River Clarification

Climate
Ecology
Watershed

Next Step for the Dry Run Creek Video Project…

- Junior and senior undergraduates at Iowa four-year
- $1000
- Sustainability through a planned learning activity
- how you will use that knowledge in future life experiences
- Work with a faculty mentor
- Deadline = Oct. 30

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FOR SUSTAINABLE AGRICULTURE

Fluvial Geomorphology – WHY?

A. Critically important to understanding Landscape evolution

- Regional (tectonic and climatic)

vs.

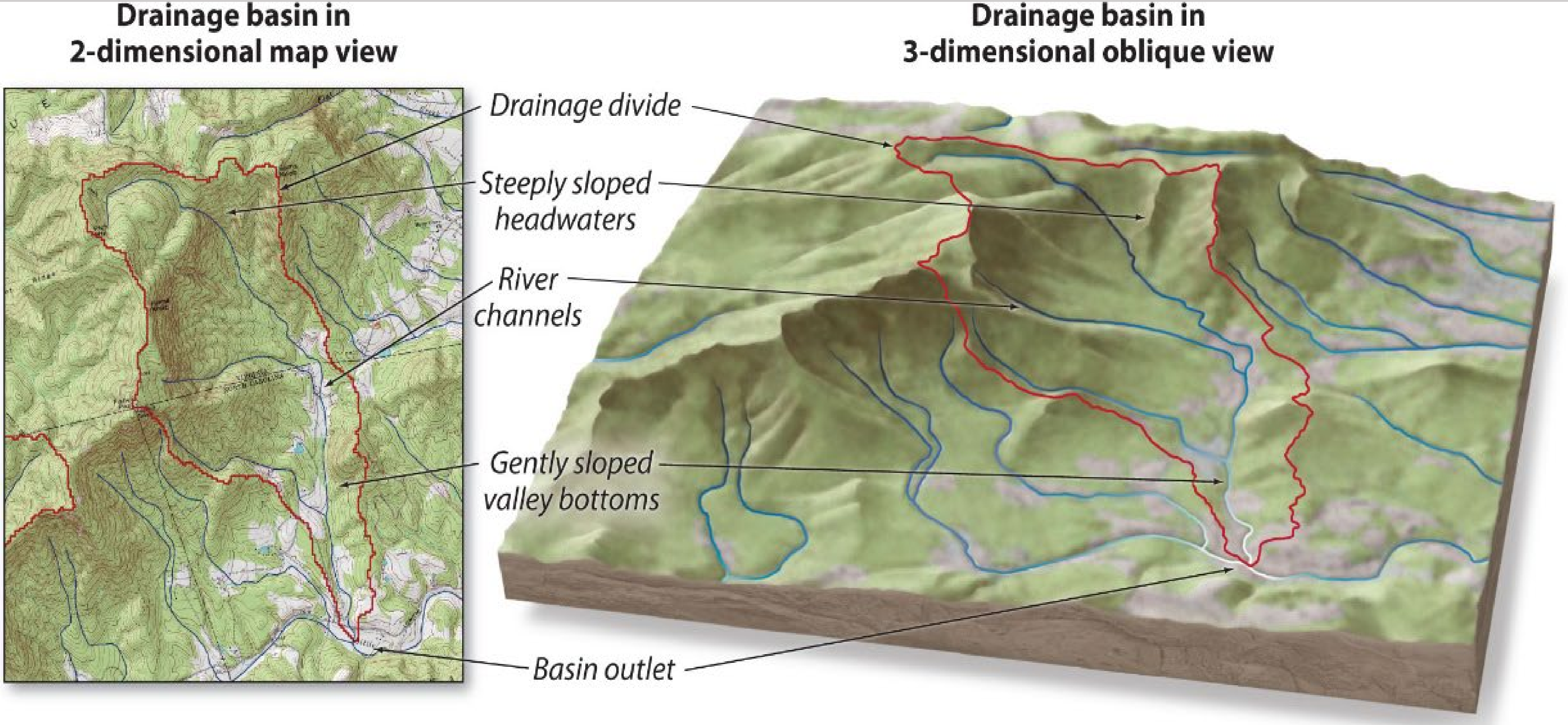
Local controls (discharge, Vegetation, sediment type/load)

