

River Environments

Rivers have become regular features in the news. In any given year, one or more rivers become notorious for their devastating floods. But for most of the time, rivers are very useful – they provide people with their livelihoods, a place to live near and are a great source of recreation and leisure. Learning to live and cope with rivers would seem to be of increasing importance. And yet, many human activities seem to make the river environment, and the human use of it, more hazardous. Is it possible for humans to live harmoniously with rivers, while benefit from them at the same time?

The number of people living on floodplains is accelerating each year.

What processes and factors are responsible for distinctive fluvial landforms?

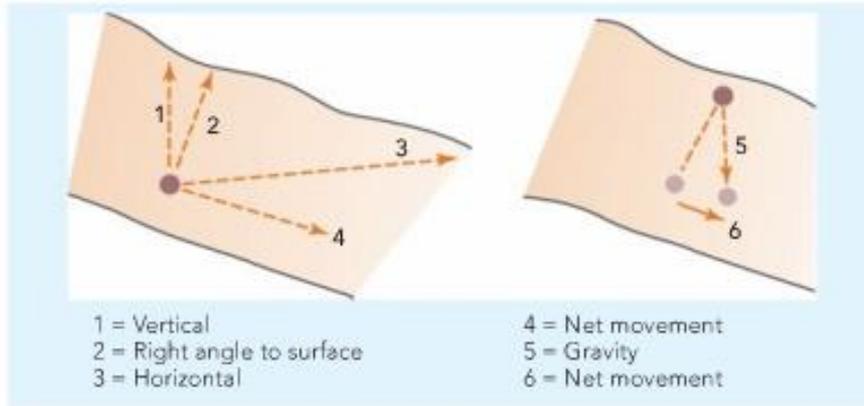
<i>Questions for Investigation</i>	<i>Key Ideas</i>	<i>Content</i>
What processes and factors are responsible for distinctive fluvial landforms?	<p>Slope processes and channel processes give rise to distinctive fluvial landforms.</p> <p>These processes are influenced by a range of factors which vary from place to place.</p>	<p>The study of a river basin or river basins, including practical research and out-of-classroom work – fieldwork, to illustrate:</p> <ul style="list-style-type: none">• a range of features associated with erosion in river systems;• a range of features associated with deposition in river systems;• the factors affecting the development of these features, including rock type and structure, slope, climate and sea-level change;• the processes responsible for these features, including weathering, mass movement, erosion and deposition.

Slope Processes

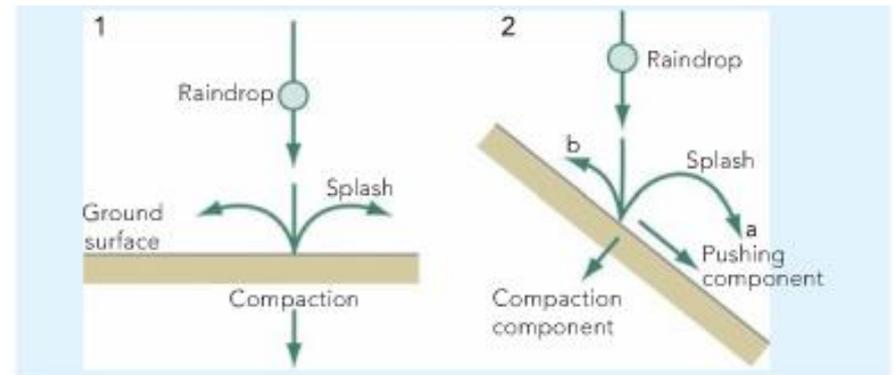
- Slopes are defined as any part of the solid land surface where there is an incline (gradient).
- Processes operating on slopes have a major impact on fluvial landscapes as slope processes transfer material downslope to the river.

