

Alluvial Rivers

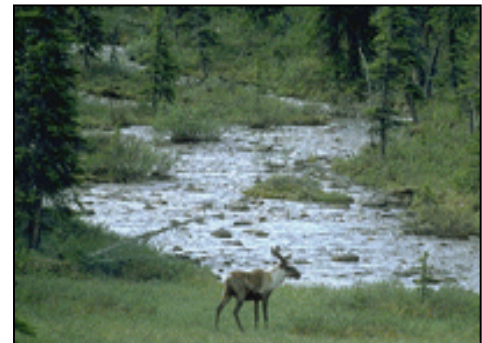
- Erodible channel boundaries (alluvial banks and bed)
- Transport Capacity \leq Sediment Supply
- Storage can be quite high
- Input \geq Output

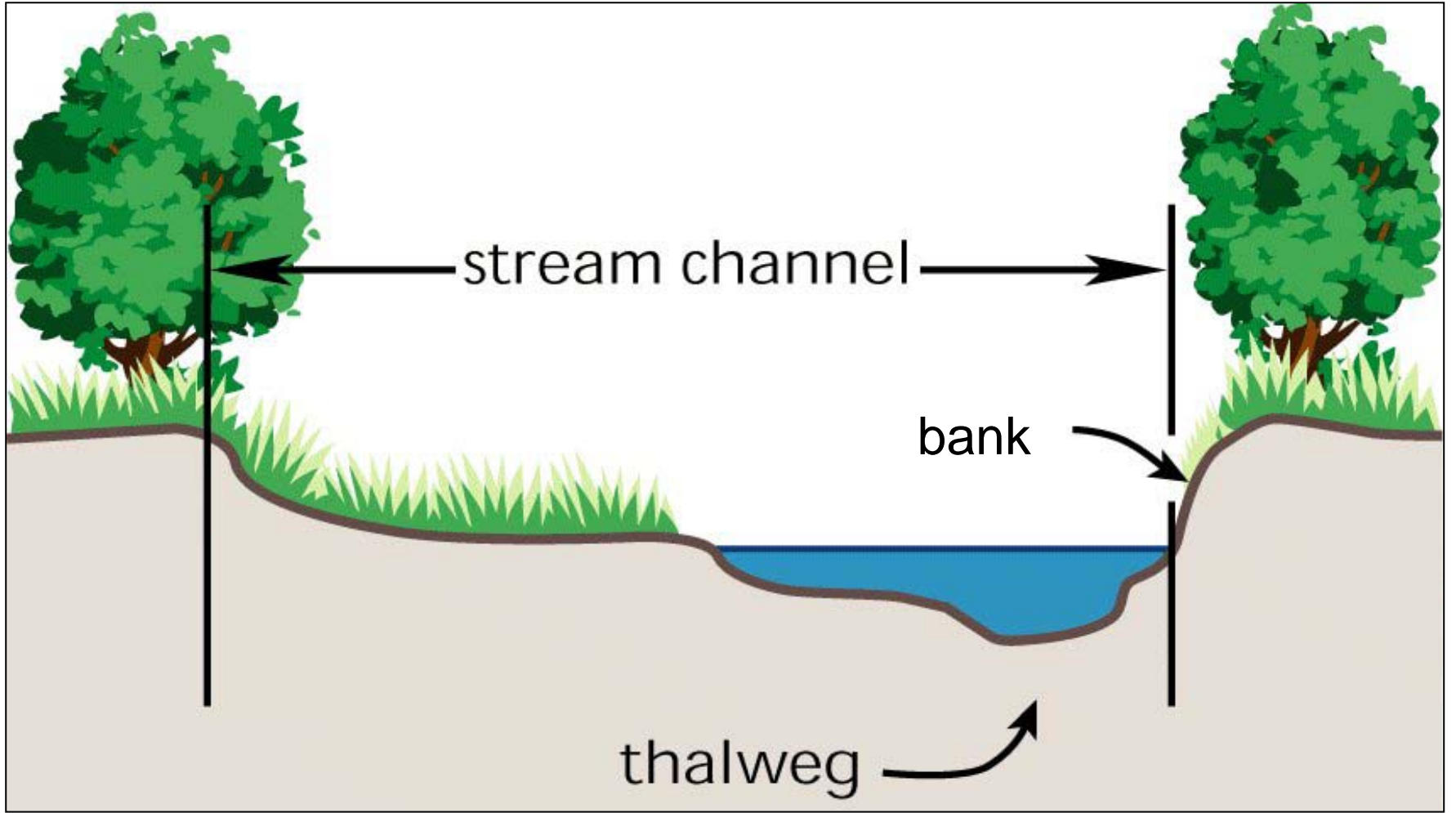


Importance of alluvial rivers

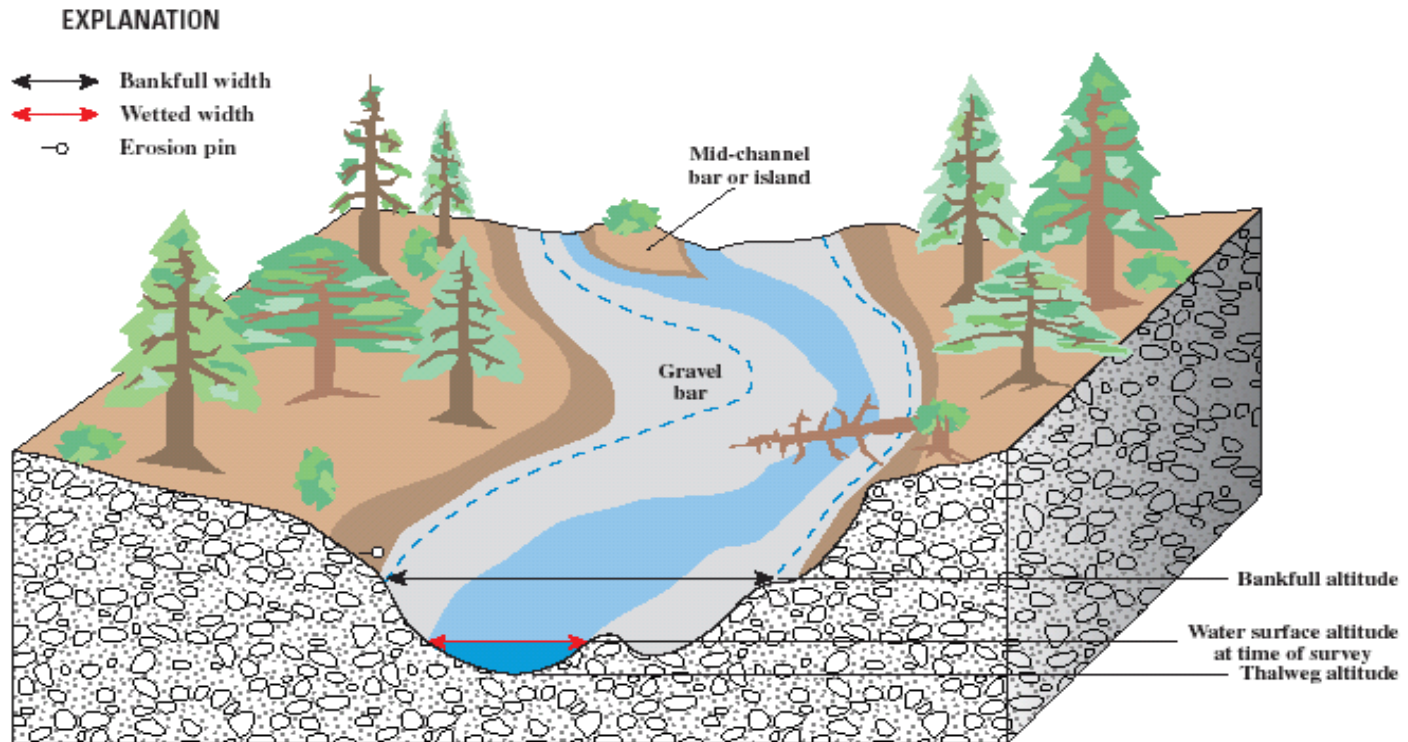
Rivers:

- Provide water and nutrients for agriculture
- Provide habitat to diverse flora and fauna
- Provide routes for commerce
- Provide recreation
- Provide electricity