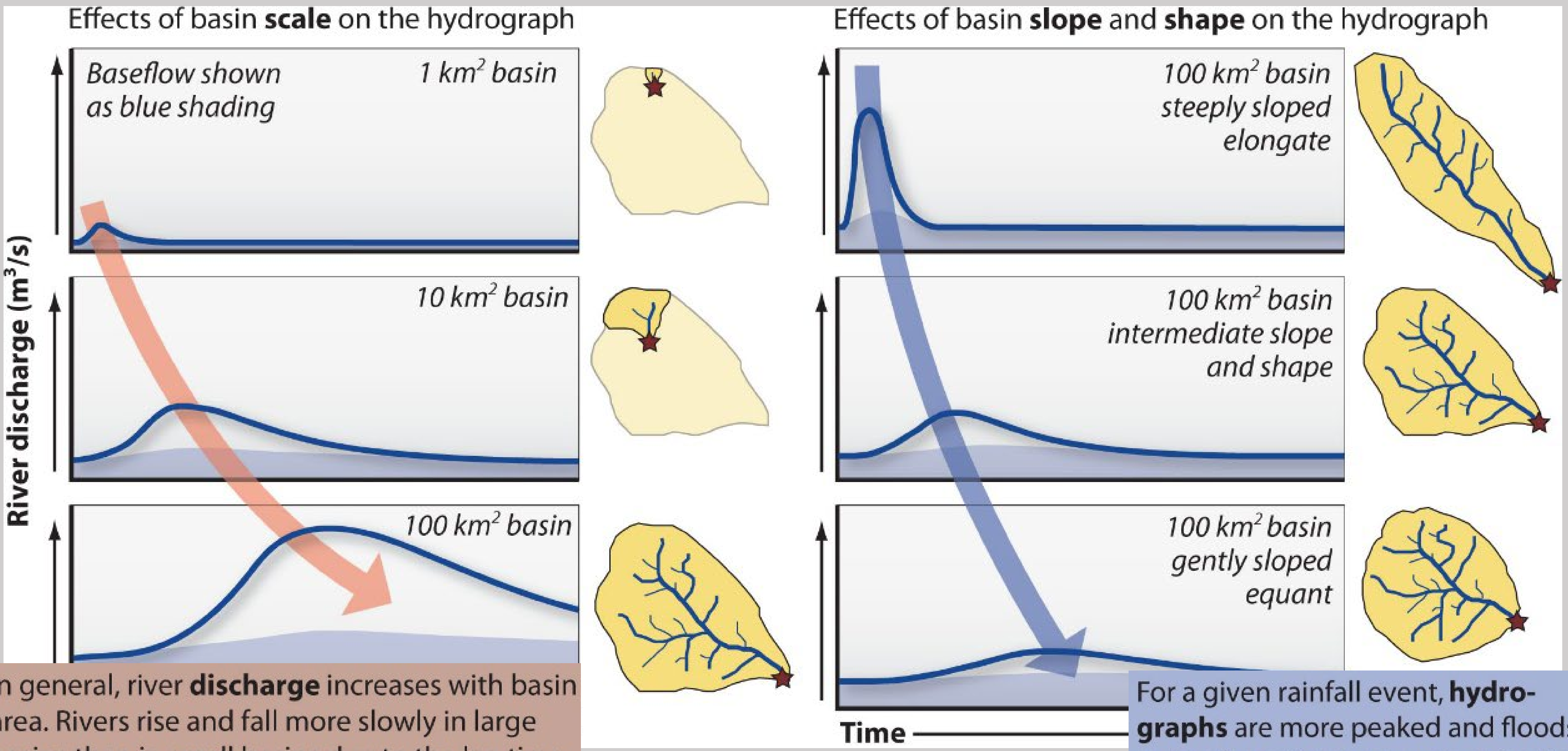
B. Streams and Rivers are the ‘life-blood’ of our society.

Controlling Variables

1. Stream velocity (m/s) or (ft/s)
2. Discharge (m^3/s) or (ft^3/s)
3. Gradient
4. Channel size and shape
5. Sediment load
6. Geologic environment
7. Vegetation
8. Anthropogenic modification
9. Hydrologic system/climate/geography

Watersheds – OK, but what about gradients?





