Chapter 18 Opener
Understanding Earth, Fifth Edition
© 2007 W.H. Freeman and Company

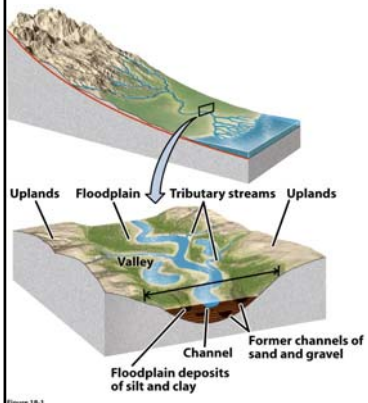


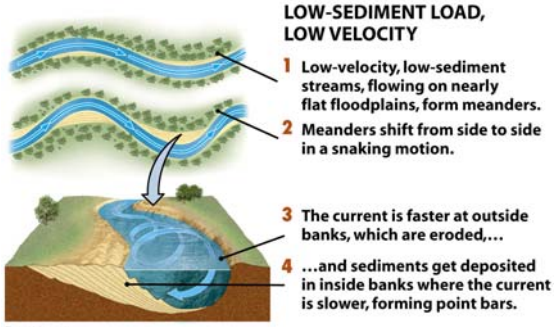
Figure 18-1
Understanding Earth, Fifth Edition
© 2007 W.H. Freeman and Company

Stream – body of water that flows and is normally confined to a channel

Stream valley - sloping area around the stream

Stream channel - bottom of valley

Floodplain - plain bordering a river that is prone to flooding



LOW-SEDIMENT LOAD, LOW VELOCITY

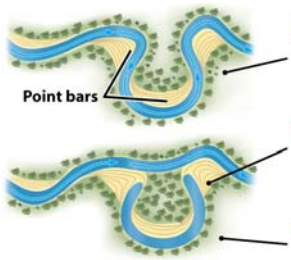
1 Low-velocity, low-sediment streams, flowing on nearly flat floodplains, form meanders.

2 Meanders shift from side to side in a snaking motion.

3 The current is faster at outside banks, which are eroded,…

4 …and sediments get deposited in inside banks where the current is slower, forming point bars.

Figure 18-3a part 1
Understanding Earth, Fifth Edition
© 2007 W.H. Freeman and Company



5 As the erosion and deposition process continues, the bends grow closer and the point bars bigger.

6 During a major flood, when velocity and water volume increase, the river takes a new, shorter course, cutting across the loop.

7 The abandoned loop remains as an oxbow lake.

Figure 18-3a part 3
Understanding Earth, Fifth Edition
© 2007 W.H. Freeman and Company

Meanders in an Alaskan river

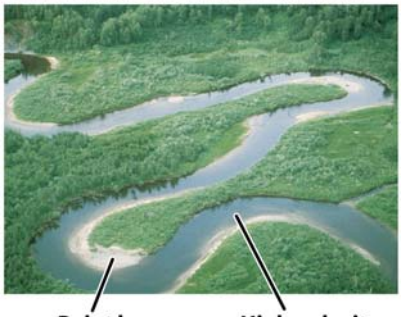


Figure 18-3a part 2
Understanding Earth, Fifth Edition

Meanders in the Mississippi River delta

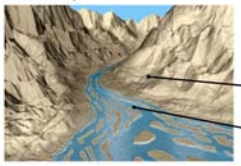
Figure 18-3a part 4
Understanding Earth, Fifth Edition

Figure 18-2
Understanding Earth, Fifth Edition

Low-water period (e.g., summer)

1 Where high-velocity, high-sediment streams flow over nearly flat, easily eroded terrain (e.g., at the mouths of canyons or the terminal ends of melting glaciers),…

High-water period (e.g., spring snowmelt)



2 …the fast-moving, sediment-laden water does not form oxbow bends…

3 …but cuts across the soft sediments at the edges of existing channels, creating shallow, crisscrossed braided channels.

