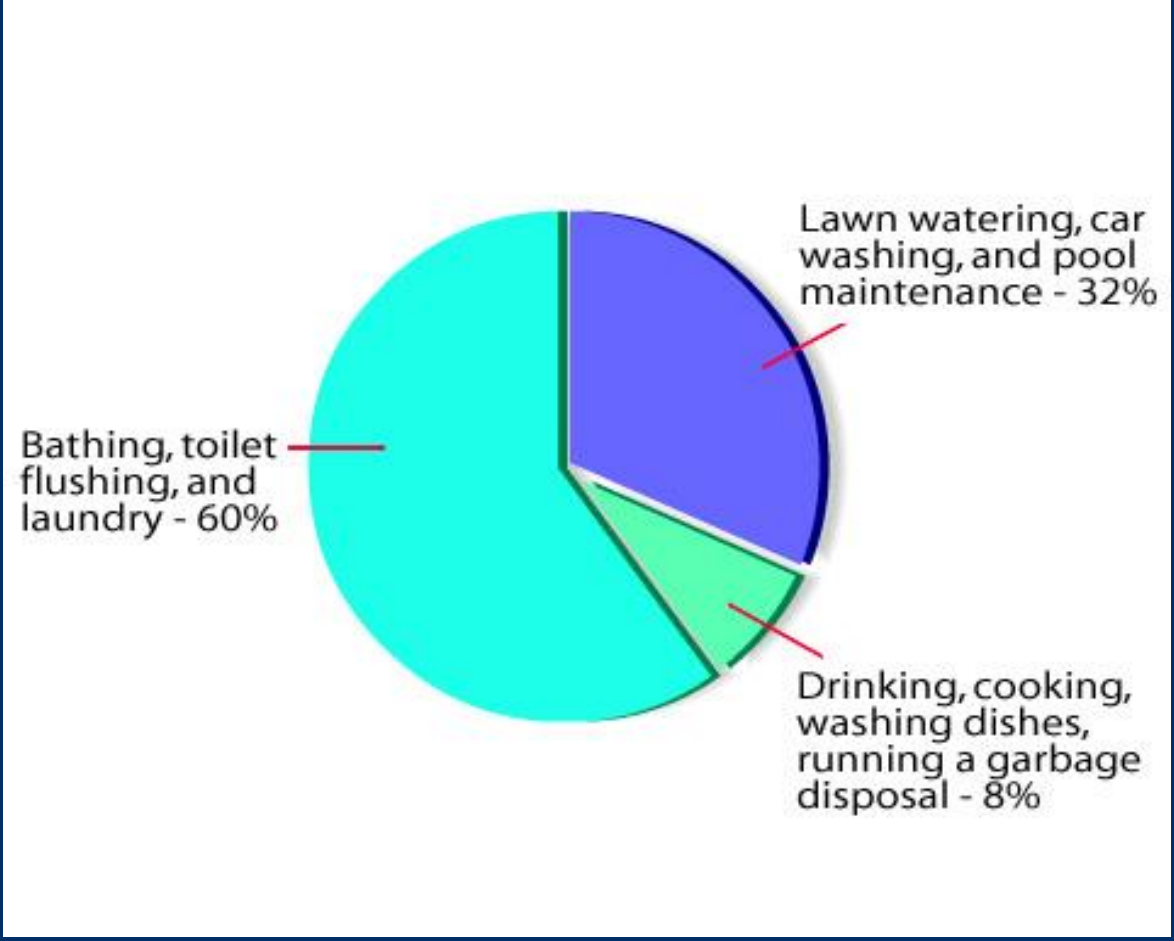
Conservation of Water, continued

desalination a process of removing salt from ocean water

- Desalination is expensive and is impractical for supplying water to large populations.
- Currently, the best way of maintaining an adequate supply of fresh water is the wise use and conservation of the fresh water that is now available.

End Of Slide

Water Use in Households



End Of Slide

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.

End Of Slide

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.*

End Of Slide


C A N A D A
MONTANA
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
WYOMING
NEBRASKA
IOWA
ILLINOIS
INDIANA
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
TENNESSEE
GULF OF MEXICO
MISSISSIPPI RIVER BASIN ALLIANCE
MISSISSIPPI ALLIANCE RIVER BASIN
MAP OF THE
MISSISSIPPI RIVER WATERSHED
JUNE 2004


Lake Superior
MICHIGAN
WISCONSIN
Iron Mountain
Kingsford
Menominee
Marinette
Green Bay
Lake Michigan

Parts of a River System, *continued*

- 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.

End Of Slide

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.

End Of Slide

Chapter menu

Resources

Channel Erosion, *continued*

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.

Channel Erosion, *continued*

Stream Load, *continued*

- The *suspended load* consists of particles of fine sand and silt. The velocity, or rate of downstream travel, of the water keeps these particles suspended, so they do not sink to the stream bed.
- The *bed load* is made up of larger, coarser materials, such as coarse sand, gravel, and pebbles. This material moves by sliding and jumping along the bed.
- The *dissolved load* is mineral matter transported in liquid solution.

End Of Slide
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Resources

Channel Erosion, *continued*

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.

End Of Slide
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Channel Erosion, *continued*

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.