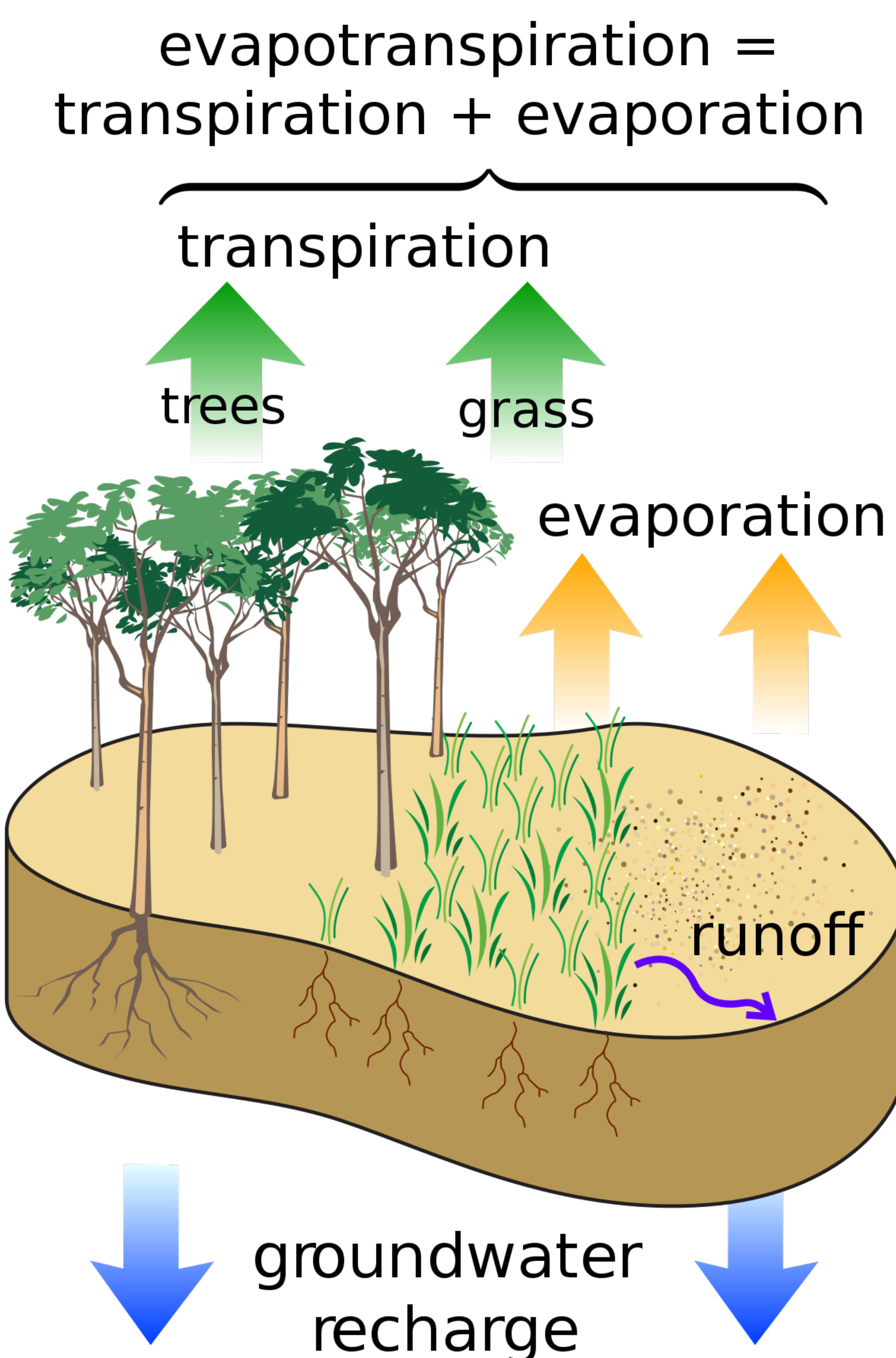
In general, river **discharge** increases with basin area. Rivers rise and fall more slowly in large basins than in small basins due to the lag time of water coming from distal locations. The area under the curves increases with basin area as more water runs off from larger basins, especially in humid regions.