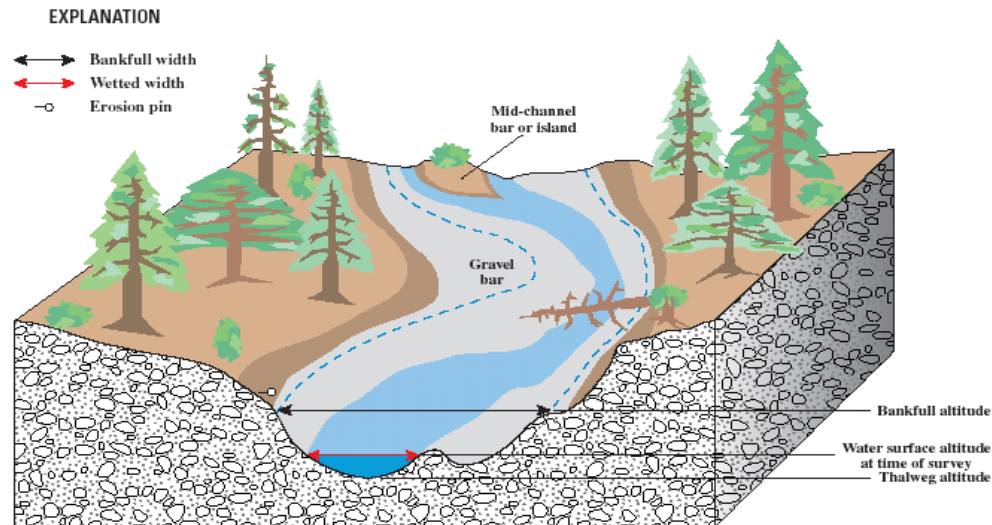


Bankfull Discharge



Bankfull Discharge

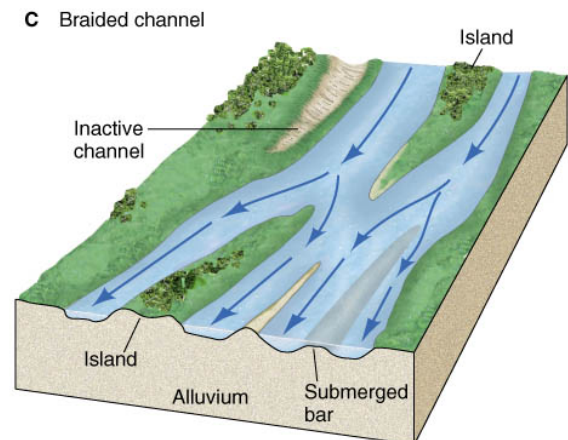
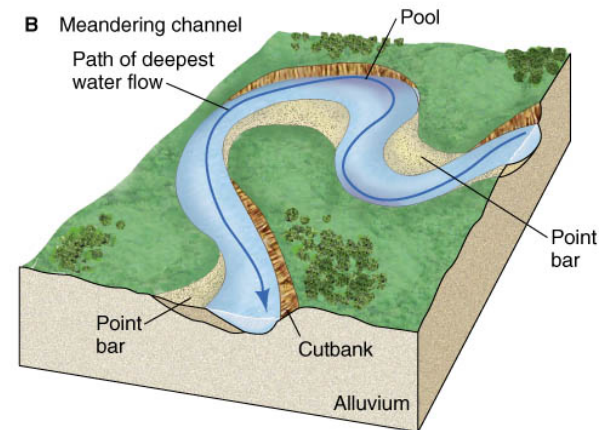
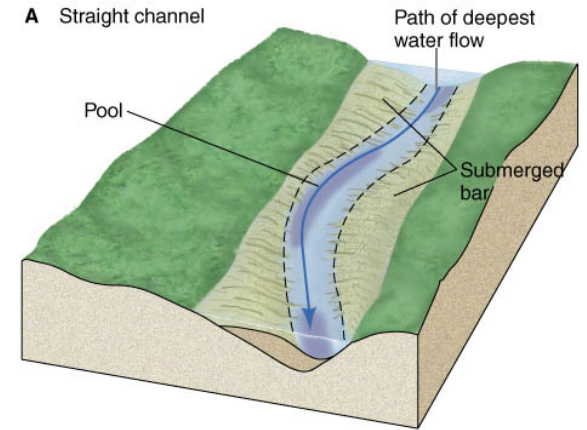
Typically bankfull discharge equates to a roughly 2-year recurrence interval flow.



Channel Patterns

Three basic map-pattern forms of streams:

- Straight
- Meandering
- Braided



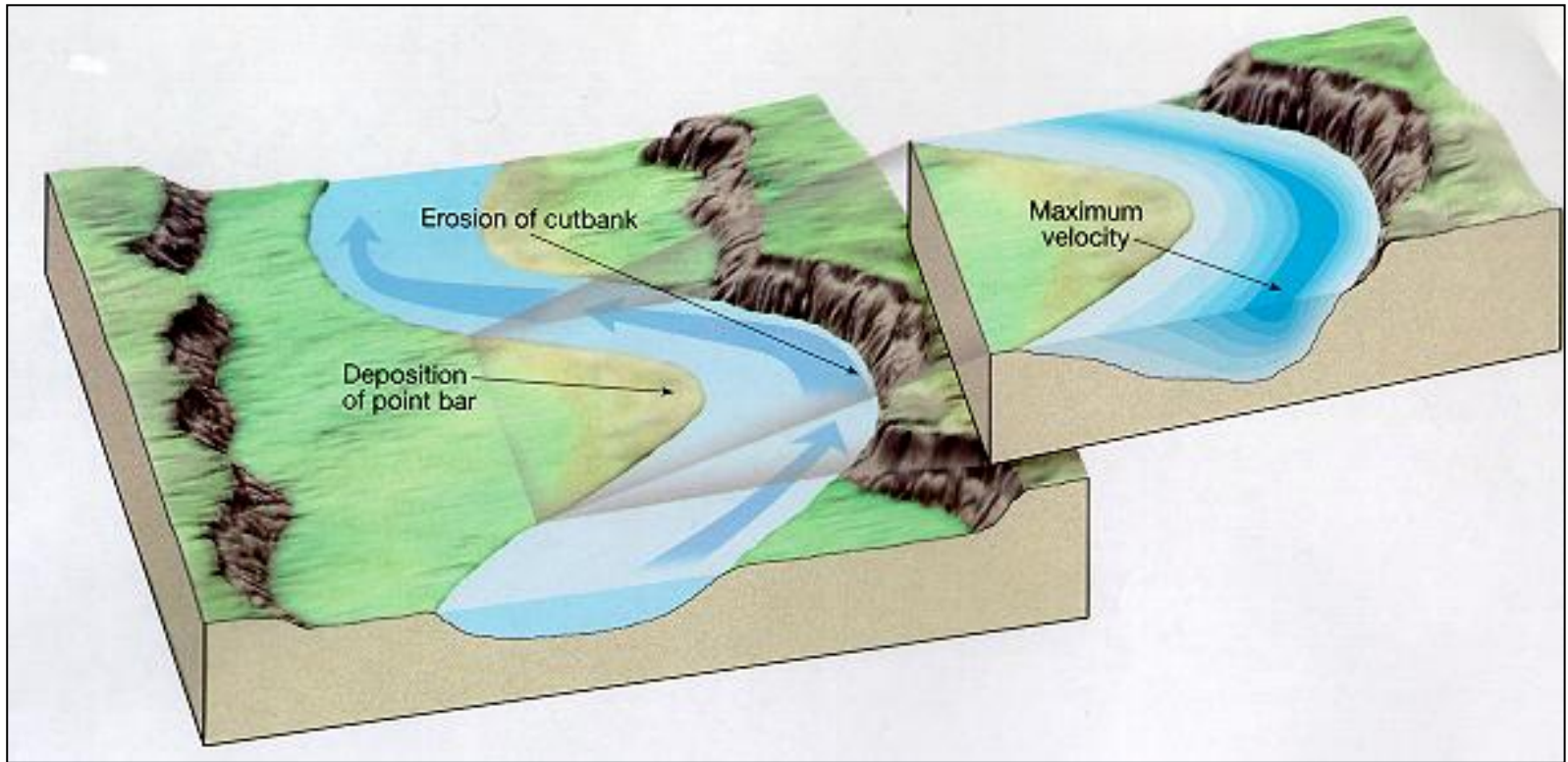
STRAIGHT CHANNELS

Straight channels are rare.

- Straight channels form where streams are confined by topography or follow geologic structures.
- Generally mountain streams.



Streams generally erode on outer (cut) banks where velocity is greatest, and deposit on the inner sides of bends where velocity is slower.



Meanders tend to grow as the flow erodes the banks, favoring development of meandering channels.

Meandering Channels



Meandering channels

Loops or **meanders** form as stream erodes its banks.

Erosion takes place on the **cut bank**, which is the outside loop of the meander.

Deposition takes place on the **point bar**, which is on the inside loop of the meander.