End Of Slide
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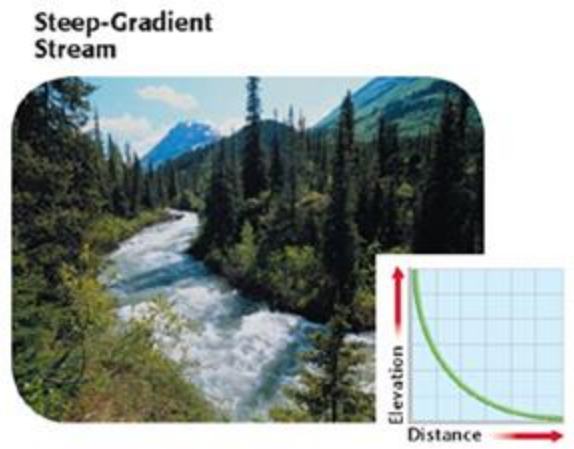
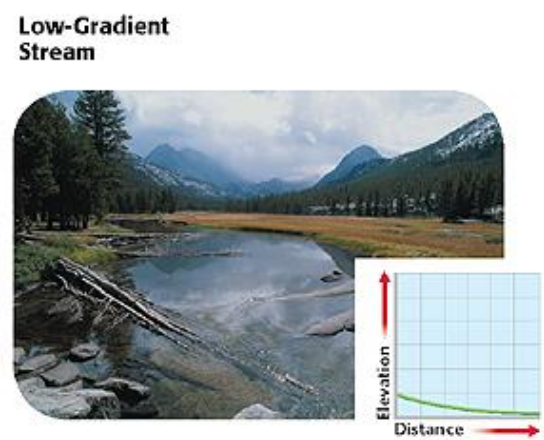
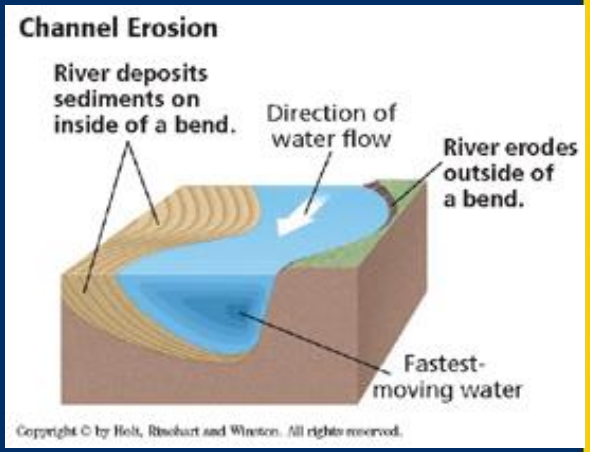
Channel Erosion, *continued*

The image below shows stream gradients and channel erosion.







End Of Slide

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 increase. 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.

End Of Slide

Evolution of River Channels, *continued*

Meandering Channels, *continued*

- 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.

End Of Slide
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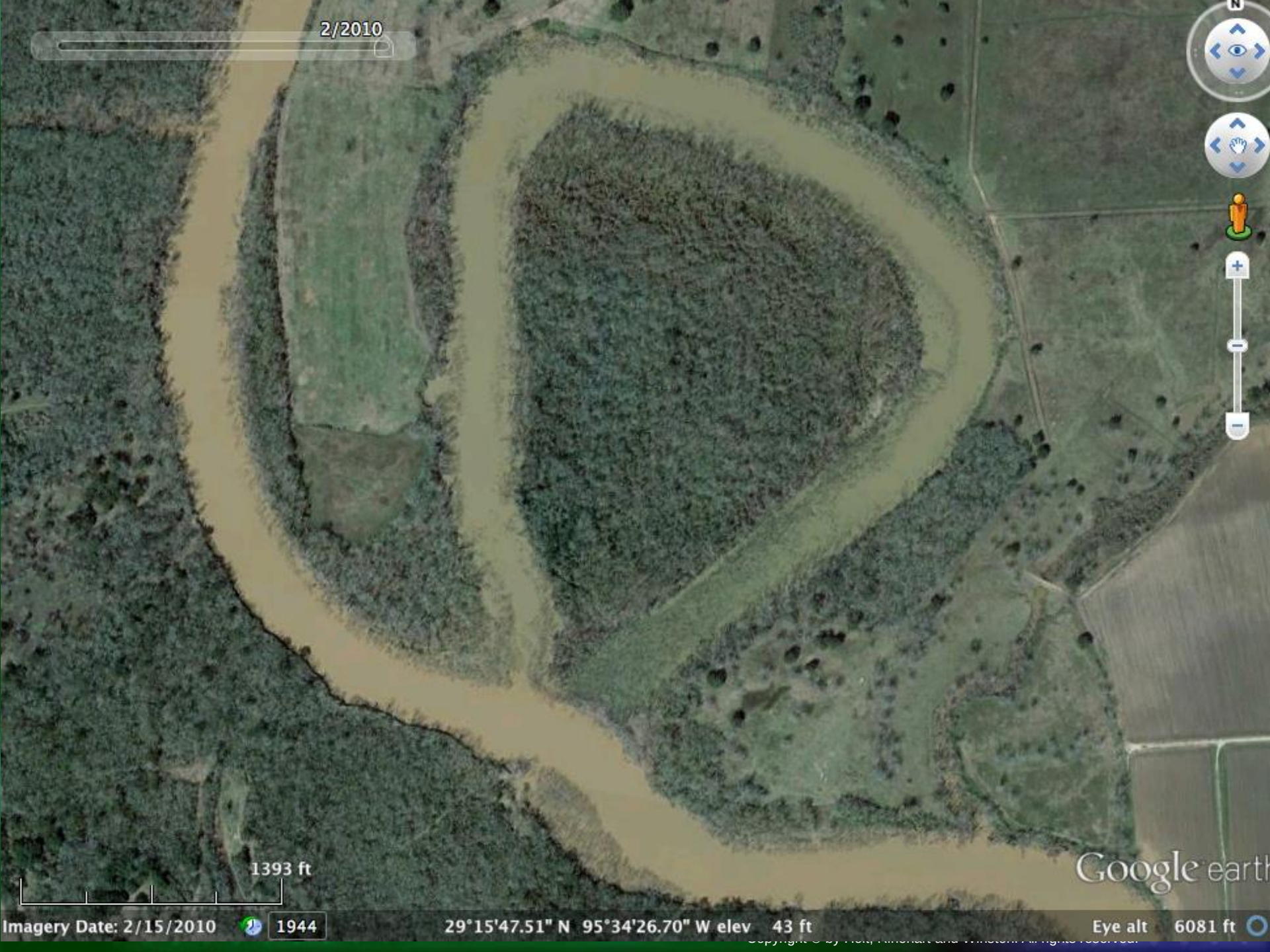