Figure 18-3b part 1
Understanding Earth, Fifth Edition

A braided stream of the Chitina River, Alaska

Figure 10-3b part 2
Understanding Earth, Fifth Edition

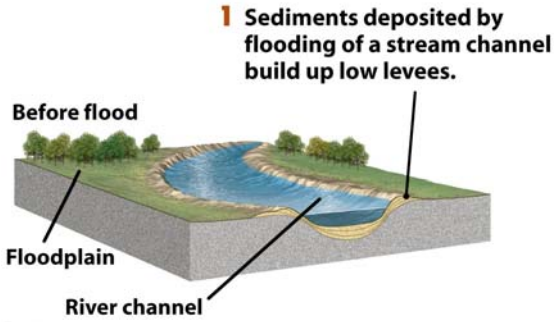
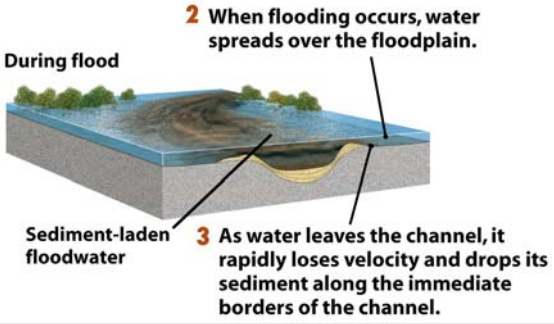


Figure 10-4 part 1
Understanding Earth, Fifth Edition

A key principle – when streams SLOW DOWN, they become less capable of carrying sediment. Some sediment carried by the stream may thus settle down to the stream bed.



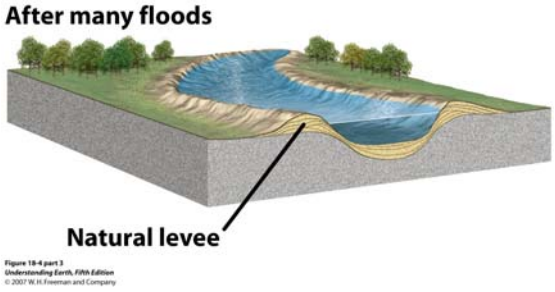
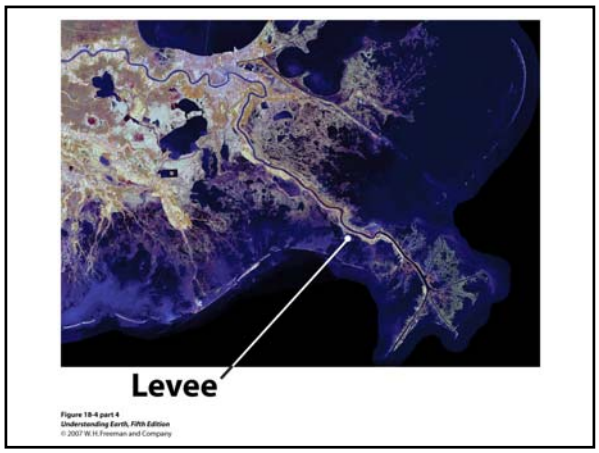
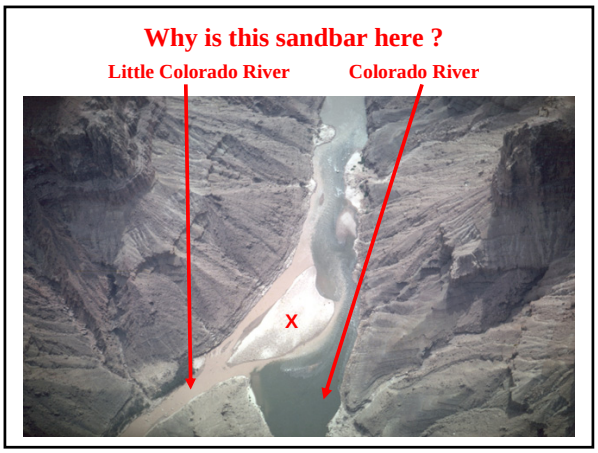
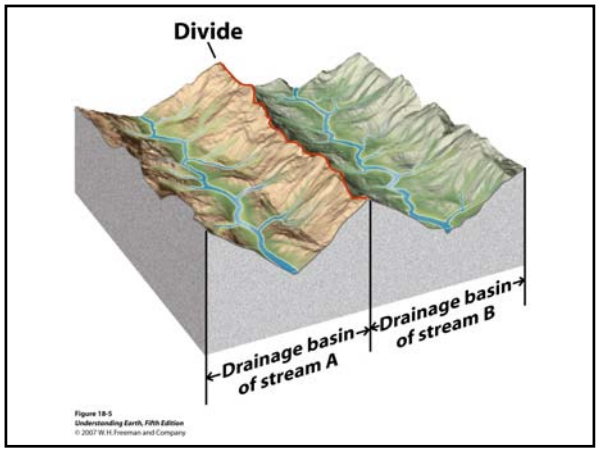