Meandering channels

Change their channel course gradually

Create floodplains wider than the channel

- Very Fertile soil
- Subjected to seasonal flooding

Meandering channels

Cut Banks



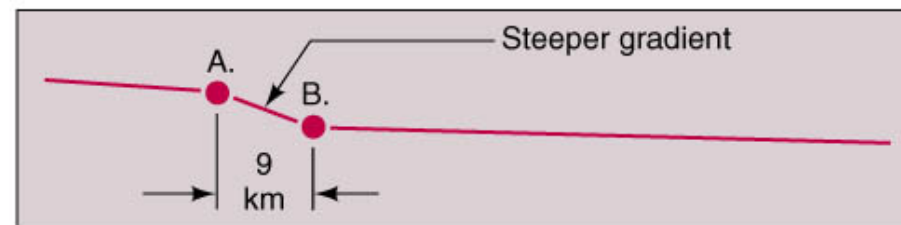
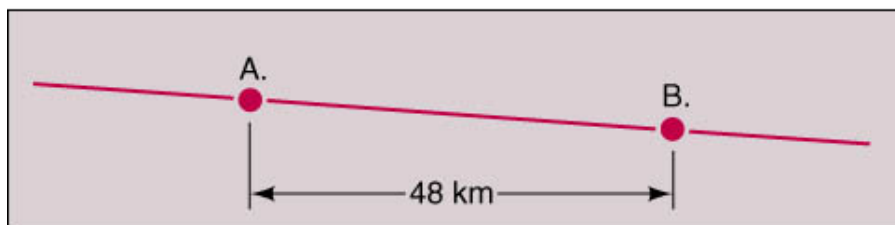
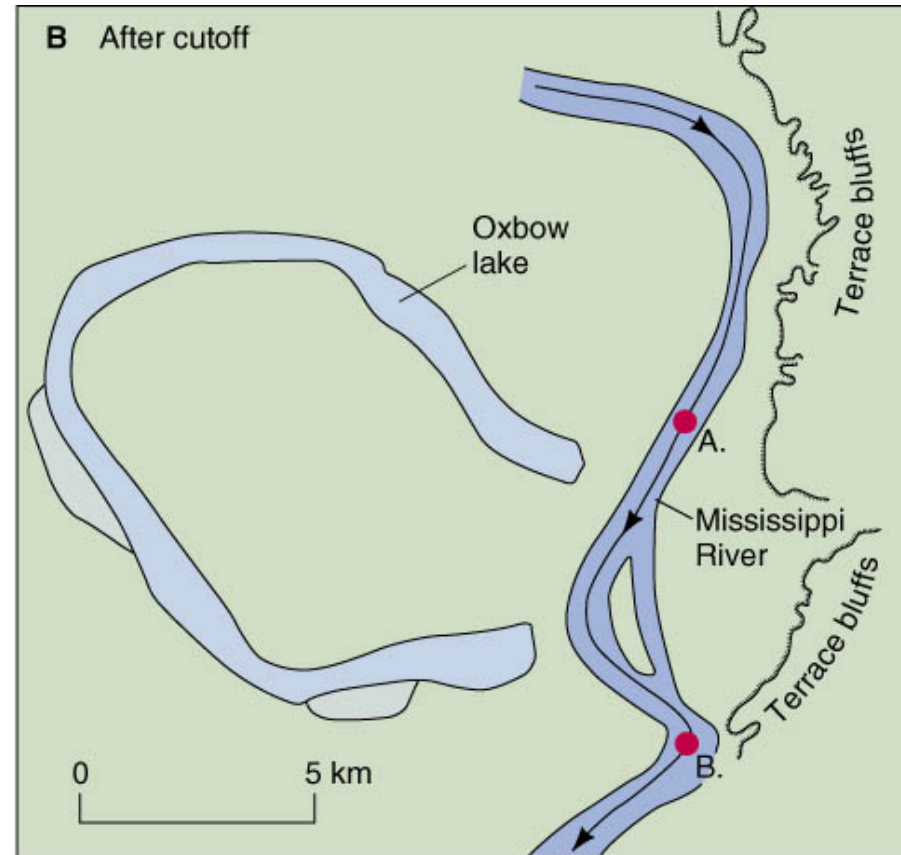
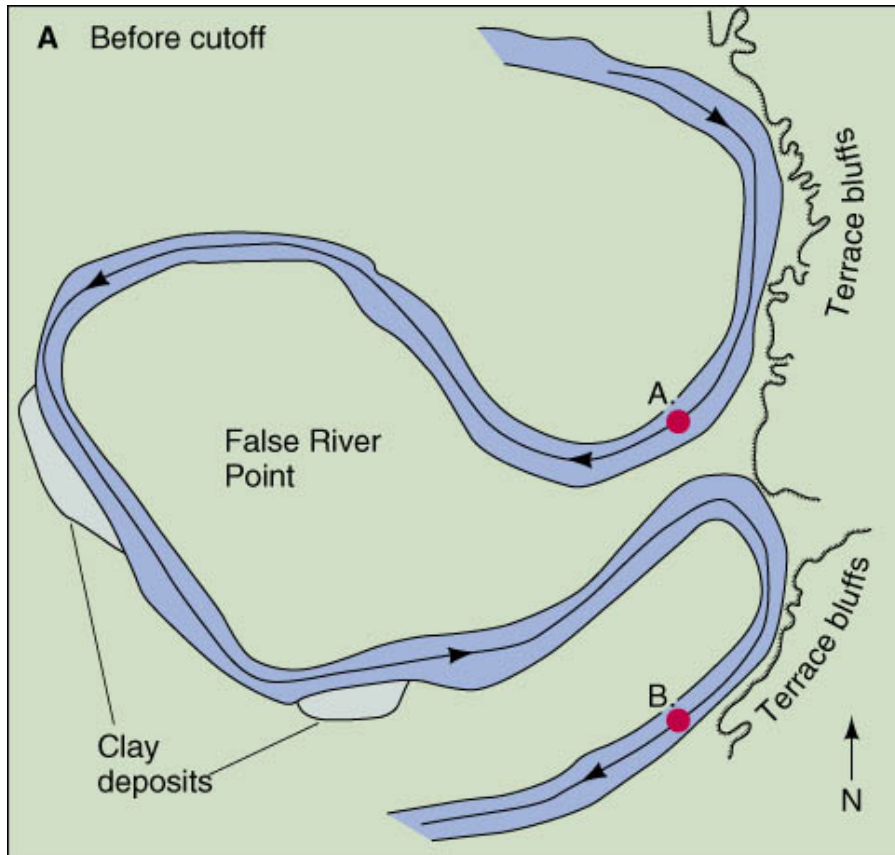
Point Bars



- Meandering streams often characterized by large loopy bends across their floodplains.
- Meanders occur most commonly in channels that lie in fine-grained stream sediments and have gentle gradients.



Growing meanders can intersect each other and cut off a meander loop, forming an oxbow lake.



Old channels abandoned as a river meanders across its floodplain form **oxbows**.



Meander "train" = belt of meandering

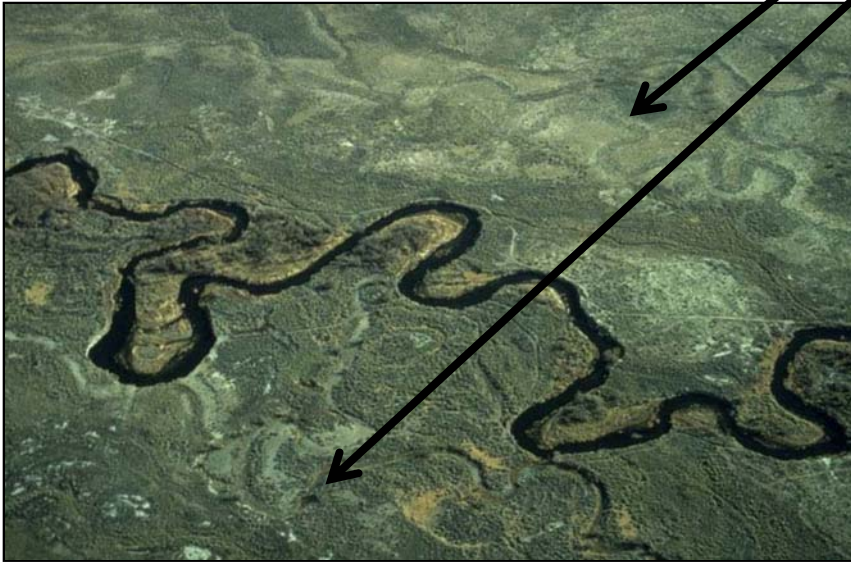


Owens River, CA



Sacramento River, CA

Note old meanders

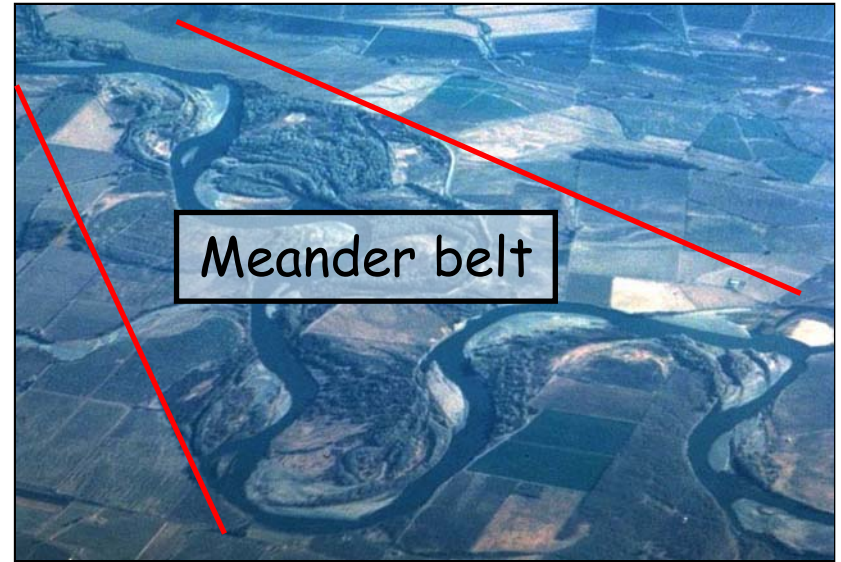
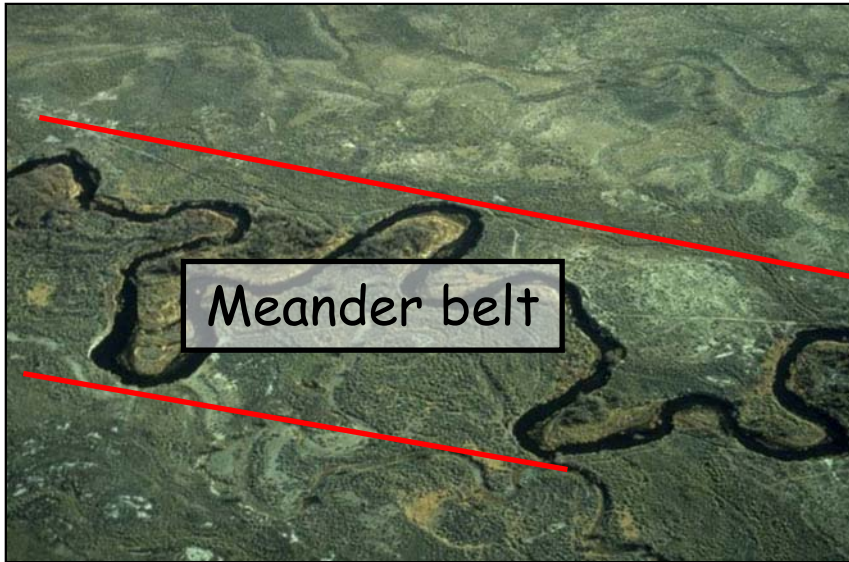