2/2010
1393 ft
Google earth
Imagery Date: 2/15/2010
1944
29°15'47.51" N 95°34'26.70" W elev 43 ft
Eye alt 6081 ft

Reading Check

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

End Of Slide

Reading Check

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

A river that has meanders probably has a low gradient.

End Of Slide

Evolution of River Channels, *continued*

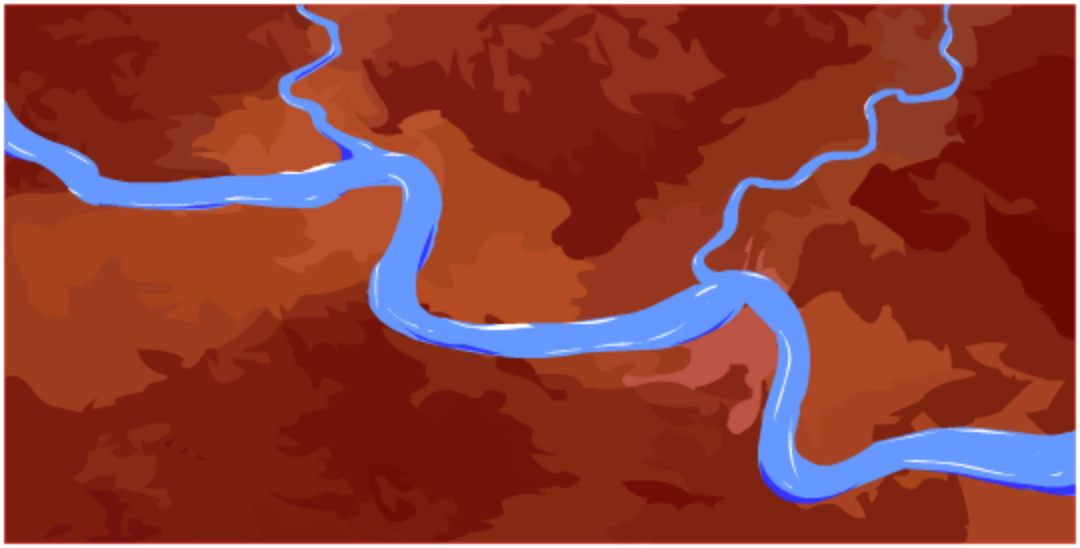
Braided Streams

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.

End Of Slide

Tributary, River System, and Drainage Basin



Objectives

- **Explain** the two types of stream deposition.
- **Describe** one advantage and one disadvantage of living in a floodplain.
- **Identify** three methods of flood control.
- **Describe** the life cycle of a lake.

End Of Slide

Deltas and Alluvial Fans

delta a fan-shaped mass of rock material deposited at the mouth of a stream; for example, deltas form where streams flow into the ocean at the edge of a continent

Chapter Menu

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Deltas and Alluvial Fans, *continued*

alluvial fan a fan-shaped mass of rock material deposited by a stream when the slope of the land decreases sharply; for example, alluvial fans form when streams flow from mountains to flat land

- When a stream descends a steep slope and reaches a flat plain, the speed of the stream suddenly decreases. As a result, the stream deposits some of its load on the level plain at the base of the slope.
- Alluvial fans differ from deltas in that alluvial fans form on land instead of being deposited in water.

End Of Slide

Floodplains

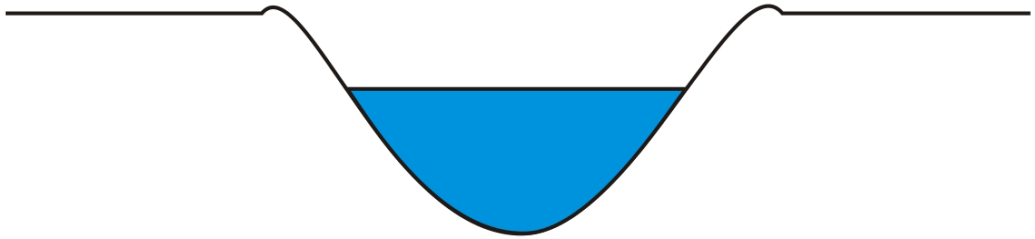
floodplain an area along a river that forms from sediments deposited when the river overflows its banks

- The volume of water in nearly all streams varies depending on the amount of rainfall and snowmelt in the watershed.

