



Watershed Legacies and Their Implications

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Rivers as Ecosystems

River corridor

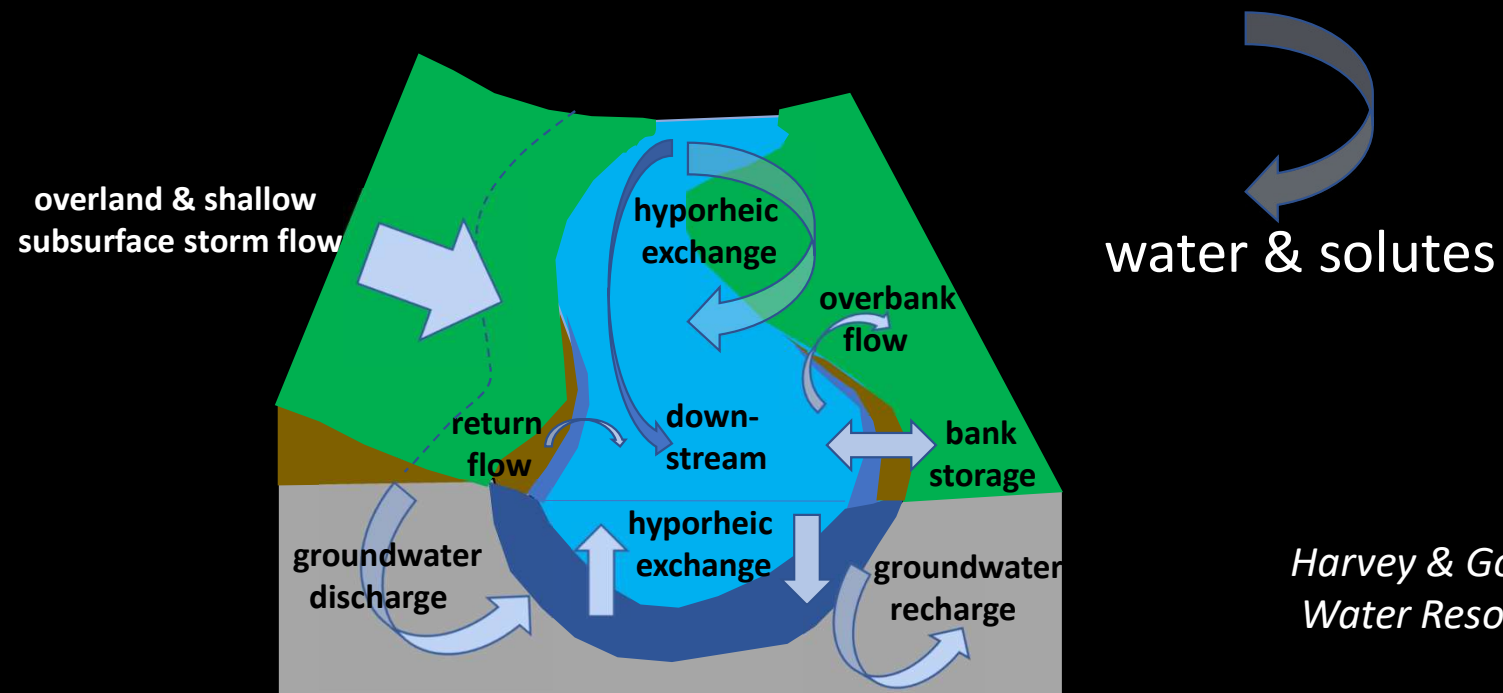
3D process & form