For a given rainfall event, **hydrographs** are more peaked and floods more abrupt in narrow, steep basins than in equant, gently sloping basins. The area under the curves, the total discharge, remains constant for all three example basins.

Urbanization?

Can evapotranspiration be quantified?, in DRC?

- Yes… through modeling
  - Precipitation & upland tree evapotranspiration (ET) are considered the two most important components controlling annual water budgets in catchment hydrology
  - Vegetation types and densities, temperature, soil types, saturation levels…
  - ArcE: A GIS tool for modelling actual evapotranspiration (AE)
- Yes, but the rural to urban transition will complicate matters



Evapotranspiration and agriculture
Does Farming increase or decrease (ET)?

- Depends… Natural vegetation, ET? and other factors
  - Dry Run Creek – Urban Heat Islands

UCAR CENTER FOR SCIENCE EDUCATION

  - UN – Food and Agriculture Organization (FAO)

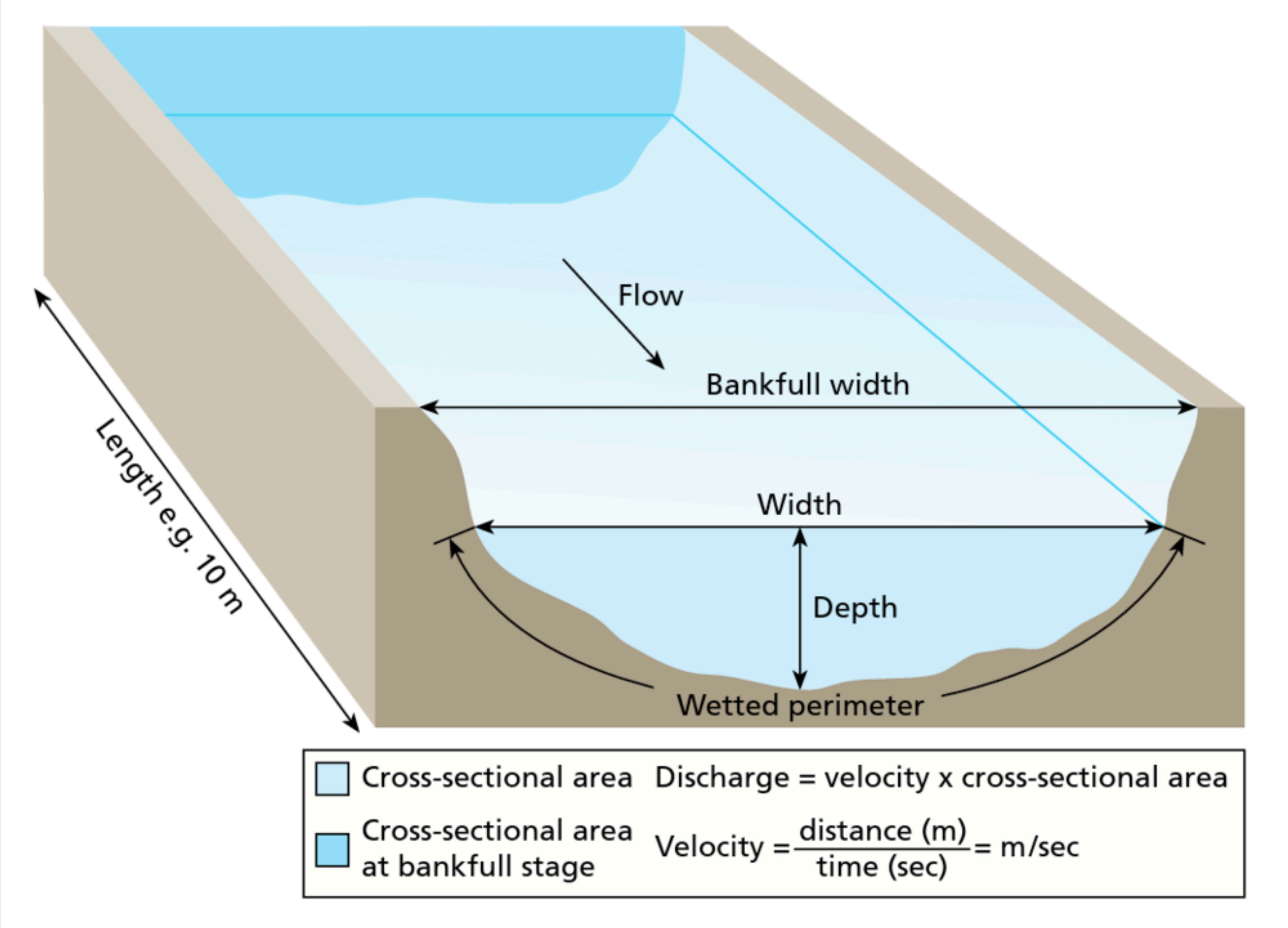
  http://www.fao.org/3/X0490E/x0490e04.htm