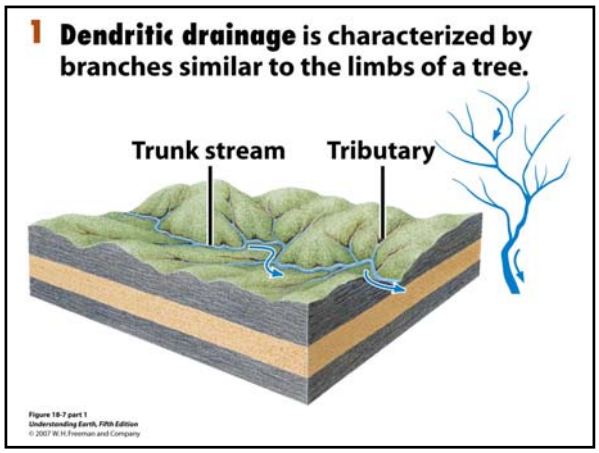
Figure 10-4 part 3
Understanding Earth, Fifth Edition

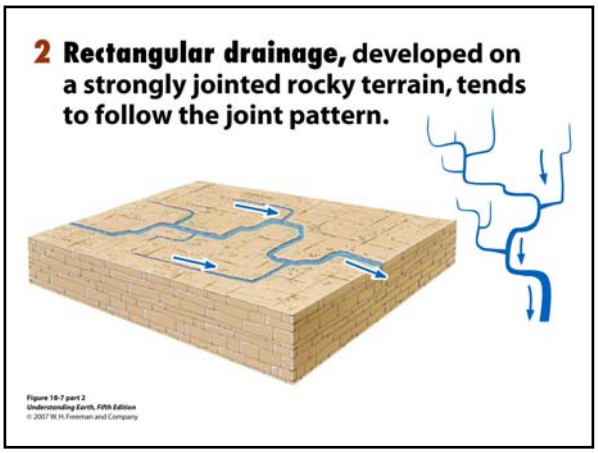

Levee

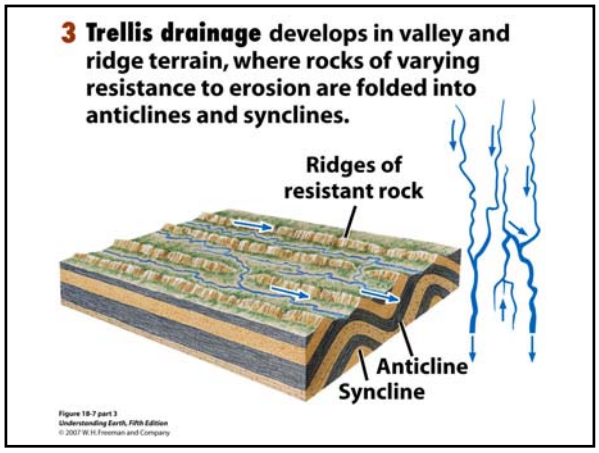

Why is this sandbar here ?
Little Colorado River
Colorado River
X

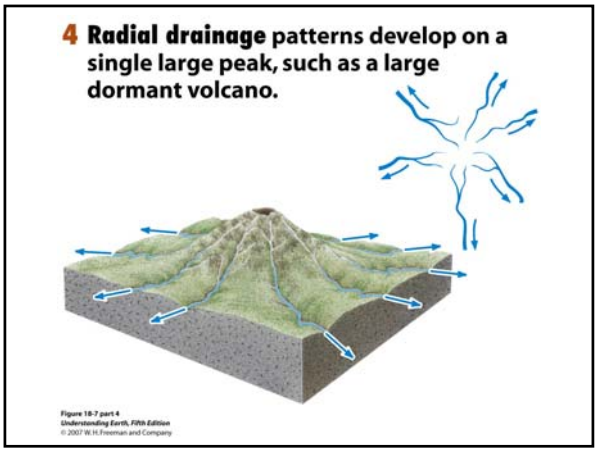

Divide
Drainage basin of stream A
Drainage basin of stream B

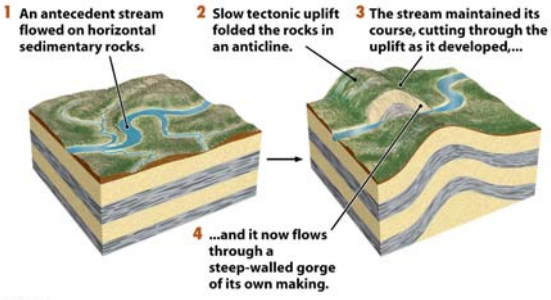

Oregon
Idaho
Wyoming
Nevada
Utah
Colorado
California
New Mexico
Arizona
Mexico
PACIFIC OCEAN
400 km
Gulf of California
Drainage basin of the Colorado River


1 Dendritic drainage is characterized by branches similar to the limbs of a tree.
Trunk stream