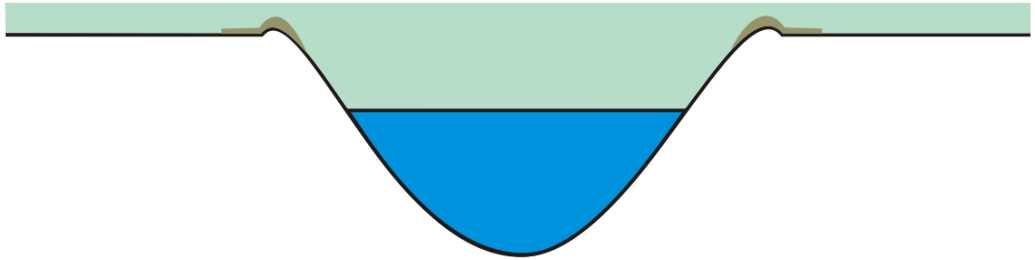
Floodplains, *continued*

Natural Levees

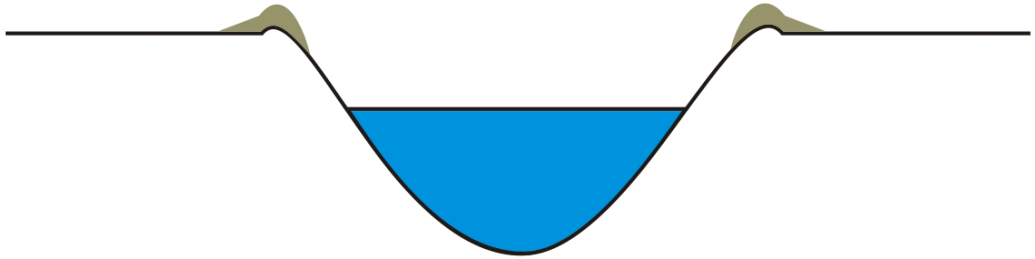
- When a stream overflows its banks and spreads out over the floodplain, the stream loses velocity and deposits its coarser sediment load along the banks of the channel.
- The accumulation of these deposits along the banks eventually produces raised banks, called *natural levees*.



A stream within its banks



A stream at flood stage deposits large particles along its banks



After many floods, natural levees been built up along stream banks

Floodplains, *continued*

Finer Flood Sediments

- Finer sediments are carried farther out into the floodplains by the flood waters and are deposited there.
- A series of floods produces a thick layer of fine sediments, which becomes a source of rich floodplain soils.

End Of Slide

Human Impacts on Flooding

- Human activity can contribute to the size and number of floods in many areas.
- Vegetation, such as trees and grass, protects the ground surface from erosion by taking in much of the water that would otherwise run off.
- Logging and the clearing of land for agriculture or housing development can increase the volume and speed of runoff, which leads to more frequent flooding.

End Of Slide

Flood Control

- Indirect methods of flood control include forest and soil conservation measures that prevent excess runoff during periods of heavy rainfall.
- More-direct methods include the building of artificial structures that redirect the flow of water.
- The most common method of direct flood control is the building of *dams*. Another direct method of flood control is the building of *artificial levees*.

End Of Slide

Reading Check

Describe two ways that floods can be controlled.

End Of Slide

Reading Check

Describe two ways that floods can be controlled.

Floods can be controlled indirectly through forest and soil conservation measures that reduce or prevent runoff, or directly by building artificial structures, such as dams, levees, and floodways, to redirect water flow.

End Of Slide

The Life Cycle of Lakes

- Most lakes are relatively short lived in geologic terms.
- Many lakes eventually disappear because too much of their water drains away or evaporates.
- Lake basins may also disappear if they fill with sediments. Streams that feed a lake deposit sediments in the lake. The lake basin may eventually become dry land.