Owens River, CA



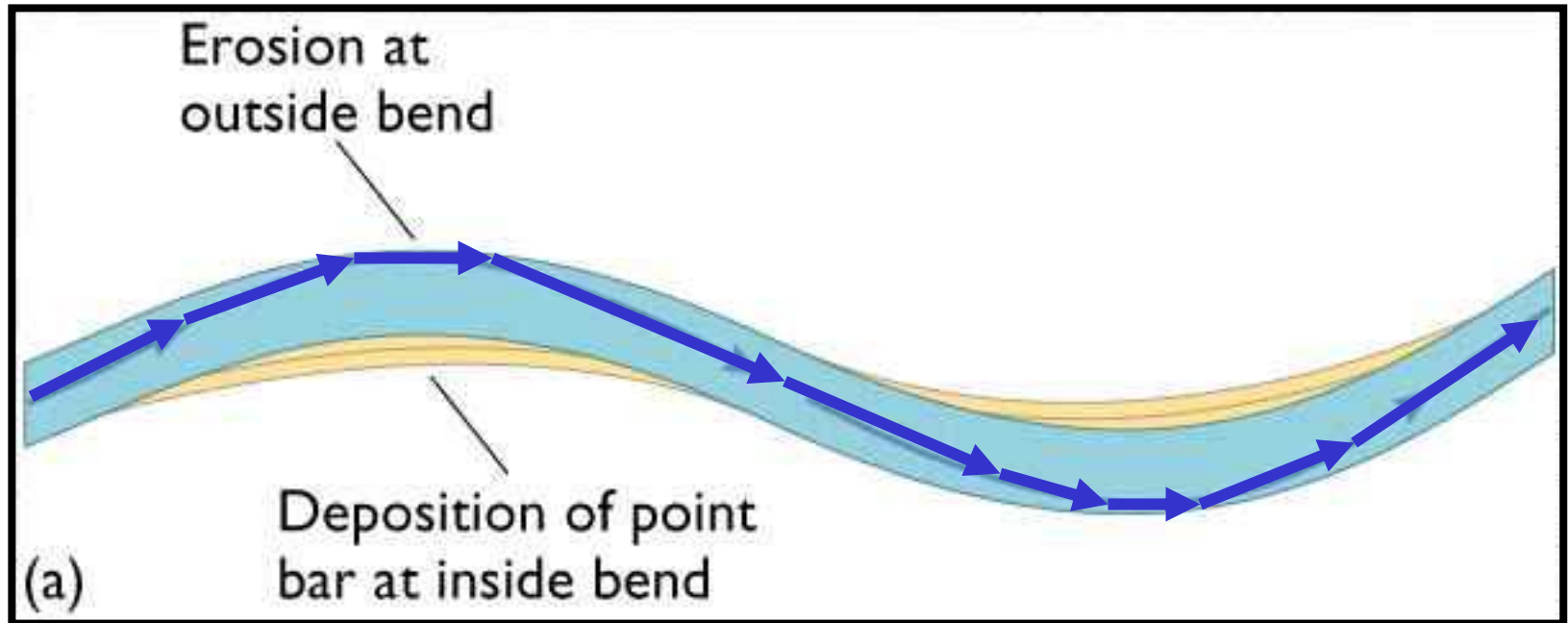
Sacramento River, CA

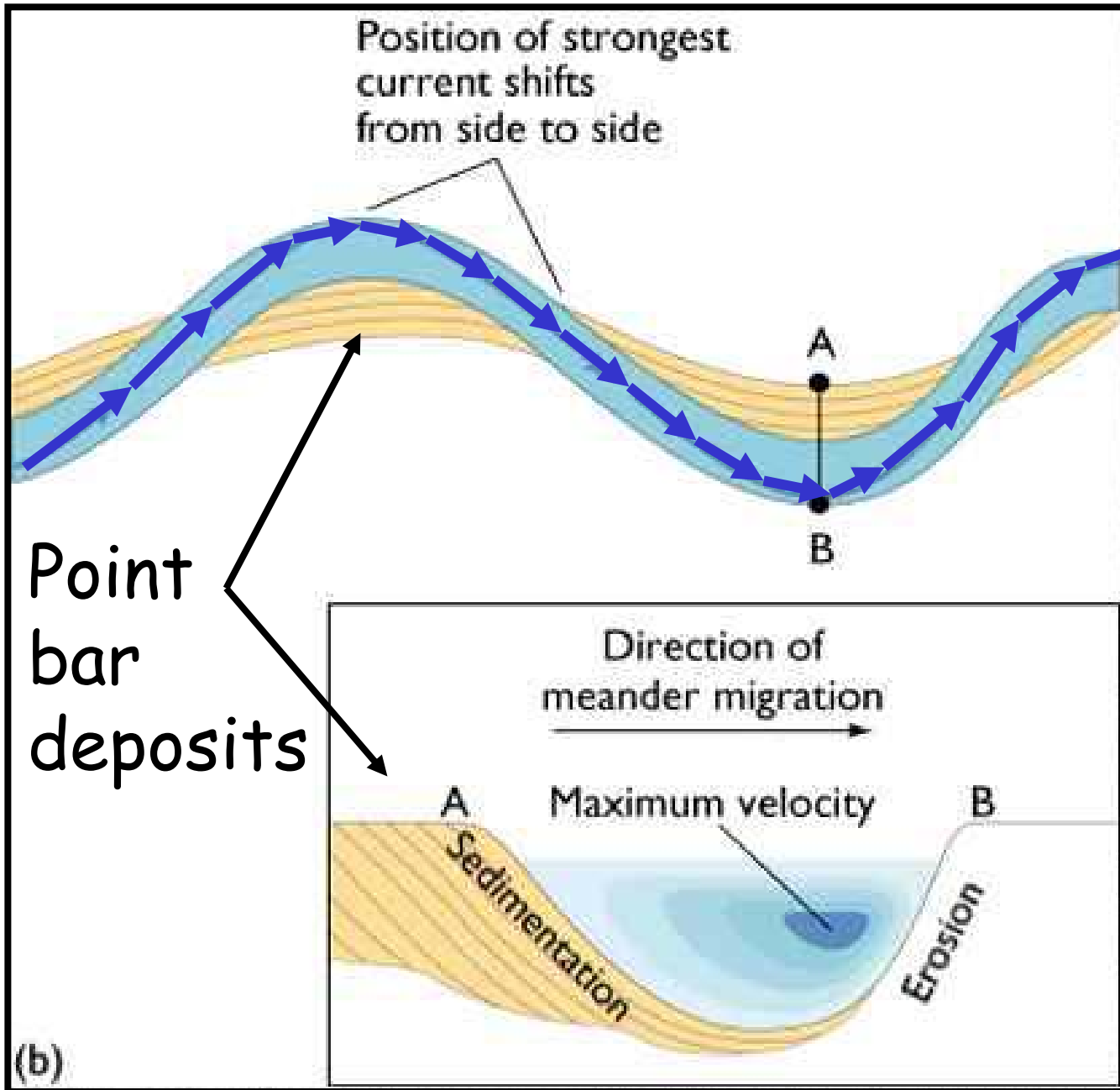
Meander "train" = belt of meandering



Channel migration zone = area across which the river is prone to move.