Stream Discharge

- Average channel width *
- Average channel depth *
- Average velocity

= Q = Discharge

Cfs or Cms



Flow Velocity / Manning's Equation

$U = (R^{2/3} S^{1/2})/n$

- U = Stream flow velocity
- R = Hydraulic Radius ((cross sectional area (A_{cs}) / Wetted perimeter (P_w))
- S = Water surface slope
- n = Manning roughness coefficient

- Manning's Eqn. Calculator , you can make your own in excel
- USGS report1 USGS report 2 – How values are calculated
- Oregon State.edu values

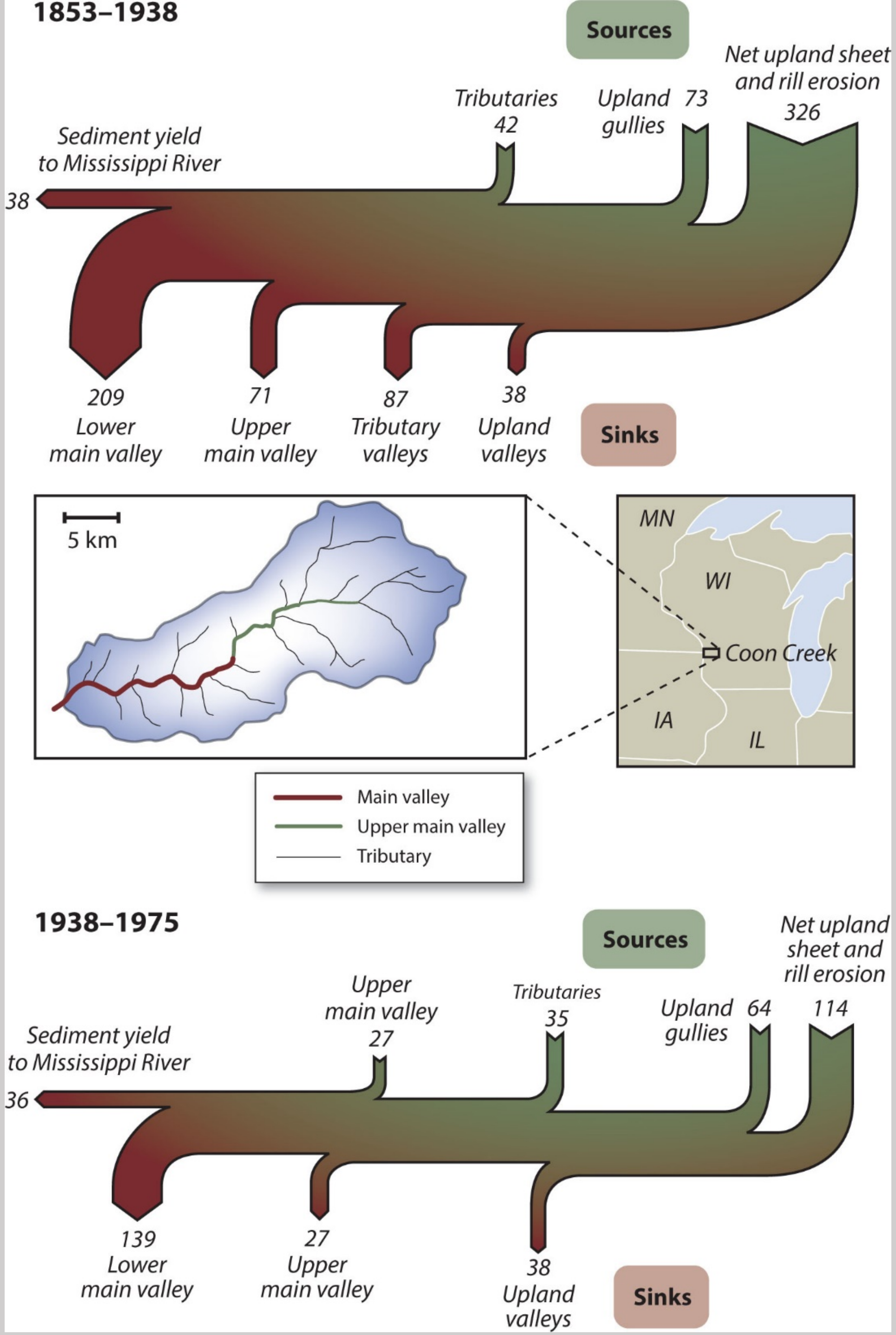
How does hydrology affect ecology?