End Of Slide

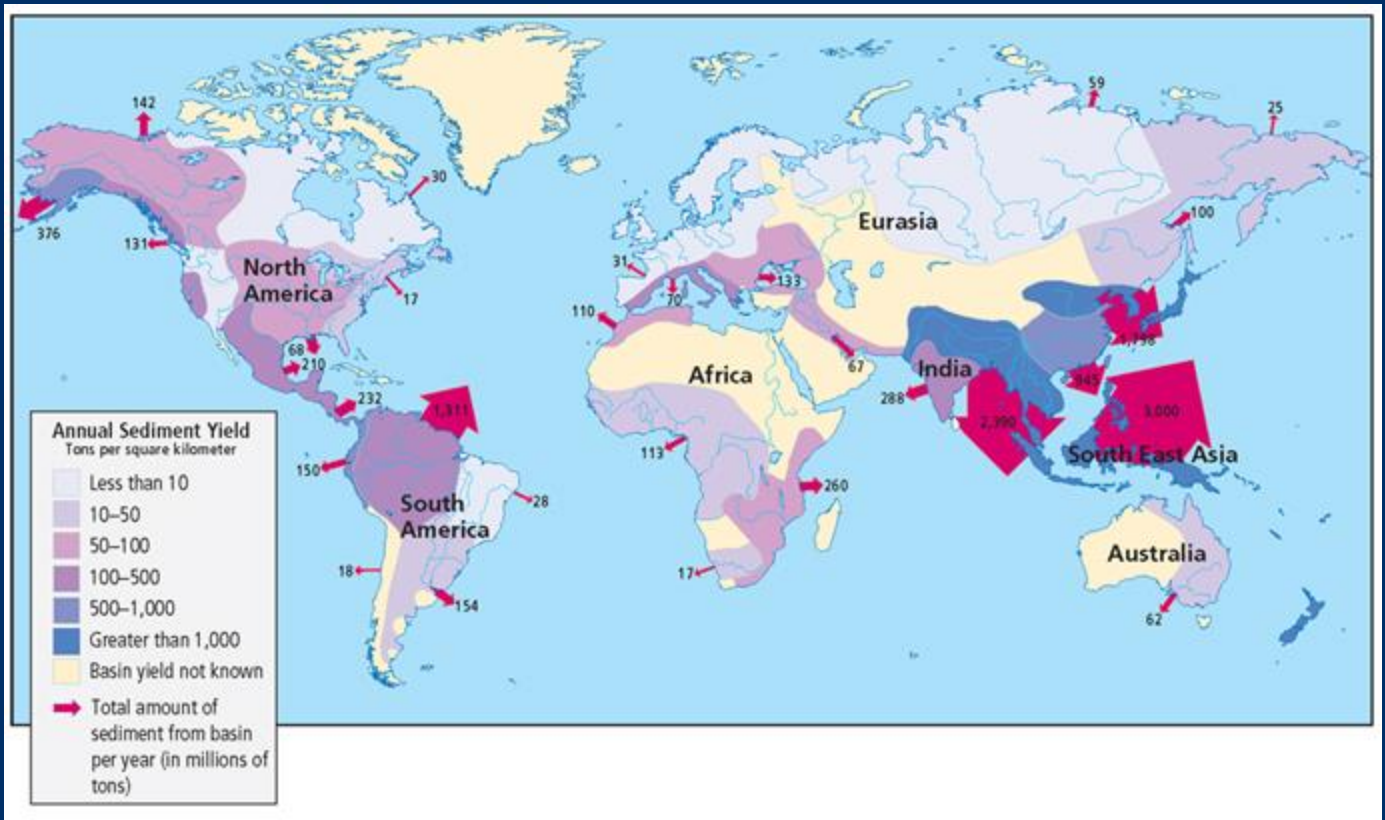
Delta

Brain Food Video Quiz

End Of Slide

Maps in Action

World Watershed Sediment Yield



End Of Slide

Multiple Choice

1. Condensation is often triggered as water vapor rising in the atmosphere

   A. cools
   B. warms
   C. contracts
   D. breaks apart

Multiple Choice, *continued*

1. Condensation is often triggered as water vapor rising in the atmosphere

   A. cools
   B. warms
   C. contracts
   D. breaks apart

Multiple Choice, *continued*

2. The continuous movement of water from the ocean, to the atmosphere, to the land, and back to the ocean is

F. condensation.
G. the water cycle.
H. precipitation.
I. evapotranspiration.

Multiple Choice, *continued*

2. The continuous movement of water from the ocean, to the atmosphere, to the land, and back to the ocean is

F. condensation.
G. the water cycle.
H. precipitation.
I. evapotranspiration.

Multiple Choice, *continued*

3. Which of the following formations drains a watershed?

A. floodplains
B. a recharge zone
C. an artesian spring
D. streams and tributaries

Multiple Choice, *continued*

3. Which of the following formations drains a watershed?

A. floodplains
B. a recharge zone
C. an artesian spring
D. streams and tributaries

Multiple Choice, *continued*

4. Like rivers, lakes have life cycles. Most lakes have short life cycles and eventually disappear. Which of the following conditions may cause a lake to disappear?

F. when evaporation exceeds precipitation
G. when precipitation exceeds evaporation
H. when sediments are removed from the lake
I. when a local water budget is balanced

Multiple Choice, *continued*

4. Like rivers, lakes have life cycles. Most lakes have short life cycles and eventually disappear. Which of the following conditions may cause a lake to disappear?

F. when evaporation exceeds precipitation
G. when precipitation exceeds evaporation
H. when sediments are removed from the lake
I. when a local water budget is balanced

Short Response, *continued*

5. What is the term for a volume of water that is moved by a stream during a given amount of time?

Short Response, *continued*

5. What is the term for a volume of water that is moved by a stream during a given amount of time?

discharge

Short Response, *continued*

6. The gradient of a river is defined as a change in what over a given distance?

Short Response, *continued*

6. The gradient of a river is defined as a change in what over a given distance?

elevation

Short Response, *continued*

7. Streams are said to have varying loads. What makes up a stream's load?

Short Response, *continued*

7. Streams are said to have varying loads. What makes up a stream's load?

small particles and dissolved minerals

Short Response, *continued*

8. Desalination removes what naturally occurring compound from ocean water?

Short Response, *continued*

8. Desalination removes what naturally occurring compound from ocean water?

salt

Reading Skills

Read the passage below. Then, answer questions 9-11.

The Mississippi Delta

In the Mississippi River Delta, long-legged birds step lightly through the marsh and hunt fish or frogs for breakfast. Hundreds of species of plants and animals start another day in this fragile ecosystem. This delta ecosystem, like many other ecosystems, is in danger of being destroyed.