Fluxes & context

- thresholds
- trajectories
- alternative states

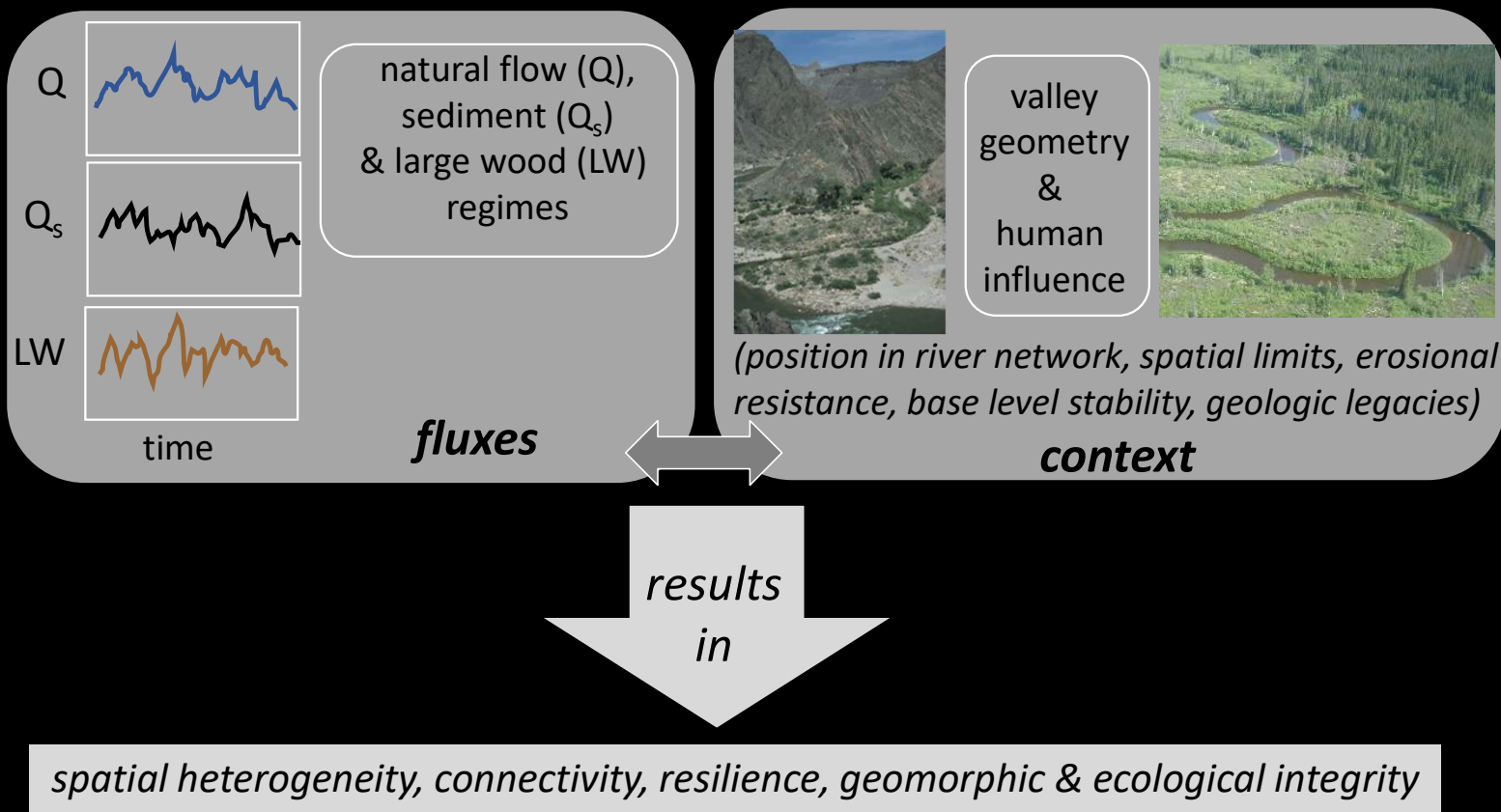


A river corridor includes the active channel(s), floodplain, & underlying hyporheic zone