- Physical
- Chemical
- Biological

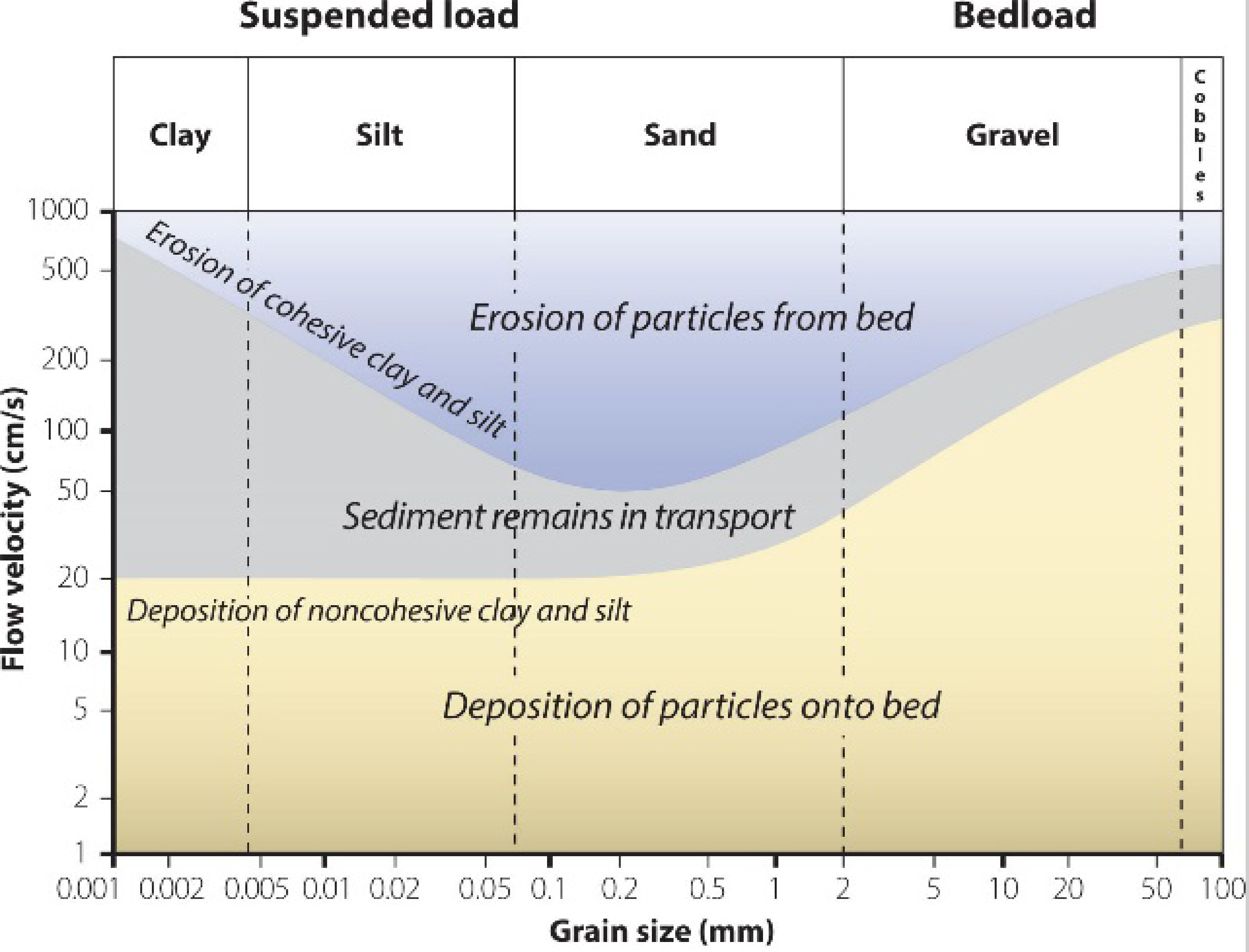
Moving the Needle in 2020: Achieving Cedar River Watershed Goals
November 8, 2019 1 to 4:30