The threat to the Mississippi River Delta ecosystem comes from efforts to make the river more useful. Large parts of the river bottom have been dredged to deepen the river for ship traffic. Underwater channels were built to control flooding. What no one realized was that the sediments that once formed new land now pass through the channels and flow out into the ocean. Those river sediments had once replaced the land that was lost every year to erosion. Without them, the river could no longer replace land lost to erosion. So, the Mississippi River Delta began shrinking. By 1995, more than half of the wetlands were already gone—swept out to sea by waves along the Louisiana coast.

Reading Skills, *continued*

9. Based on the passage, which of the following statements about the Mississippi River is true?

A. The Mississippi River never floods.
B. The Mississippi River is not wide enough for ships to travel on it.
C. The Mississippi River's delicate ecosystem is in danger of being lost.
D. The Mississippi River is disappearing.

Reading Skills, *continued*

9. Based on the passage, which of the following statements about the Mississippi River is true?

A. The Mississippi River never floods.
B. The Mississippi River is not wide enough for ships to travel on it.
C. The Mississippi River's delicate ecosystem is in danger of being lost.
D. The Mississippi River is disappearing.

Reading Skills, *continued*

10. Based on the passage, which of the following statements is true?

F. By 1995, more than half of the Mississippi River was gone.

G. Underwater channels control flooding.

H. Channels help form new land.

I. Sediment cannot replace lost land.

Reading Skills, *continued*

10. Based on the passage, which of the following statements is true?

F. By 1995, more than half of the Mississippi River was gone.

G. Underwater channels control flooding.

H. Channels help form new land.

I. Sediment cannot replace lost land.

Reading Skills, *continued*

11. The passage mentions that damage to the ecosystems came from efforts to make the river more useful. For who or what was the river being made more useful?

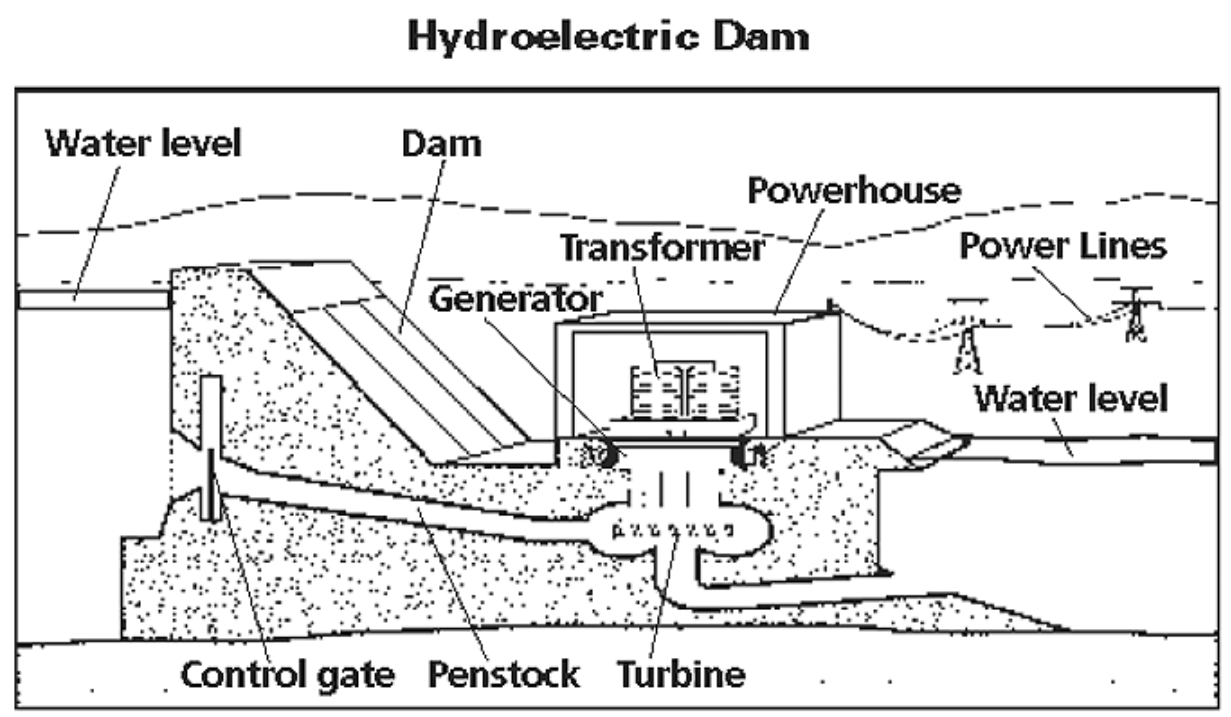
Reading Skills, *continued*

11. The passage mentions that damage to the ecosystems came from efforts to make the river more useful. For who or what was the river being made more useful?

Answers should include: the river was altered to accommodate human society and human inventions, such as boats; students should realize that the river was being altered to benefit humans and that any attempts to alter nature in order to benefit human society may have unexpected—and unwanted—consequences.

Interpreting Graphics

Use the diagram below to answer questions 12-13. The diagram shows how a hydropower plant works.



Interpreting Graphics, *continued*

12. Hydroelectric dams are used to generate electricity for human use. As water rushes past the machinery inside, an electric current is generated. What does water rush past to turn the generator, which produces the current?