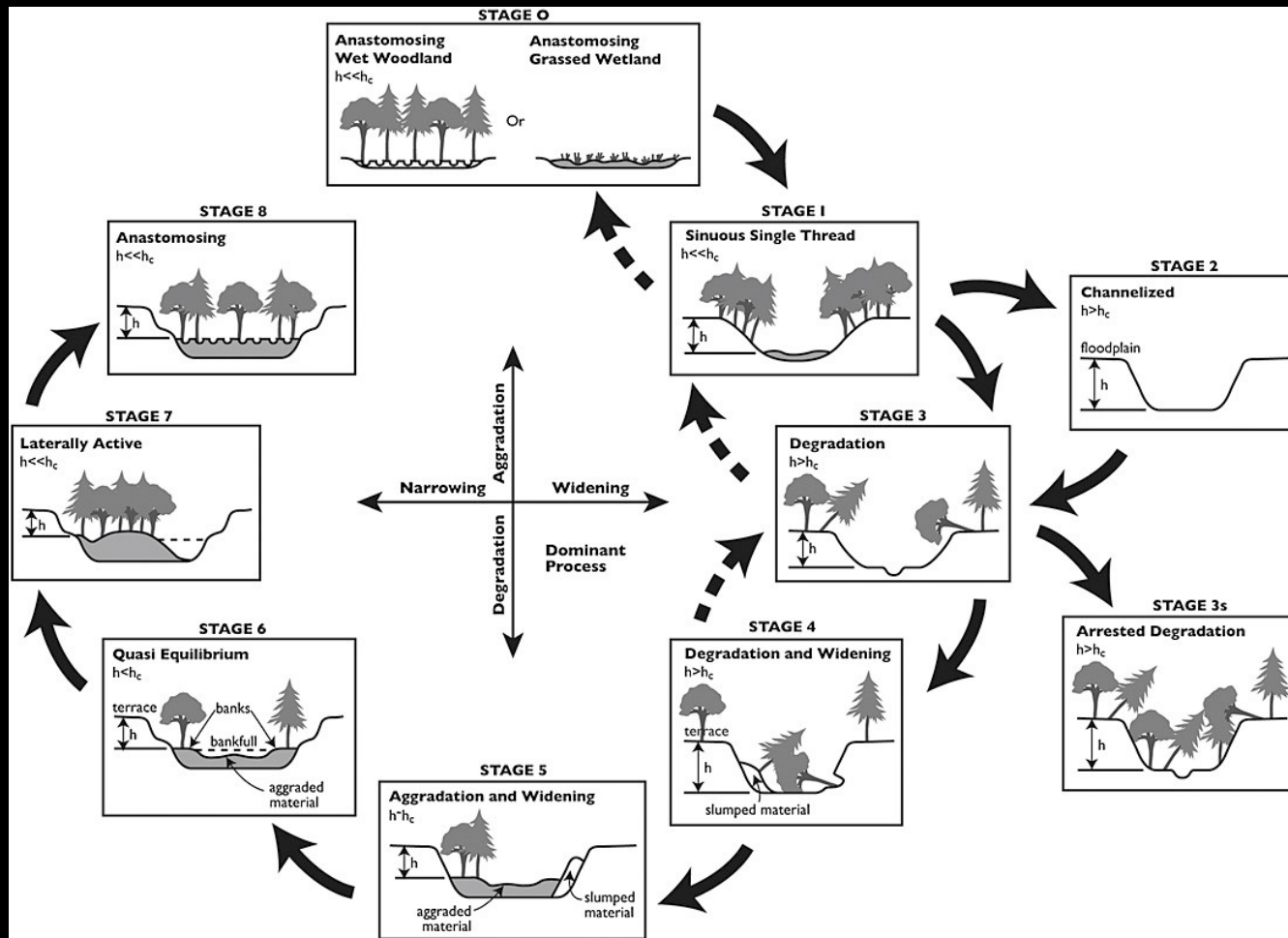


*Harvey & Gooseff, 2015,
Water Resources Research*

Rivers as Ecosystems: river corridors -- 3D process & form



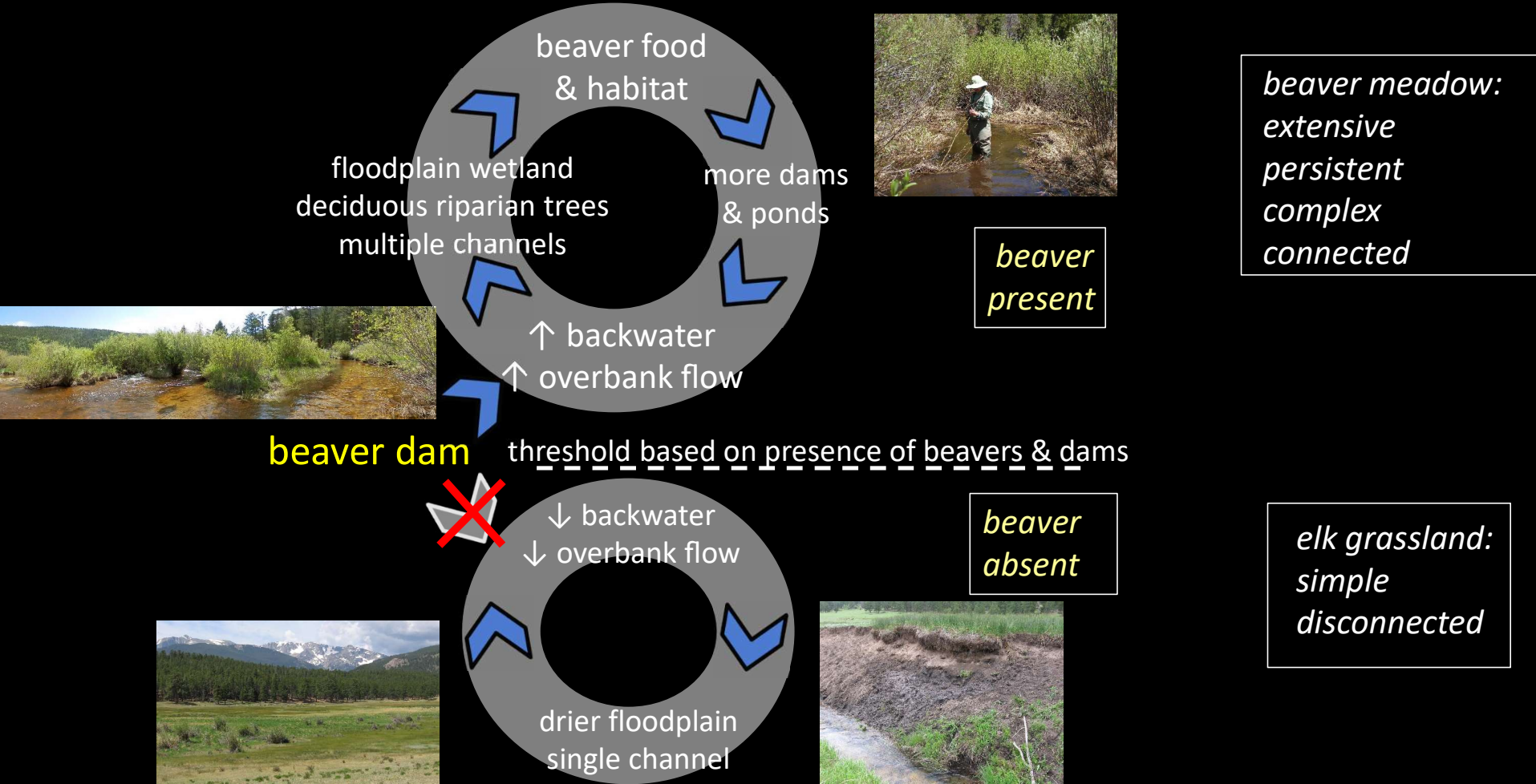
Rivers as Ecosystems: fluxes & context



*Cluer & Thorne, 2014,
River Research & Applications*

Rivers as Ecosystems: thresholds & trajectories

Conceptual Model for Beaver Meadows/Elk Grasslands



Rivers as Ecosystems: alternative states

Changes in the Land: European Settlement

Beaver trapping



Uplands

- land cover changes (timber harvest, agriculture, mining)



River corridors

- land cover changes
- mill dams
- floodplain drainage
- channel engineering & artificial levees
- dams & flow regulation
- large wood removal



Mill Creek, PA

Changes in the Land: Legacies

Fluxes into river corridors

- water
- sediment
- solutes/contaminants

Forms in river corridors

- simplified & homogenized
- excess storage (sediment, nutrients)
- increased conveyance (water, sediment, nutrients)



Big Spring Run, PA

Reference Conditions



What are they?