Slow Movements

Soil creep



Rain splash erosion

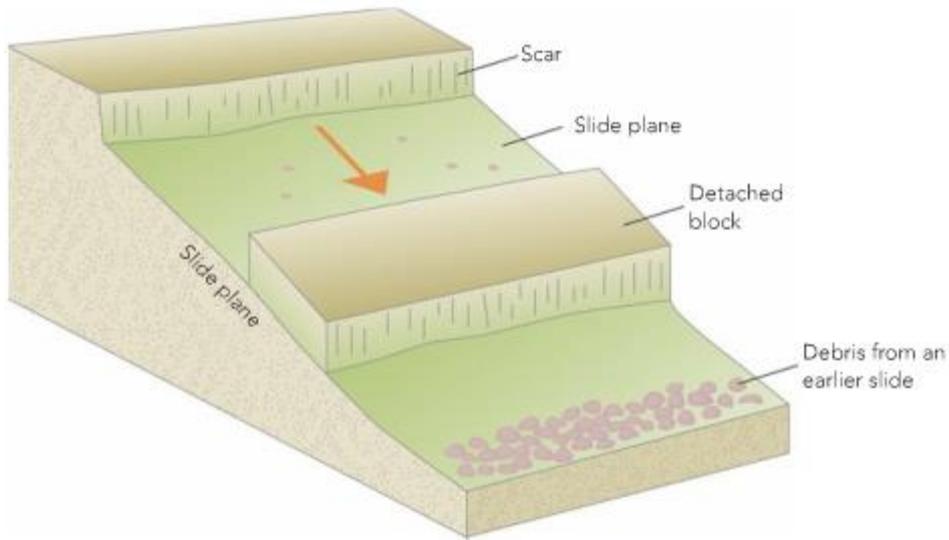


Flow Movements

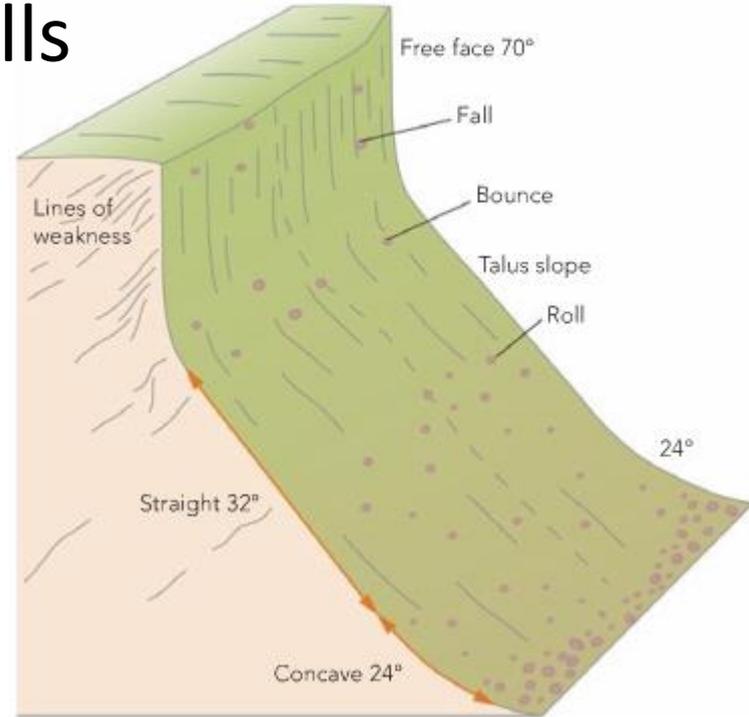
- **Surface wash:** occurs when soil's infiltration capacity is exceeded > can lead to formation of gullies
- **Sheetwash:** unchannelled flow of water over a soil surface
- **Throughflow:** water moving down through the soil