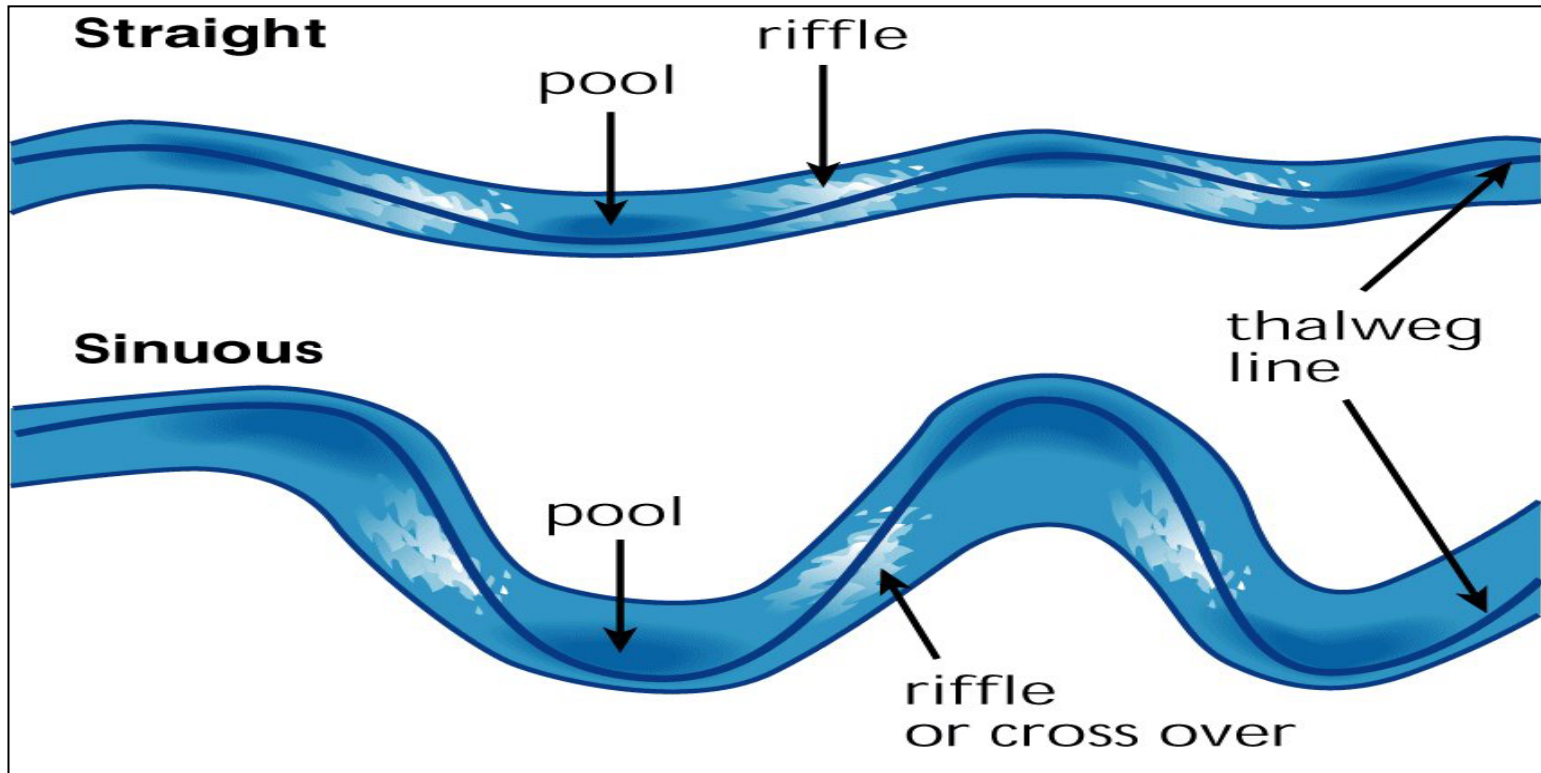
Formation of Meanders





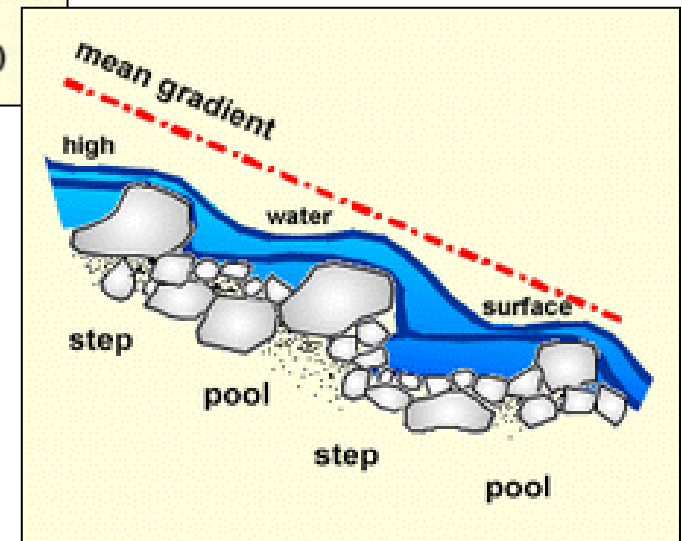
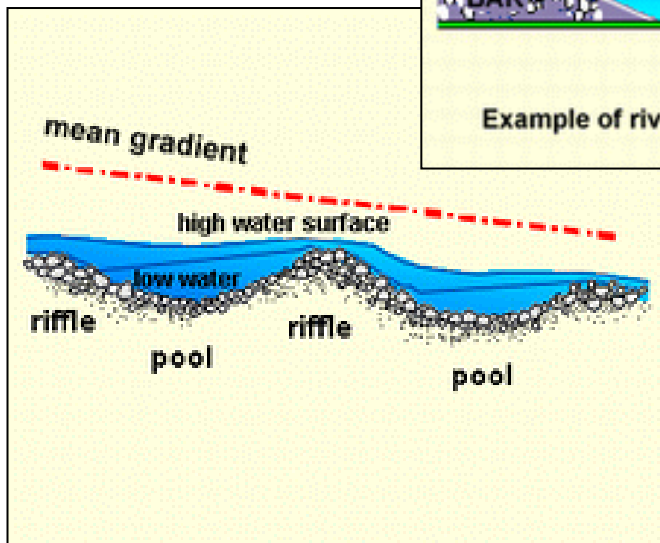
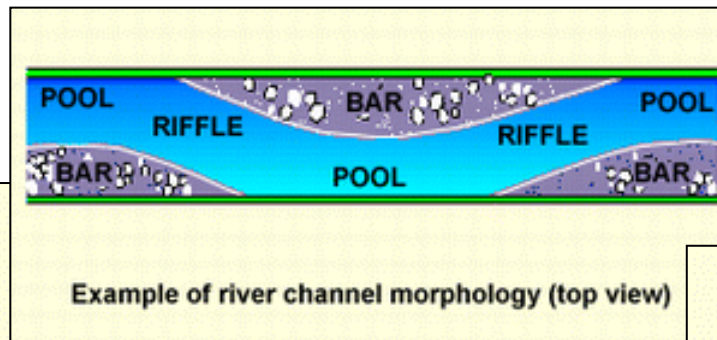
Pool - riffle sequence