A. a transformer
B. the control gate
C. an intake
D. a turbine

Interpreting Graphics, *continued*

12. Hydroelectric dams are used to generate electricity for human use. As water rushes past the machinery inside, an electric current is generated. What does water rush past to turn the generator, which produces the current?

A. a transformer
B. the control gate
C. an intake
D. a turbine

Interpreting Graphics, *continued*

13. Look at the diagram above. What direction does the water flow? What makes the water flow in this direction?

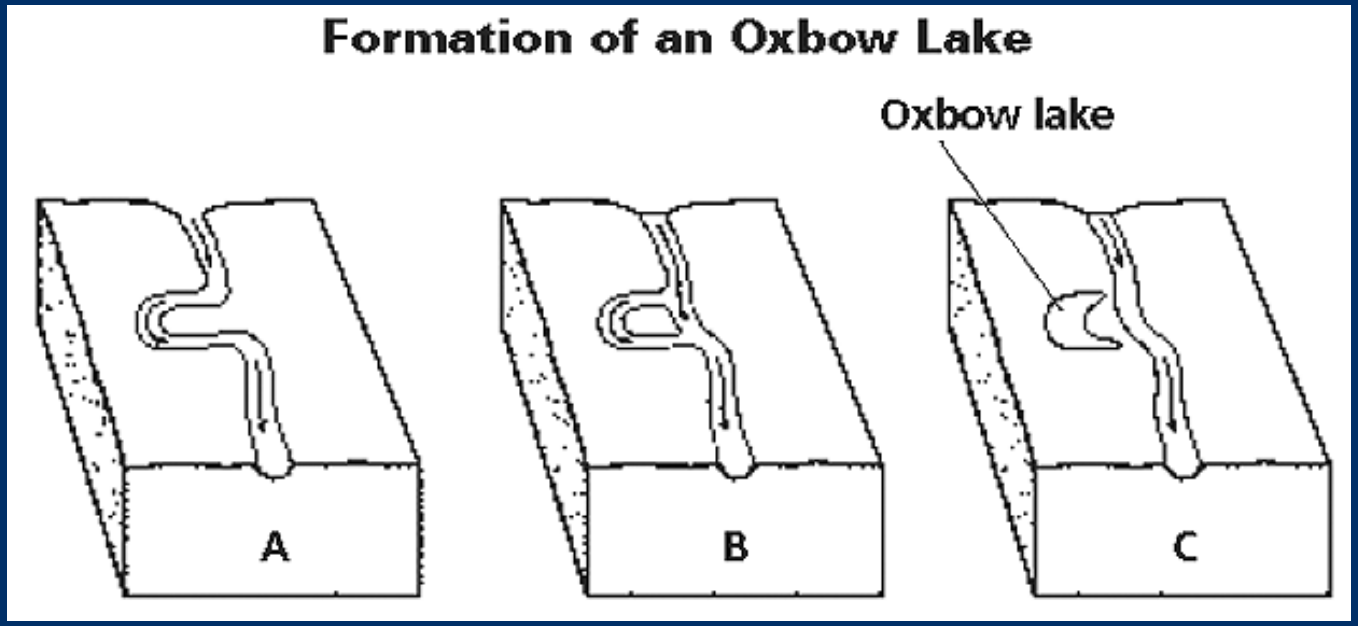
Interpreting Graphics, *continued*

13. Look at the diagram above. What direction does the water flow? What makes the water flow in this direction?

Answers should include: water flows from the left to the right in the diagram. This flow can be deduced from the difference in water levels; students should understand that water naturally seeks to equalize the levels of the two pools and that, in situations such as those shown in the graphics, the water in the deeper pool will move into the shallower pool, if possible; water is propelled from the deep reservoir on the left through the penstock by gravity and into the more shallow reservoir on the right

Interpreting Graphics, *continued*

Use the graphic below to answer questions 14-15. The graphic shows the formation of an oxbow lake.