Fast Movements

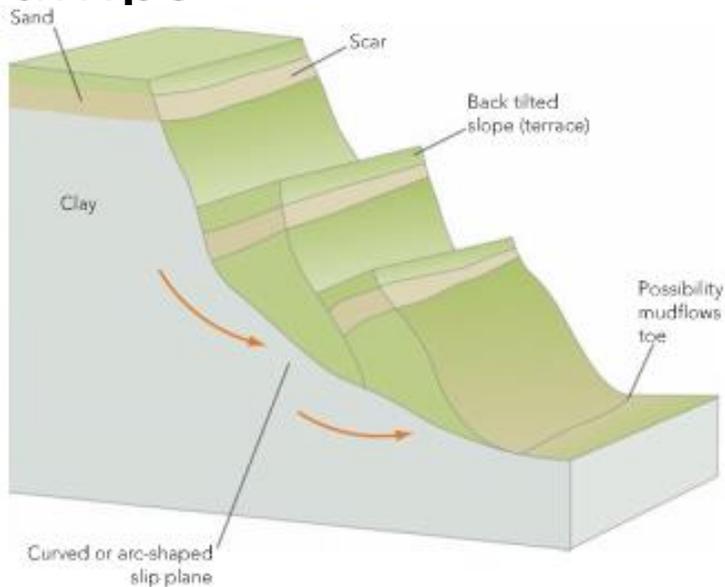
Slides



Falls



Slumps



Factors affecting slopes

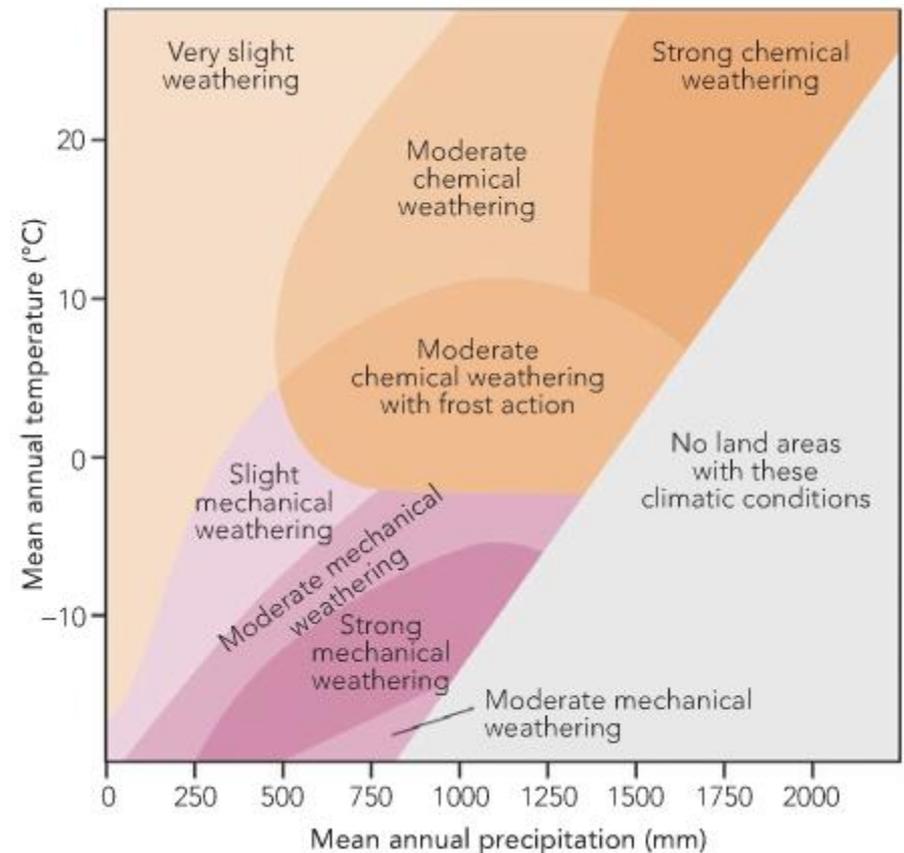
- Climate: slopes in temperate environments are rounder due to chemical weathering whereas slopes in arid environments are jagged or straight because of mechanical weathering
- Rock type and structure: older resistant rock vs. younger weaker rock
- Aspect: south-facing slopes experience more freeze-thaw than north-facing slopes = asymmetric valley

Weathering

- Mechanical weathering
 - Freeze-thaw
 - Salt crystal growth
 - Disintegration
 - Pressure release
- Chemical weathering
 - Carbonation
 - Hydrolysis
 - Hydration
 - Oxidation
- Biological weathering

Factors affecting weathering

- Climate
- Geology



Factors affecting river flow and velocity

- Types of flow
 - Turbulent flow (need complex channel shapes e.g. meandering channels or pools and riffles, high velocities, cavitation)
 - Laminar flow (need smooth, straight, shallow channels and low velocities)
- Channel shape (hydraulic radius)
- Channel roughness (causes friction that slows down the velocity of water)