Tributary
Figure 10-7 part 1
Understanding Earth, Fifth Edition
© 2007 W.H.Freeman and Company

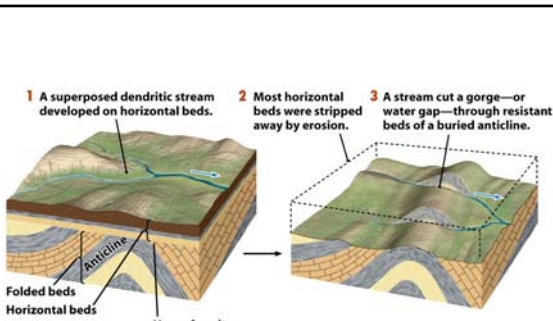

2 Rectangular drainage, developed on a strongly jointed rocky terrain, tends to follow the joint pattern.
Figure 10-7 part 2
Understanding Earth, Fifth Edition
© 2007 W.H.Freeman and Company

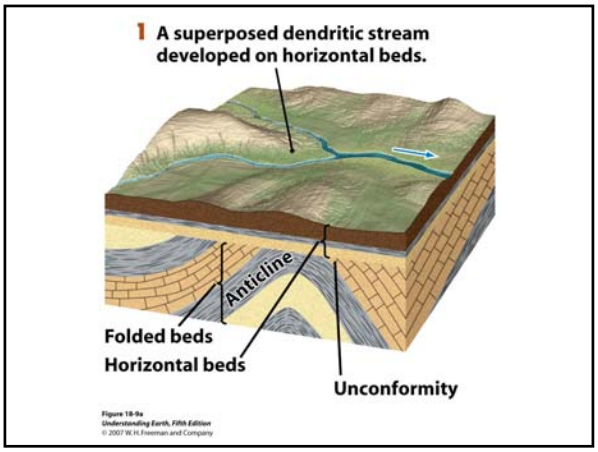

3 Trellis drainage develops in valley and ridge terrain, where rocks of varying resistance to erosion are folded into anticlines and synclines.
Ridges of resistant rock
Anticline
Syncline
Figure 10-7 part 3
Understanding Earth, Fifth Edition
© 2007 W.H.Freeman and Company