Interpreting Graphics, *continued*

14. What is the term for the wide curves whose development cases the formation of oxbow lakes?

F. wonders
G. meanders
H. bows
I. loops

Interpreting Graphics, *continued*

14. What is the term for the wide curves whose development cases the formation of oxbow lakes?

F. wonders
G. meanders
H. bows
I. loops

Interpreting Graphics, *continued*

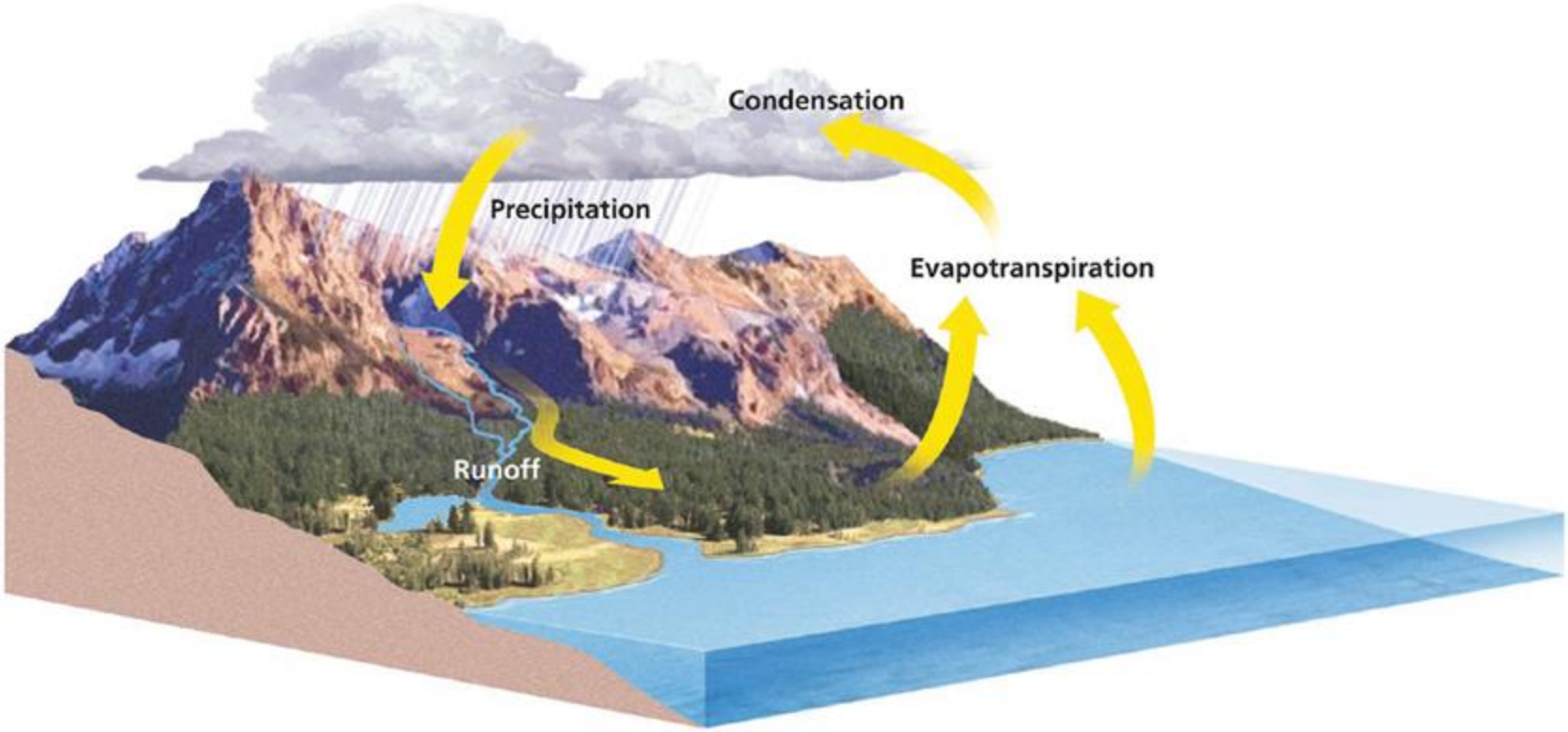
15. How does the speed at which the water flows contribute to the process of forming an oxbow lake?

Interpreting Graphics, *continued*

15. How does the speed at which the water flows contribute to the process of forming an oxbow lake?

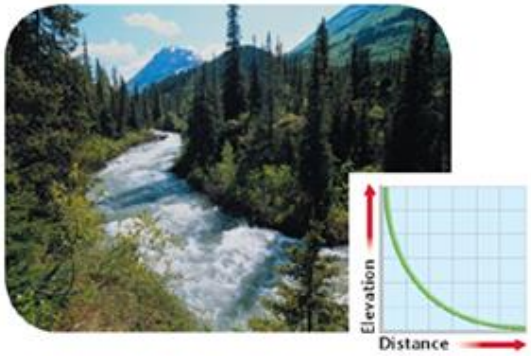
Answers should include: water on the outside edges of the river bend flows faster, which erodes the banks, and makes the meander wide; students should know that meanders form when fast-moving water that is opposite to a bar deposition erodes the adjacent bank; when meanders become so curved that they form a loop, the river may reconnect to itself and the meander may become isolated from the river, which forms an oxbow lake; the faster the flow of water is, the faster this process of erosion and meander growth occurs

The Water Cycle

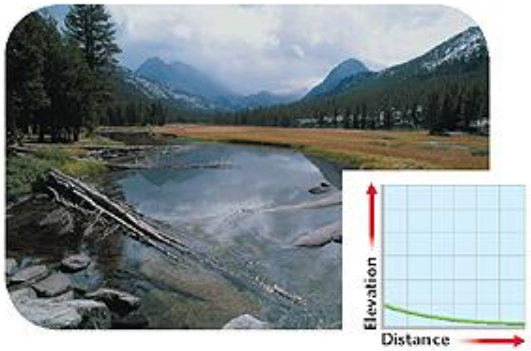


Stream Gradient and Channel Erosion

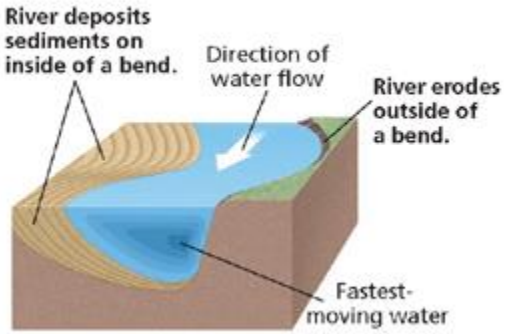
Steep-Gradient Stream



Low-Gradient Stream



Channel Erosion



World Watershed Sediment Yield