Riffle to riffle = 5 - 7 channel widths

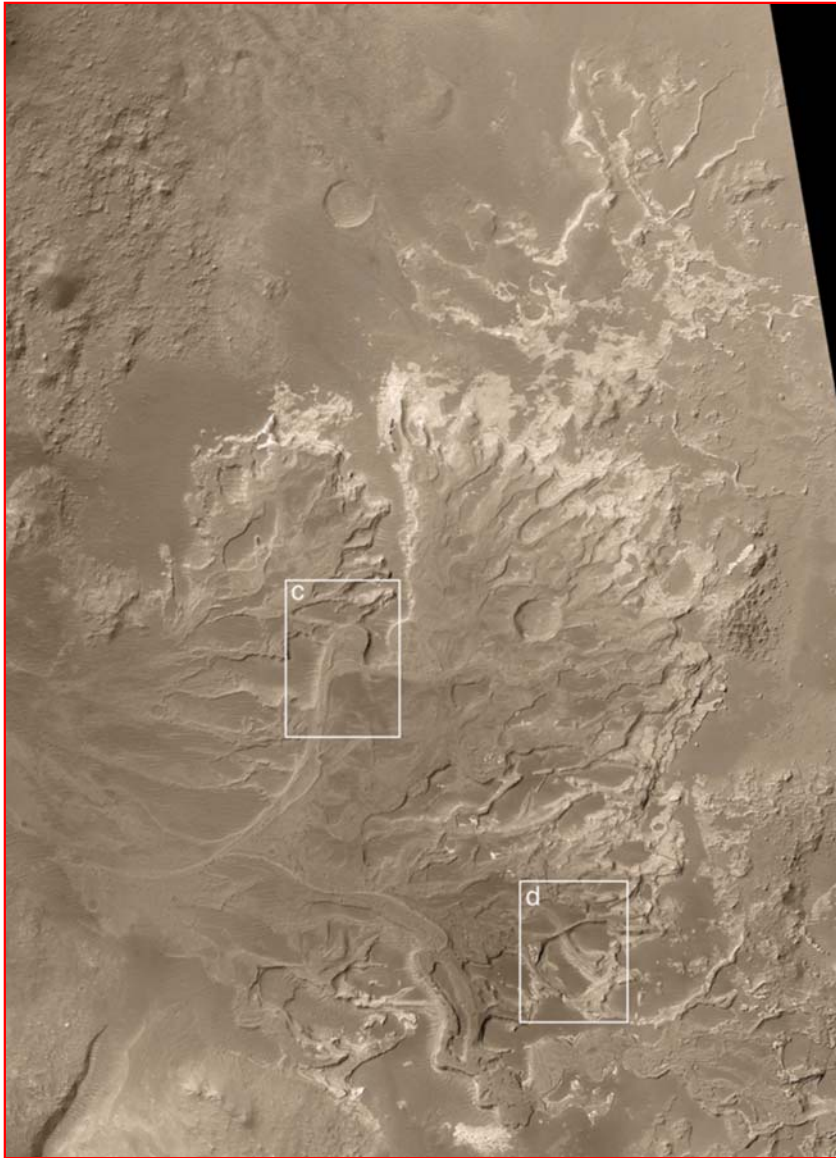


Riffles, pools, and cascades

Riffles and pools alternate in somewhat predictable patterns



Holden Crater, Mars

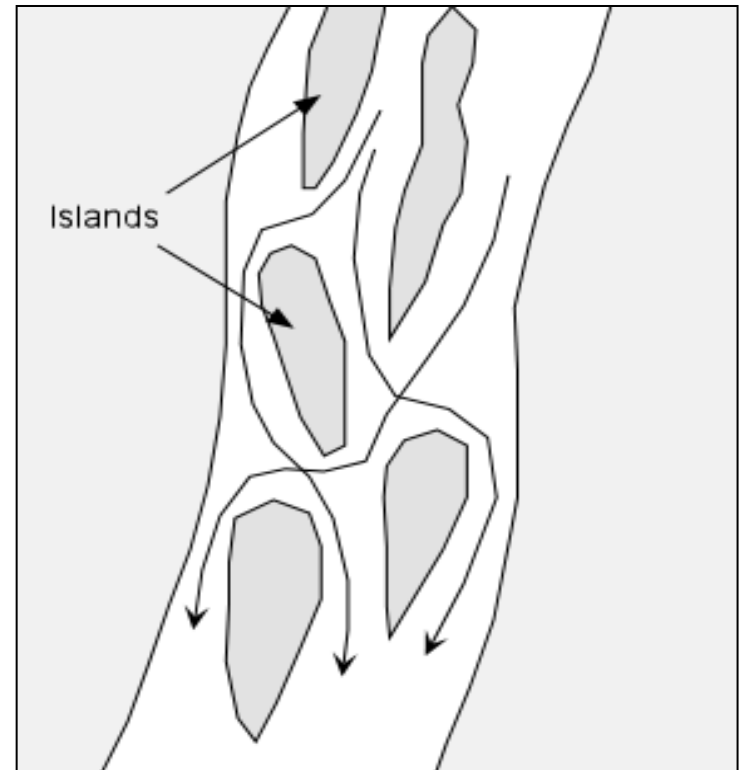


Braided Channels



BRAIDED CHANNELS

Many converging and diverging streams separated by gravel bars (or sand bars).



Braided Streams

- High sediment load
- Anastamosing channels
- Constantly changing course
- Floodplain completely occupied by channels
- Many small islands called mid-channel bars
- Usually coarse sand and gravel deposits.

Braided Channels

- If a stream is unable to move all the available load, it tends to deposit the coarsest sediment as a bar that locally divides the flow.
- Braided channels tends to form in streams having highly variable discharge, easily erodible banks, and/or a high sediment load.

Braided Channels

- Glacial streams generally are braided because:
 - The discharge varies both daily and seasonally.
 - The glacier supplies the stream with large quantities of sediment.



- Braided channels clog themselves with sediment, so channels always shifting
- Generally in streams near mountain fronts

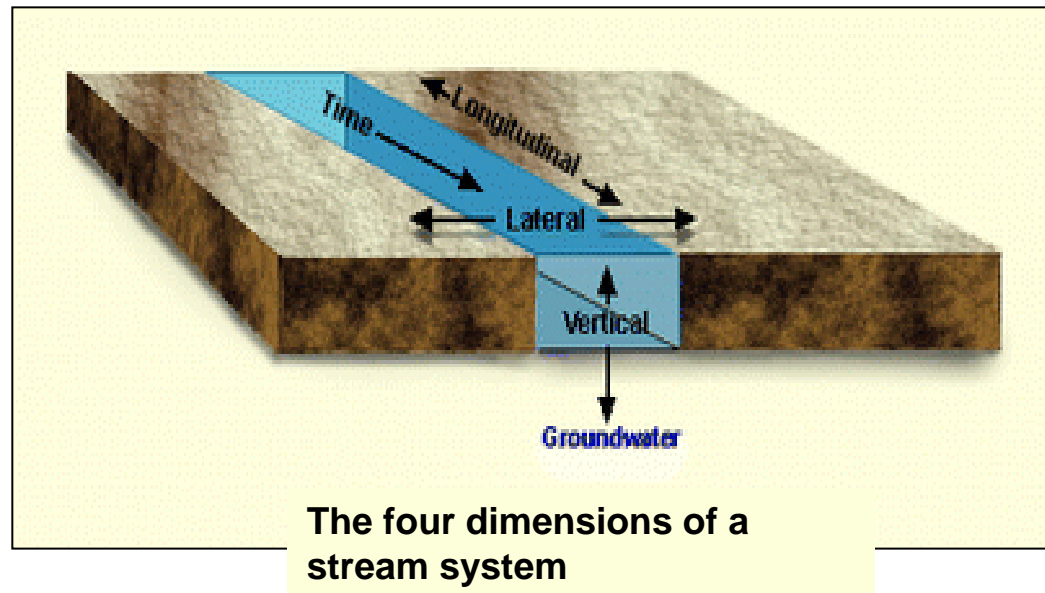


Braided Streams



Variability in river systems

- Four dimensions:
 - Longitudinal
 - Lateral
 - Vertical
 - Time



Variation in time and space

The shape, size and content of a river are constantly changing, forming a close and mutual interdependence between the river and the land it traverses.

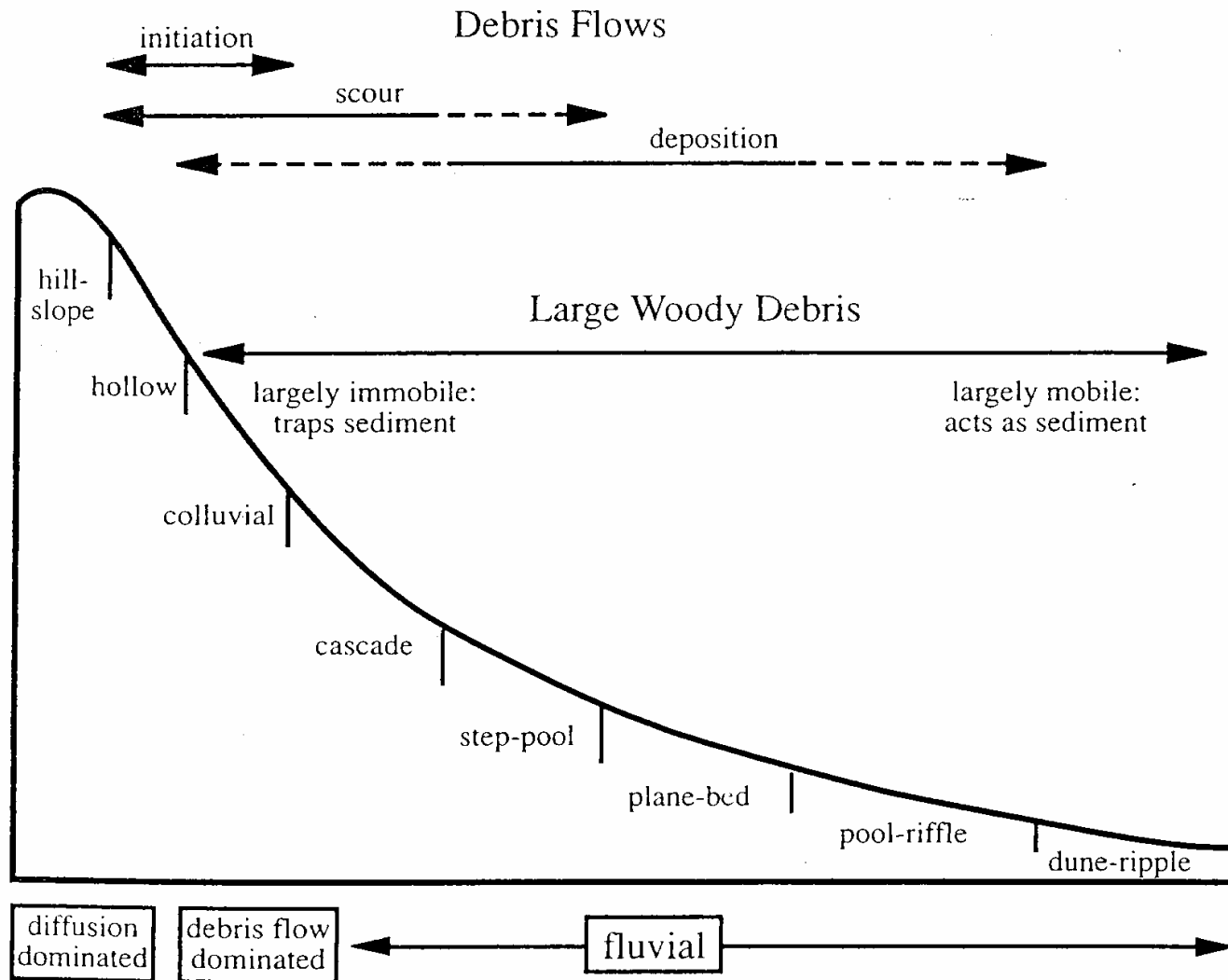


Sinuosity: Gradient and substrate

- Big meanders
 - low gradient
 - fine substrates
- Small meanders
 - high gradient
 - coarse substrates