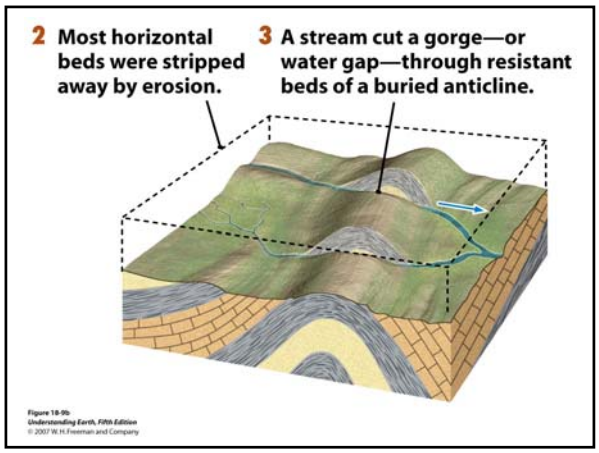

4 Radial drainage patterns develop on a single large peak, such as a large dormant volcano.
Figure 10-7 part 4
Understanding Earth, Fifth Edition
© 2007 W.H.Freeman and Company



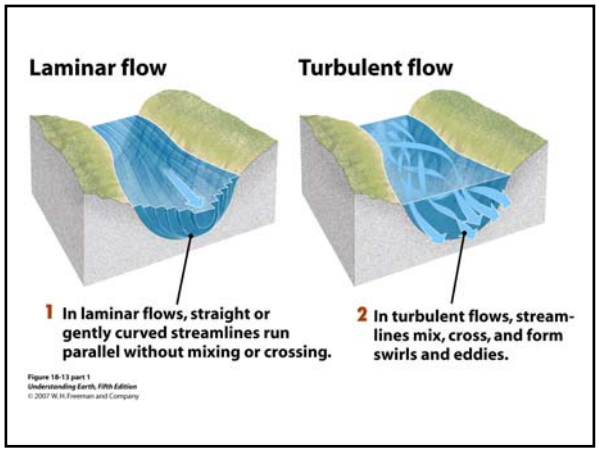
Bighorn River = antecedent river, cuts Sheep Mountain anticline