A bit of work for you…
Be ready to address

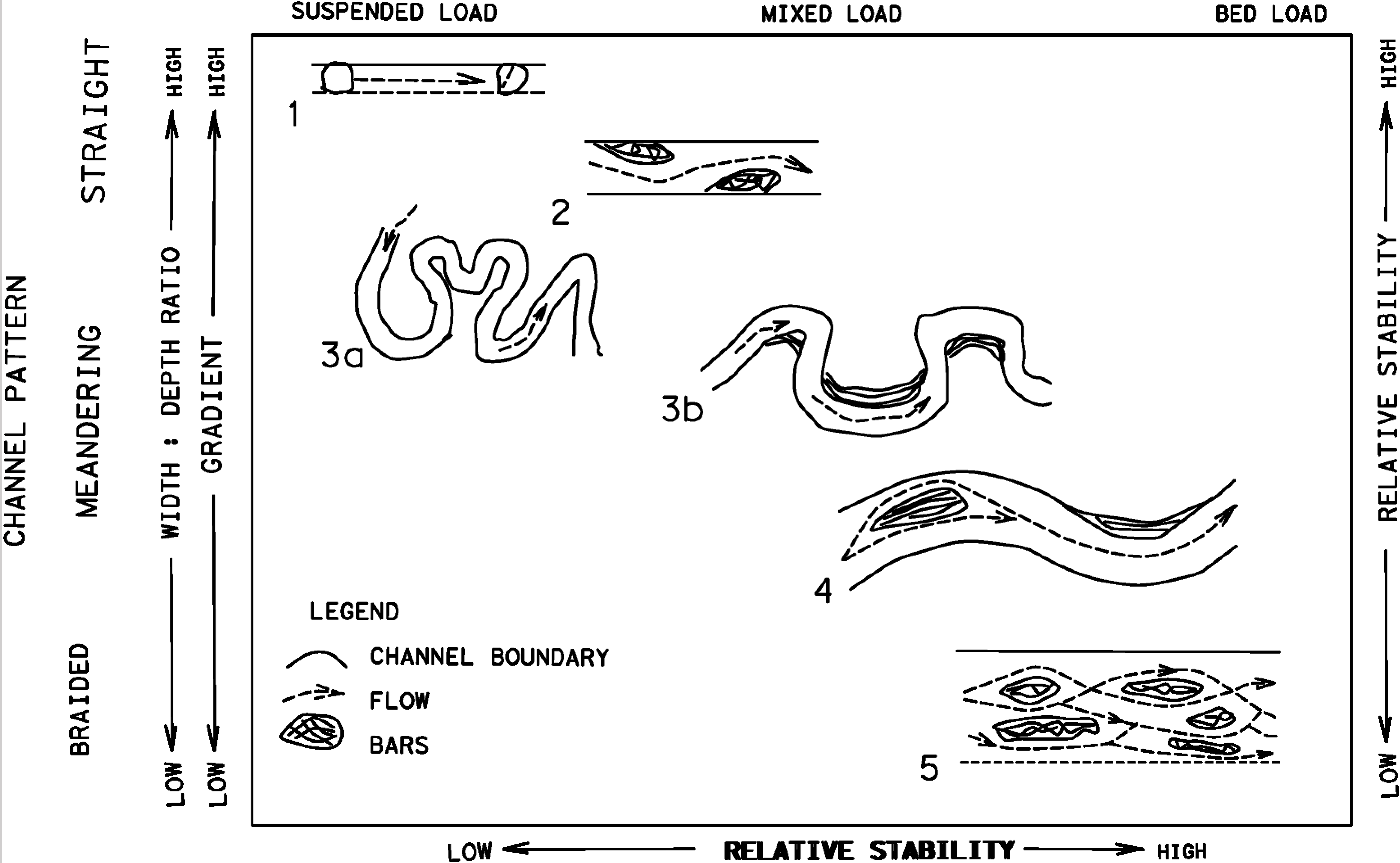
- Chapter 4
  - Digging deeper – p. 138-142
- Chapter 6
  - Worked problem p. 214
- Chapter 7
  - Digging deeper – p. 245-250