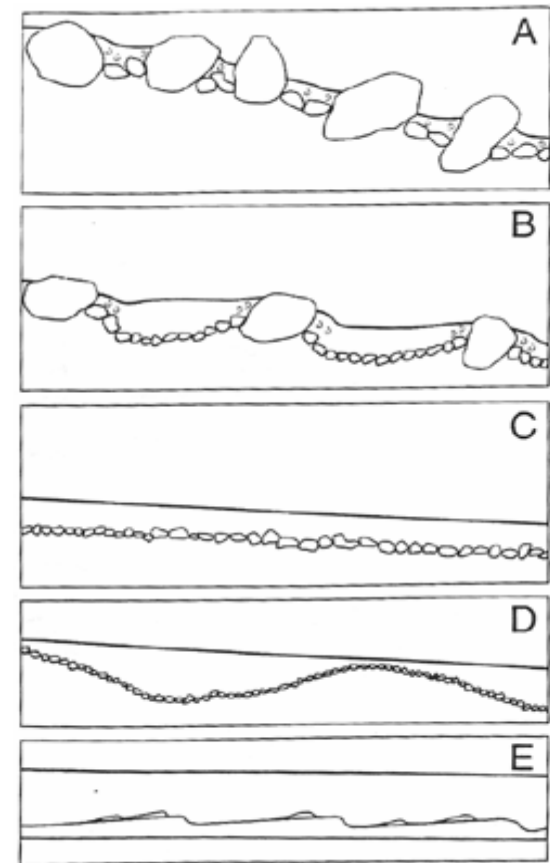


Longitudinal Profile of Mountain Rivers



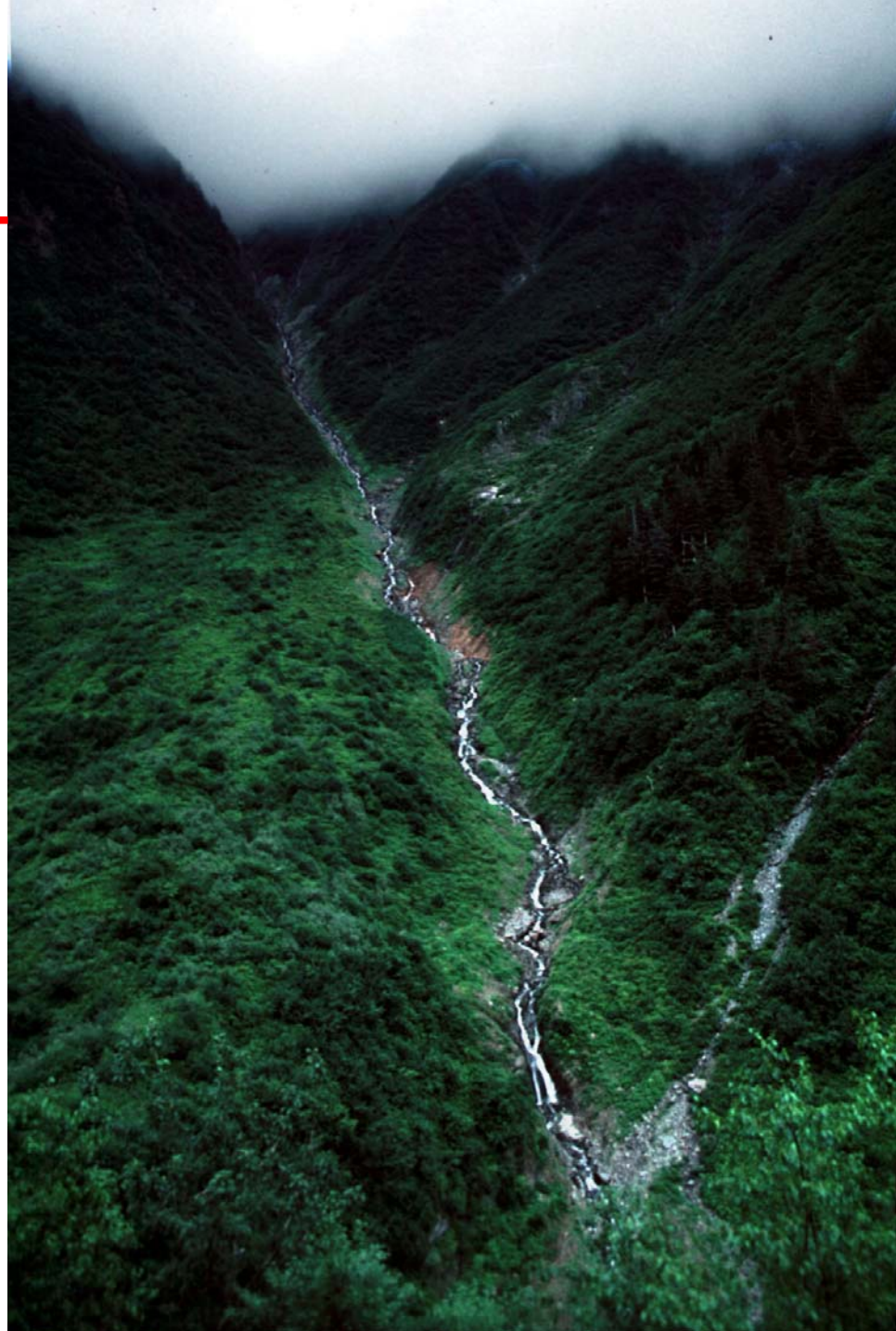
Channel type

- **Bedrock**
- **Colluvial**
- **Alluvial**
 - A. Cascade
 - B. Step-pool
 - C. Plane-bed
 - D. Pool & riffle
 - E. Dune – ripple



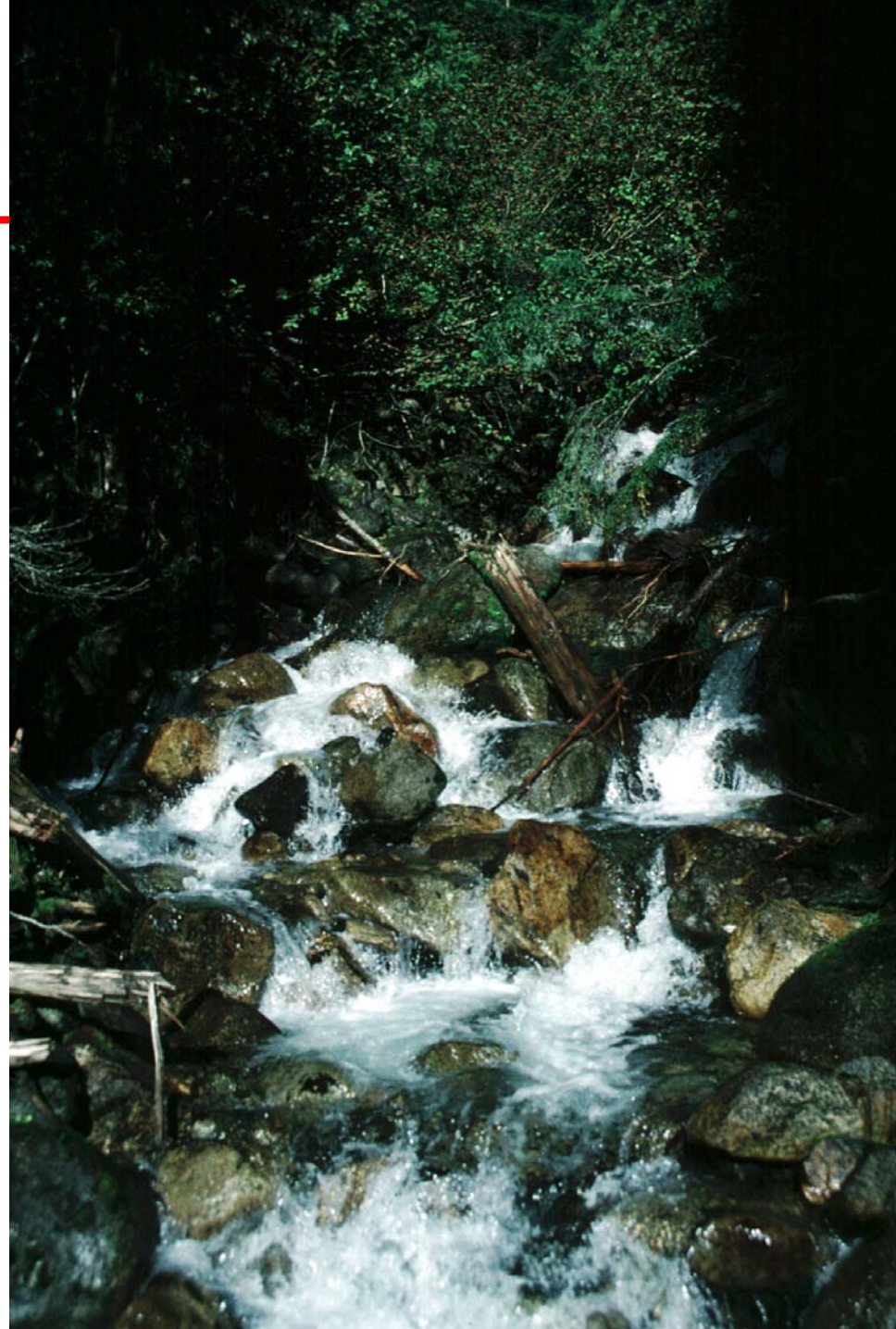
Colluvial Channels

Small headwater channels at the tips of the channel network where sediment transport is dominated by landslide processes.



