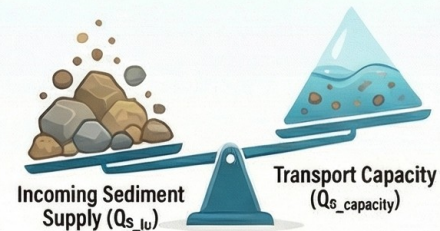


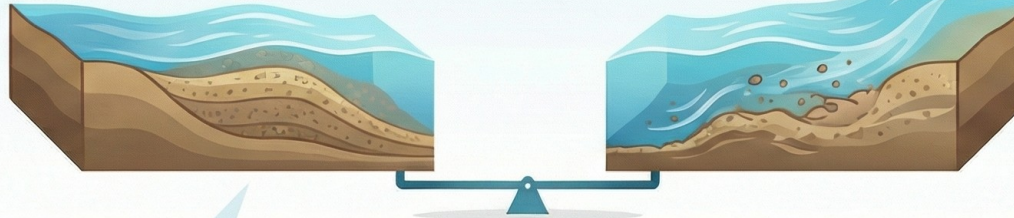
River Morphodynamics: The Science of Bed Aggradation and Degradation

The Core Principle of Sediment Balance

Aggradation vs. Degradation

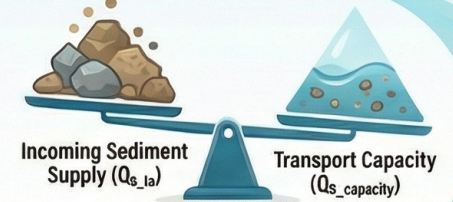


Aggradation increases bed elevation, while degradation decreases it as the riverbed erodes.



$$Q_{s_in} > Q_{s_capacity} = \text{Aggradation}$$

When more sediment enters than the flow can carry, the bed rises.



The Supply-Capacity Rule

Bed change is driven by the ratio of incoming sediment supply to transport capacity.

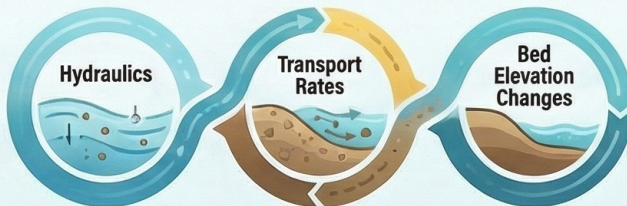
Engineering Impacts and Modeling Framework

The "Dam Effect" on Morphology

Dams trap sediment upstream (aggradation) and create a sediment deficit downstream (degradation).

The HEC-RAS Bed-Update Loop

Models iteratively compute hydraulic, transport rates, and bed elevation changes.



Equilibrium vs. Reality

Equilibrium (Standard Models)



Reality



Standard models assume instant adjustment, but real rivers exhibit lag and "memory".



Model Choice



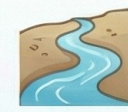
Balance



Non-equilibrium



HEC-RAS



Best For...



Sand-bed rivers



Flash floods/Pulses



Engineering Standards



Key Characteristic



Assumes instant sediment adjustment



Includes "memory" and adaptation distance



Uses quasi-steady hydraulics