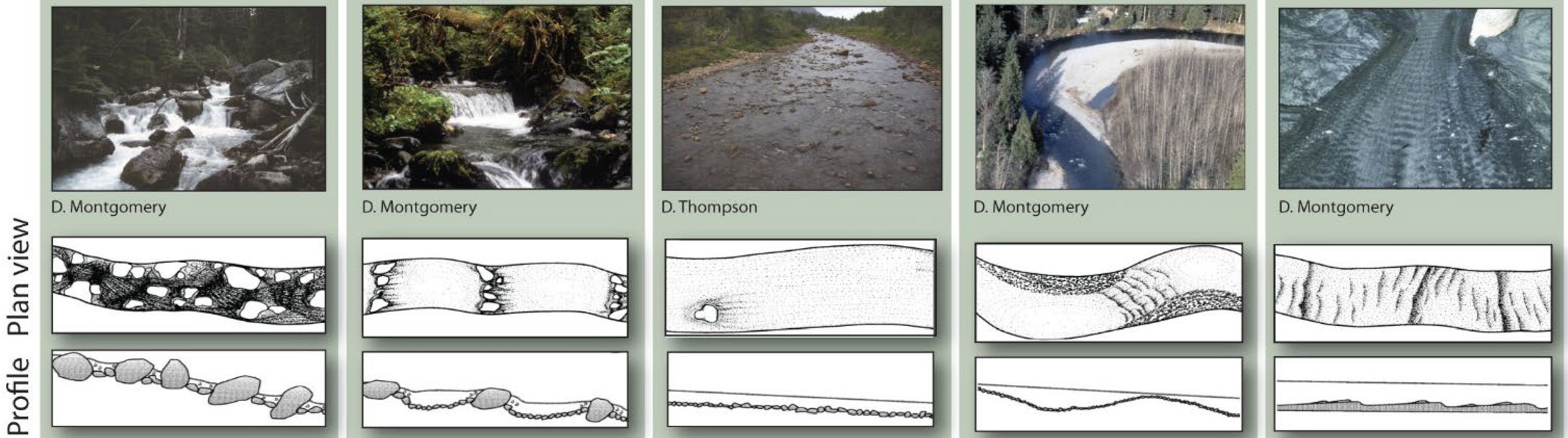
Hjulström curve p. 195



• Schumm paper #1



Cascade | **Step-pool** | **Plane-bed** | **Pool-riffle** | **Dune-ripple**



Cascade

Cascade channels, typical of mountainous headwater settings, contain disorganized bed material typically consisting of cobbles and boulders. Large clasts protrude through flow.

Step-pool

Step-pool channels contain longitudinal steps formed by large clasts organized into discrete channel-spanning accumulations. These steps separate pools containing finer material (gravel and sand).

Plane-bed

Plane-bed channels are characterized by long stretches of relatively featureless bed, which is typically composed of cobbles or gravel. Large woody debris may force the localized formation of pools and bars.

Pool-riffle

Pool-riffle channels have undulating beds with lateral bed-form oscillations that define a sequence of bars, pools, and riffles. Pool-riffle channels are often gravel-bedded and are typical of lowland valleys.

Dune-ripple

In dune-ripple channels, which are typically sand-bedded, bedforms vary with increasing flow depth and velocity, from lower-regime plane beds, to ripples, sand waves, dunes, upper-regime plane bed, and anti-dunes.

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