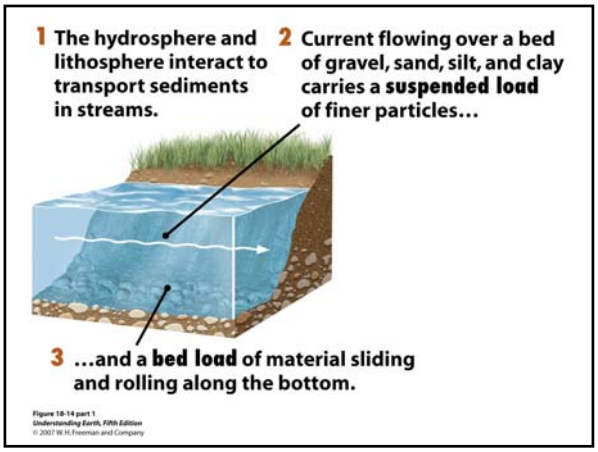


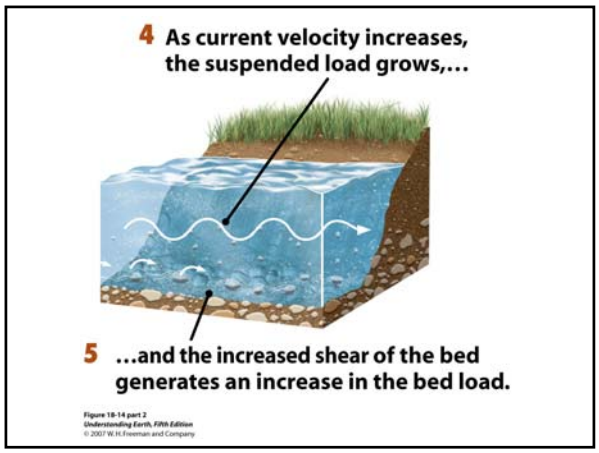


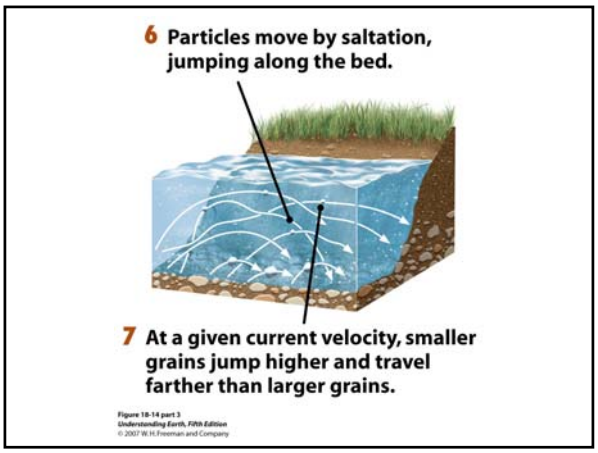


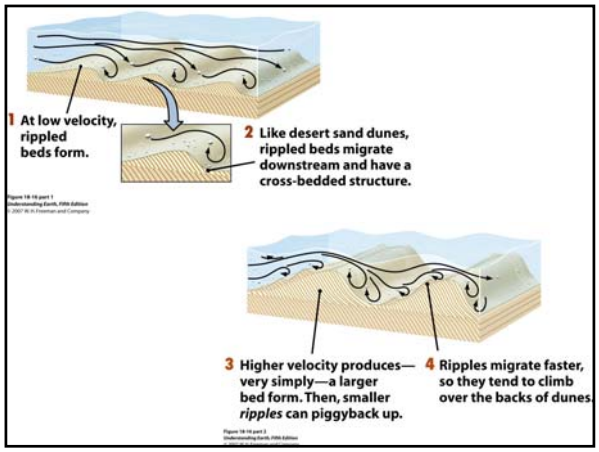
Effects of river erosion through physical abrasion of river bed