Upstream

Downstream

Discharge

Occupied channel width

Channel depth

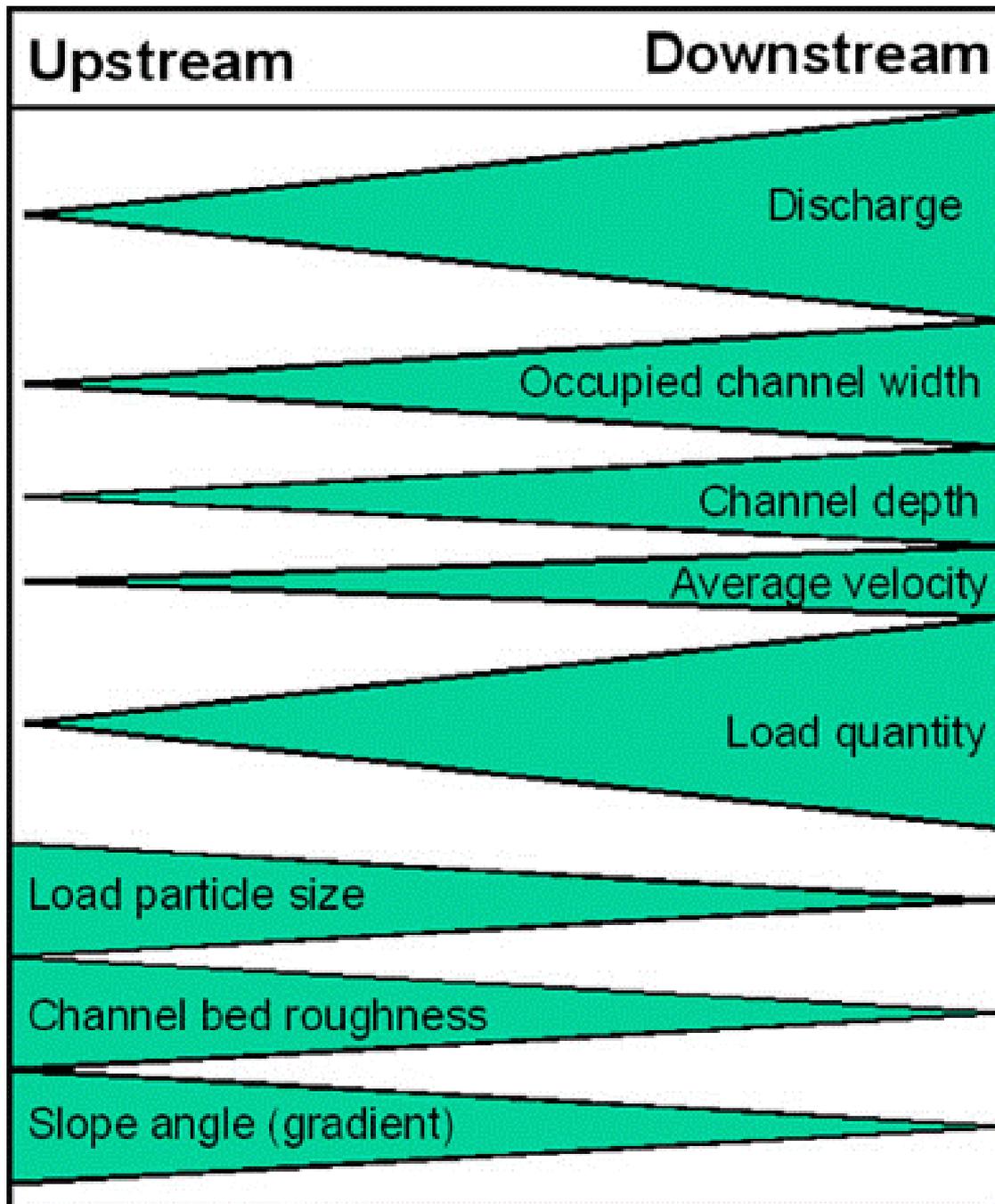
Average velocity

Load quantity

Load particle size

Channel bed roughness

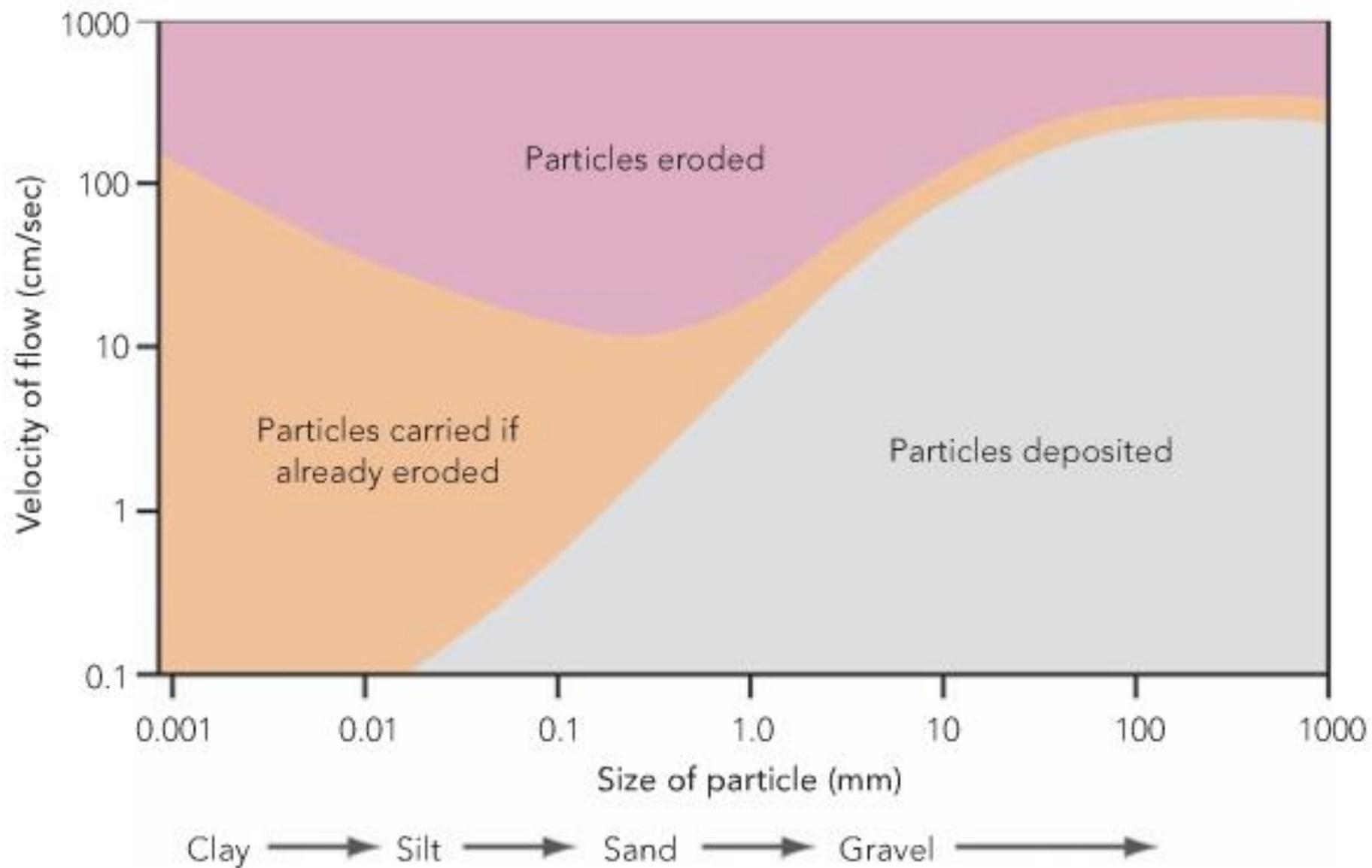
Slope angle (gradient)



Transport

Erosion by a river will provide loose material. This material is carried by the river as its load.

- Solution (dissolved)
- Suspension (carried)
- Saltation (bounced)
- Traction (rolled)



Erosion

- Abrasion
- Attrition
- Hydraulic action
- Solution

Factors affecting rates of erosion

- Load
- Velocity
- Gradient
- Geology
- pH
- Human impact

Deposition

Occurs when:

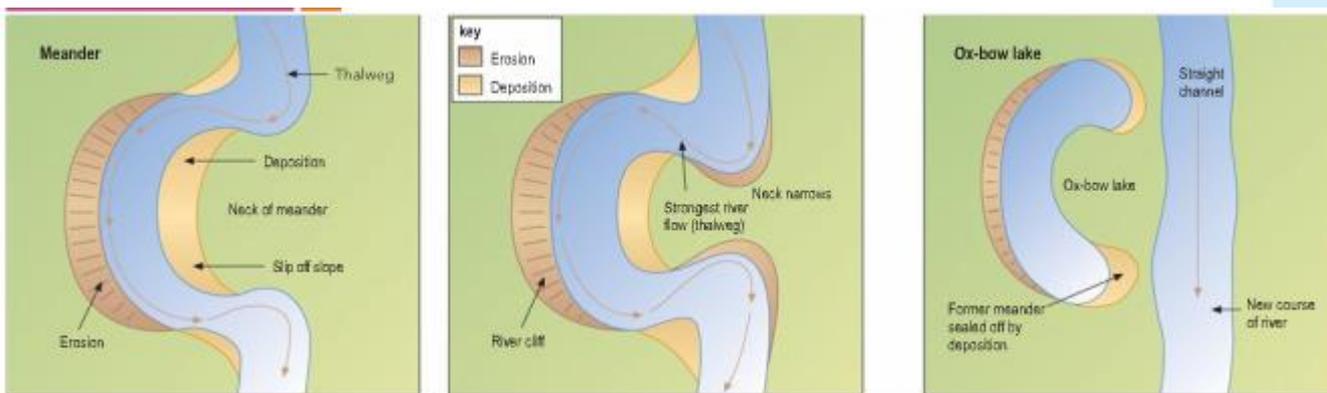
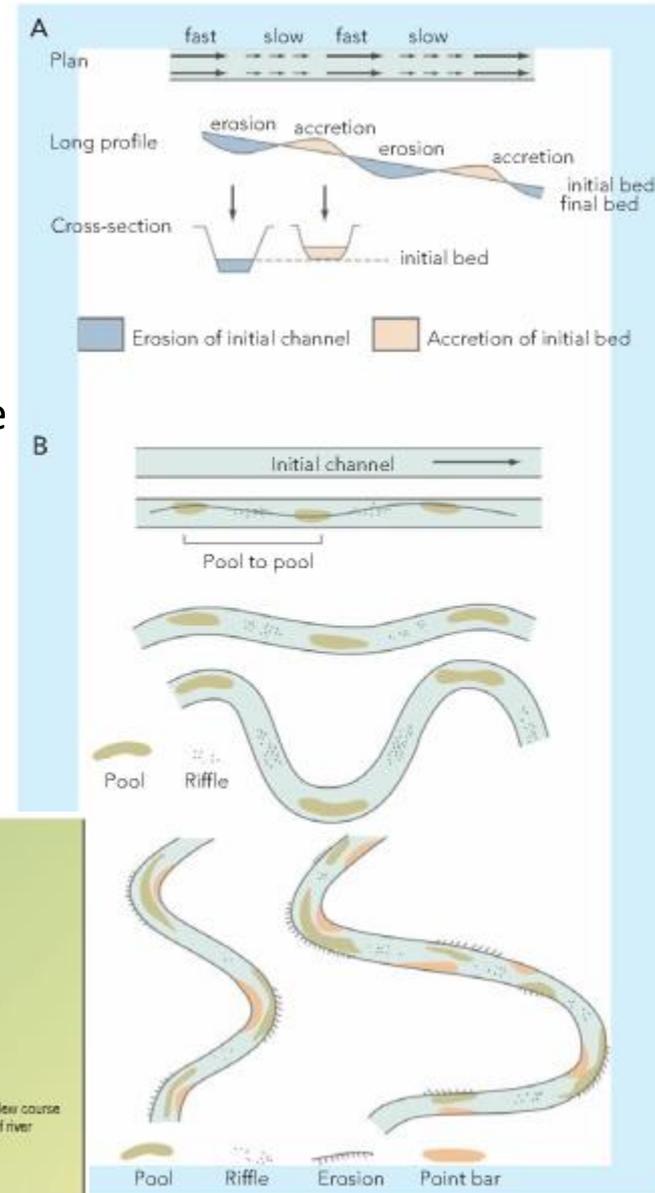
- Gradient gets shallower causing a decrease in velocity and energy
- Decrease in volume of water in the river
- Increase in the friction between water and the channel
- Human obstructions such as dams

Erosional landforms

- V-shaped valleys
 - Formed by erosion from a river. Weathering and mass movement occurs on the valley sides while the river erodes the base of the slopes. Angle of the v-shape depends on: rate of downward erosion, resistance of rocks, climate, location on river course.
- Waterfalls and gorges
 - Resistant rock, underlain by weaker rock, is undercut by hydraulic action and abrasion in the process of enlarging the plunge pool at the base of the falls. Some waterfalls are initiated by faulting others by a drop in sea level. Waterfalls move upstream as a result of the undercutting and collapse process and leave behind a gorge of recession.
- Potholes
 - A hole at the base of a stream or river. Formed through abrasion by pebbles held up by turbulent flow in the eddies of the stream.