Cascade Channels

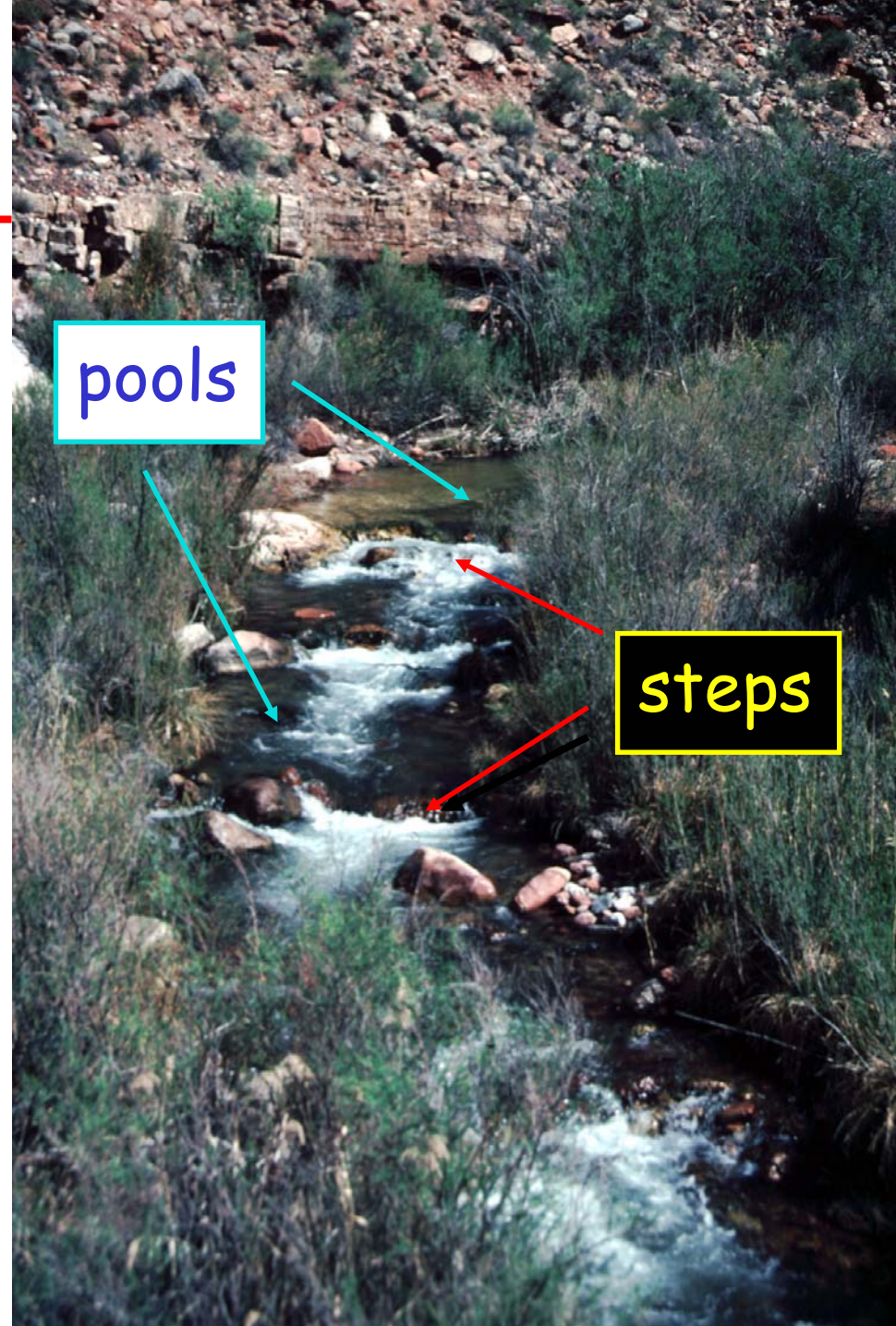
The steepest of mountain channels, characterized by tumbling flow around individual boulders; disorganized streambed structure.





Step-Pool Channels

Channels displaying full-width-spanning accumulations of coarse sediment that forms a sequence of steps.



Plane-Bed Channels

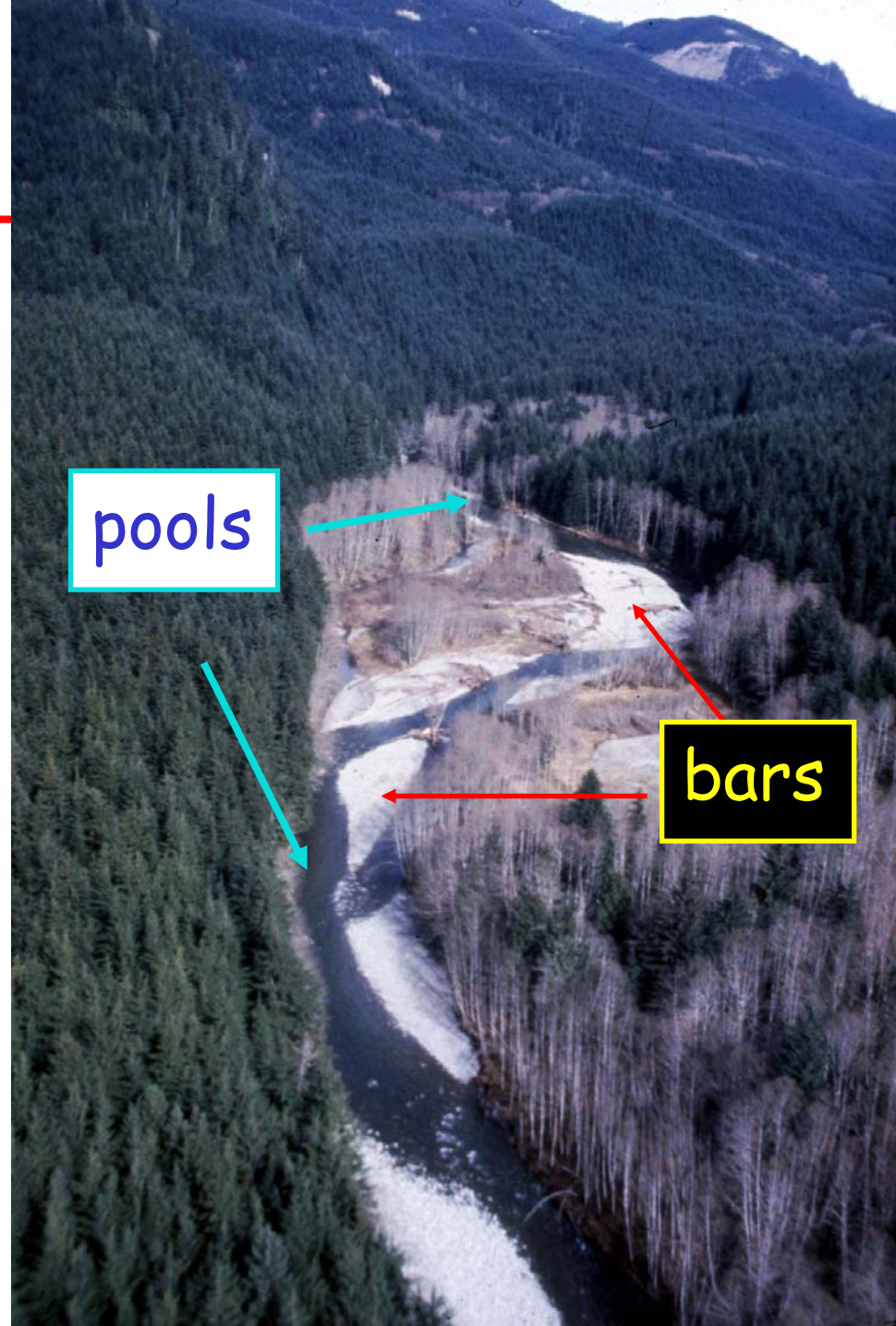
Channels lacking well-defined bedforms and instead displaying long reaches lacking pools.





Pool-Riffle Channels

The most common mountain river morphology; characterized by alternating sequence of pools and bars.





Longitudinal Profile of Mountain Rivers