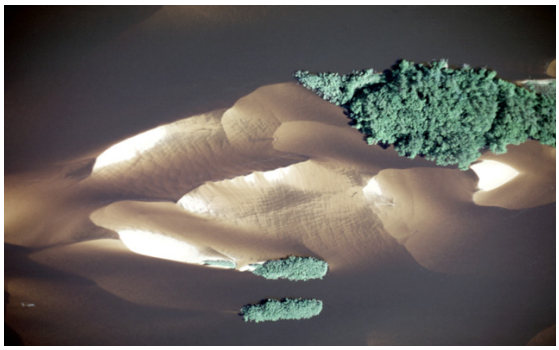


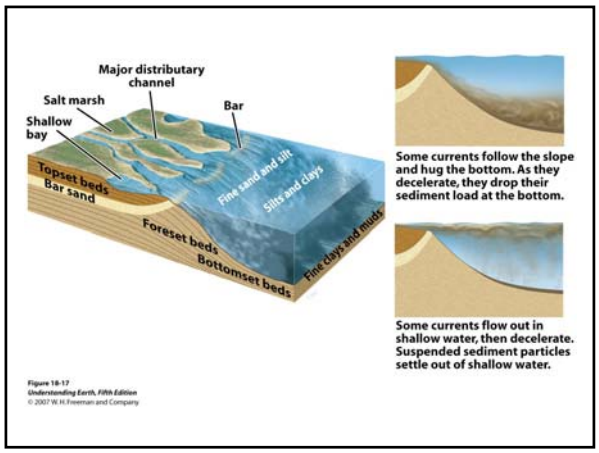




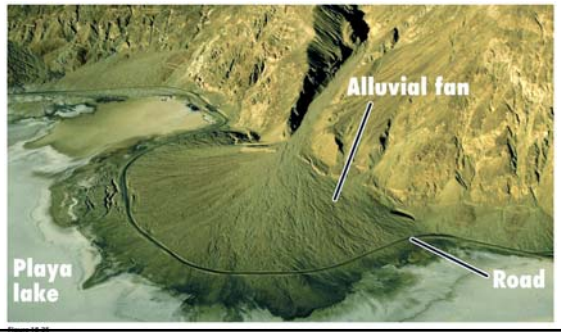


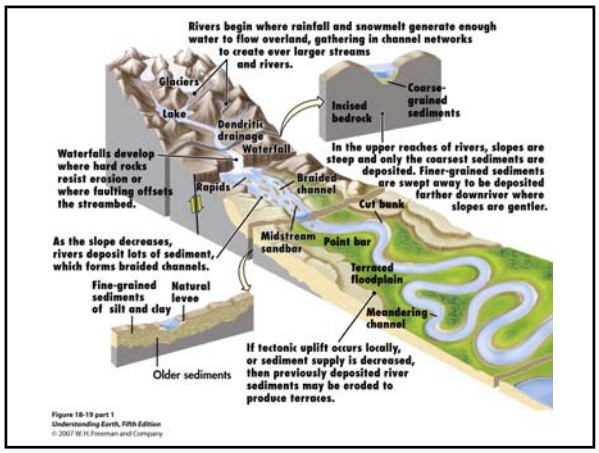
Wisconsin River sand "bar" (mega-ripple!)