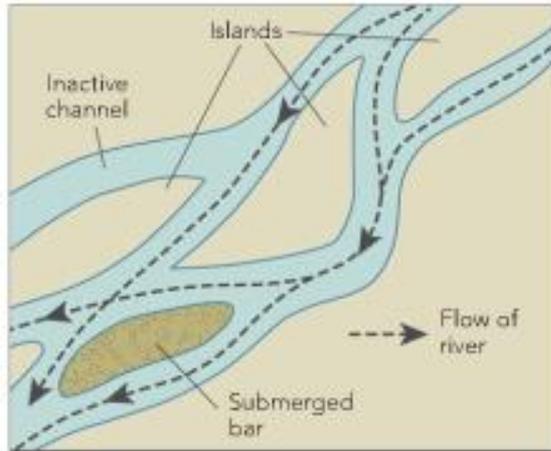
Landforms produced by erosional and deposition

- Meanders
 - Curved part of the meander is generally 6-10 times the width of the river channel and/or the discharge
 - Meandering is more pronounced when the bed load is varied
 - Meander wavelength increases in streams that carry coarse debris
 - Meandering best develops at or near the bankfull stage
- Oxbow lakes
 - Lateral erosion, caused by centrifugal forces, is concentrated on the outer, deeper bank of a meander. During times of flooding, erosion increases causing the river to break through and create a new, steeper channel. In time, the old meander is closed off by deposition to form an oxbow lake.

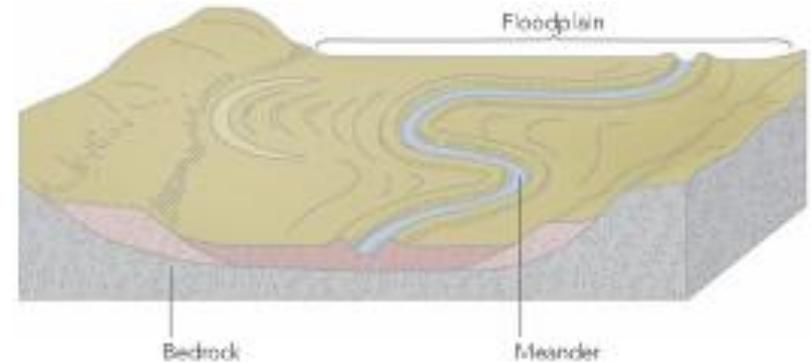


Depositional landforms

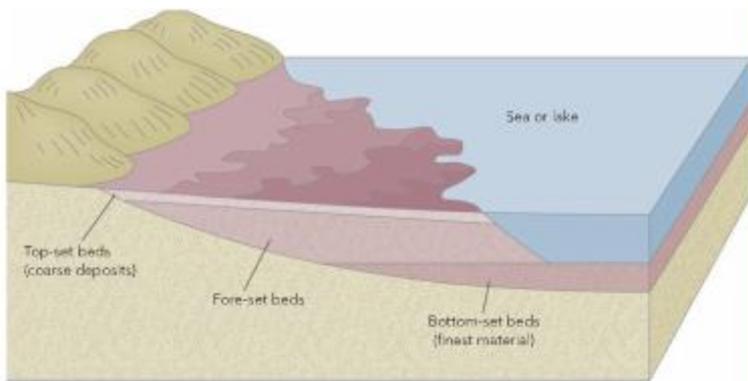
- Braided channels



- Floodplains



- Deltas



- Levees

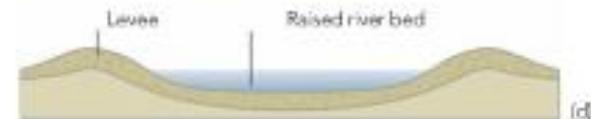
(a) When the river floods, it bursts its banks, depositing the coarsest load (gravel and sand) closest to the bank and the finer load (silt and clay) further away



(b), (c) This continues over a long time - centuries



(d) The river has built up raised banks called levees, consisting of coarse material, and a floodplain, consisting of fine material



Effects of base level changes on the formation of features

- A negative change of base level is caused by uplift or a fall in sea level.
 - Intrenched/incised meanders
 - River terraces
 - Knickpoints

