

River Systems-Runoff

- 1) Running Water
 - a) Integral part of sculpting the Earth's surface
 - b) **MOST IMPORTANT AGENT OF EROSION**
 - c) Indirectly results in the formation of sedimentary rocks
- 2) Stream Formation
 - a) Sheetflow or Sheetwash – overland flow of water
 - b) Repeated precipitation events cause a preferential channel to form – **downcutting**
 - c) Tributaries form & the main channel continues to grow up slope – **headward** erosion
- 3) Stream Morphology
 - a) Streams increase in length by headward erosion – erosion occurring at the beginning of the stream
 - b) Streams become wider through lateral erosion – mass wasting of the stream banks
 - c) Streams become deeper through downward erosion of the channel by abrasion of the sand and gravel
- 4) Stream Terminology
 - a) Stream System - main stream plus tributaries (ex. Mississippi River System)
 - b) Drainage basin - area drained by the main stream and tributaries
 - c) Drainage Divide - area of higher elevation that divides drainage basins
 - d) Function of size/scale
- 5) Stream Subsystems
 - a) Collecting System
 - i) Tributaries is head water region
 - ii) Funnel water and sediment to main channel
 - iii) Primarily **erosion** and transport
 - b) Transporting System
 - i) Main tributary
 - ii) Main process is the movement of the sediment and water
 - iii) Erosion, transport, and deposition all occur
 - c) Dispersing System
 - i) Distributaries at mouth region
 - ii) Primarily deposition of the sediment
 - iii) Coarse sediment along the confluence
 - iv) Fine particles carried further in to body of water
- 6) Drainage Patterns
 - a) Function of the underlying geology, the topography of the area, & the history of the stream
 - b) Dendritic
 - i) Resembles branches of a tree
 - ii) Random Orientation of streams
 - iii) Represents a uniform resistance of bedrock to erosion
 - iv) Underlain by sedimentary rocks or uniform igneous or metamorphic rocks
 - c) Radial
 - i) Streams radiate outward from central zone

- ii) Generally surround a topographic high point, such as a conical mountain, a dome, or a volcano
- d) Rectangular
 - i) Streams develop along fractures or joints in the underlying bedrock
 - ii) Sets of fractures/joints tend to form at right angles
- e) Trellis
 - i) Represents area of alternating weak & resistant rocks
 - ii) Tributaries develop in the weak rock
 - iii) Main stream cuts across resistant rock
 - iv) Common in folded mountain belts (Appalachians for example)
- 7) Streamflow Dynamics
- 8) Discharge – volume of water that passes a given point in one second
 - a) Generally given in ft^3/s or m^3/s
 - b) Calculated by: $Q = A v$
 - c) Where A is the cross-sectional area (length^2) & v is the velocity of the water ($\text{length}/\text{time}$)
- 9) Velocity (v)
 - a) The speed of the water at a given point along a stream
 - b) Directly related to a stream's ability to erode and transport material
 - c) High velocity water can carry heavier sediment
 - d) Is a function of
 - i) Stream Gradient
 - (1) Slope of steepness of the stream channel
 - (2) Vertical drop (relief) of a stream over a fixed distance
 - (3) Controls the potential energy of the water
 - (4) Steeper the gradient – the higher the velocity, the lower the gradient – the lower the velocity
 - (5) Meanders decrease the gradient by increasing the horizontal distance of the stream
 - (6) Stream Equilibrium
 - (a) Stream want to be at a low energy state
 - (b) When the gradient is high (high energy) erosion will occur
 - (c) When the gradient is low (low energy) deposition will occur
 - (d) Graded Stream – stream gradient is in balance (equilibrium) with the volume of water available, thus neither erosion nor deposition occur along the stream profile
 - (e) Longitudinal Profile
 - (i) Cross-sectional image showing the variation in a stream's elevation along its length
 - (ii) Base Level
 - (iii) The downward limit of stream erosion; lowest elevation to which a stream can erode its channel
 - (iv) Ultimate Base Level – sea level
 - (v) Local Base Level – lakes, resistant layers of rock, reservoirs, etc.
- ii) Channel Properties
 - (1) Wetted Perimeter
 - (a) The area in which water touches the channel walls

- (b) Channel shape and size controls the wetted perimeter
- (c) Most efficient streams have small wetted perimeters
- (d) Roughness of the channel controls the frictional resistance to water movement
- (e) A smooth channel decreases frictional force
- (f) A rough channel increases frictional force

(2) Shape

(3) Size

(4) Roughness

10) Urbanization Effects

- a) Decrease infiltration – Increases runoff
- b) Produces Higher Peak Discharge
- c) Produces shorter lag time
- d) Produces more floods
- e) Higher discharge = increased ability to erode