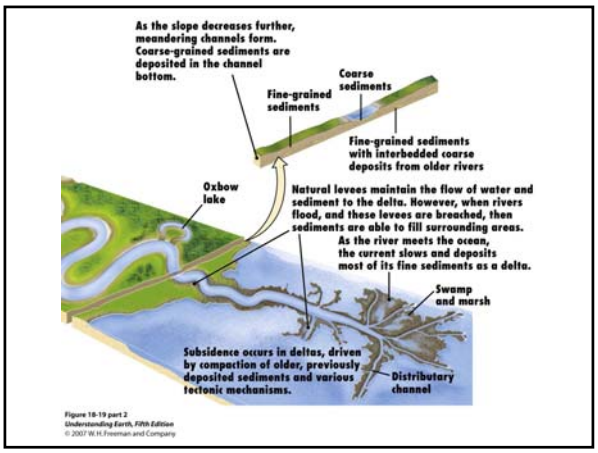


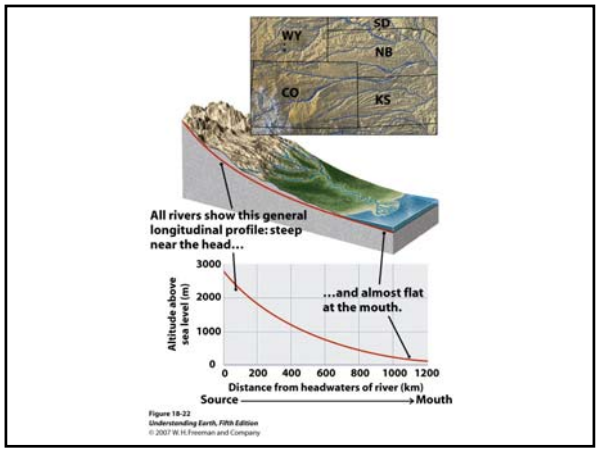


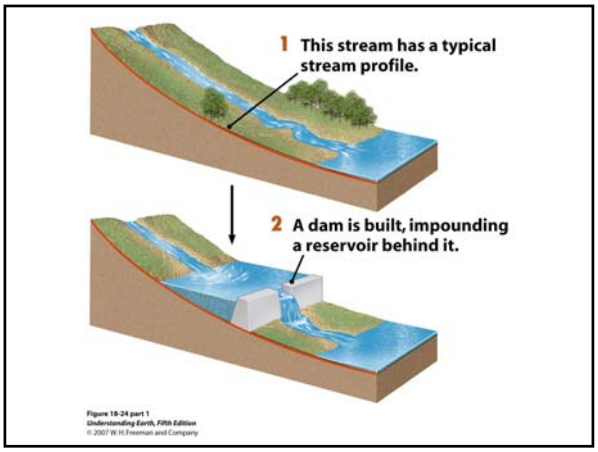
Stream's ability to carry sediment depends strongly on its velocity. Hence, slowdown in velocity can cause stream to DROP part of sediment that it carries. Slowdowns occur where mountain streams enter adjacent valleys – form alluvial fans.




Rivers begin where rainfall and snowmelt generate enough water to flow overland, gathering in channel networks to create ever larger streams and rivers.
Glaciers
Lake
Dendritic drainage
Waterfall
Incised bedrock
Coarse-grained sediments
Waterfalls develop where hard rocks resist erosion or where faulting offsets the streambed.
In the upper reaches of rivers, slopes are steep and only the coarsest sediments are deposited. Finer-grained sediments are swept away to be deposited farther downriver where slopes are gentler.
Rapids
Braided channel
Cut bank
As the slope decreases, rivers deposit lots of sediment, which forms braided channels.
Midstream sandbar
Point bar
Terraced floodplain
Fine-grained sediments of silt and clay
Natural levee
Meandering channel
If tectonic uplift occurs locally, or sediment supply is decreased, then previously deposited river sediments may be eroded to produce terraces.
Older sediments


As the slope decreases further, meandering channels form. Coarse-grained sediments are deposited in the channel bottom.
Coarse sediments
Fine-grained sediments
Fine-grained sediments with interbedded coarse deposits from older rivers
Oxbow lake
Natural levees maintain the flow of water and sediment to the delta. However, when rivers flood, and these levees are breached, then sediments are able to fill surrounding areas.
As the river meets the ocean, the current slows and deposits most of its fine sediments as a delta.
Swamp and marsh
Subsidence occurs in deltas, driven by compaction of older, previously deposited sediments and various tectonic mechanisms.
Distributary channel


WY
SD
NB
CO
KS
All rivers show this general longitudinal profile: steep near the head...
...and almost flat at the mouth.
Altitude above sea level (m)
3000
2000
1000
0
0 200 400 600 800 1000 1200
Distance from headwaters of river (km)
Source
Mouth


1 This stream has a typical stream profile.
2 A dam is built, impounding a reservoir behind it.

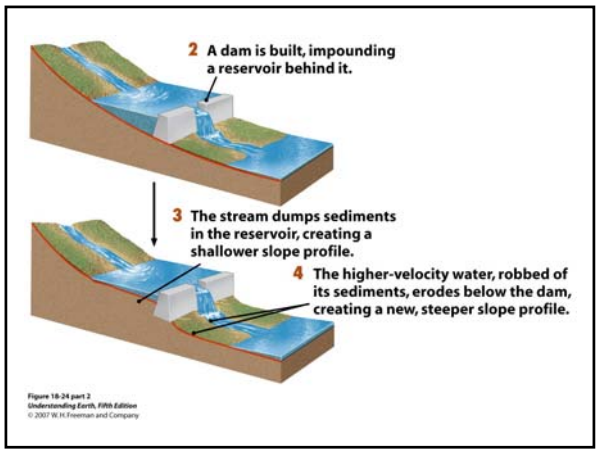


Figure 18-24 part 2
Understanding Earth, Fifth Edition