How do you identify & characterize them?

Are they relevant?



Reference conditions are most commonly defined as characteristics prior to intensive human alteration – in the US, prior to European settlement

Reference conditions are challenging to identify & characterize because

- natural systems are dynamic rather than static (natural range of variability & nonstationarity of driver variables such as hydrology)
- evidence of reference conditions may be difficult to find in a region with a long history of intensive & ubiquitous alteration

Reference Conditions

Are reference conditions relevant?

MAYBE

YES

- indicate potential form & function
- reflect conditions to which native biota are adapted

NO

- fluxes & context may have changed in a manner that precludes return to reference conditions
- climate change continues – the past & present may be unsustainable

Reference Conditions

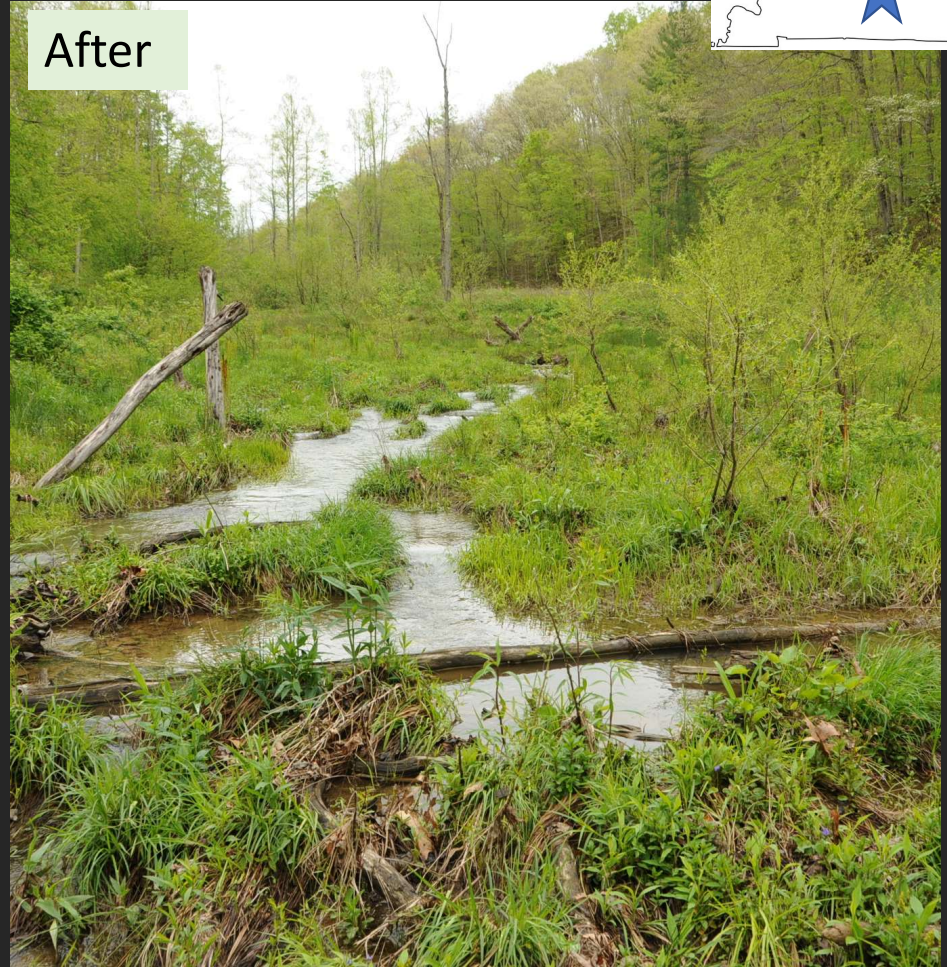
Slabcamp Creek, Daniel Boone NF, Kentucky (Art Parola, U Louisville)



Before



After



Reference Conditions

Big Spring Run, PA
(Dorothy Merritts & Bob Walter,
Franklin & Marshall College)



Before



After



Reference Conditions



Implications for Restoration

River form & function as a continuum rather than binary of pristine/degraded

Diversity of form & function (e.g., river-wetland corridors)



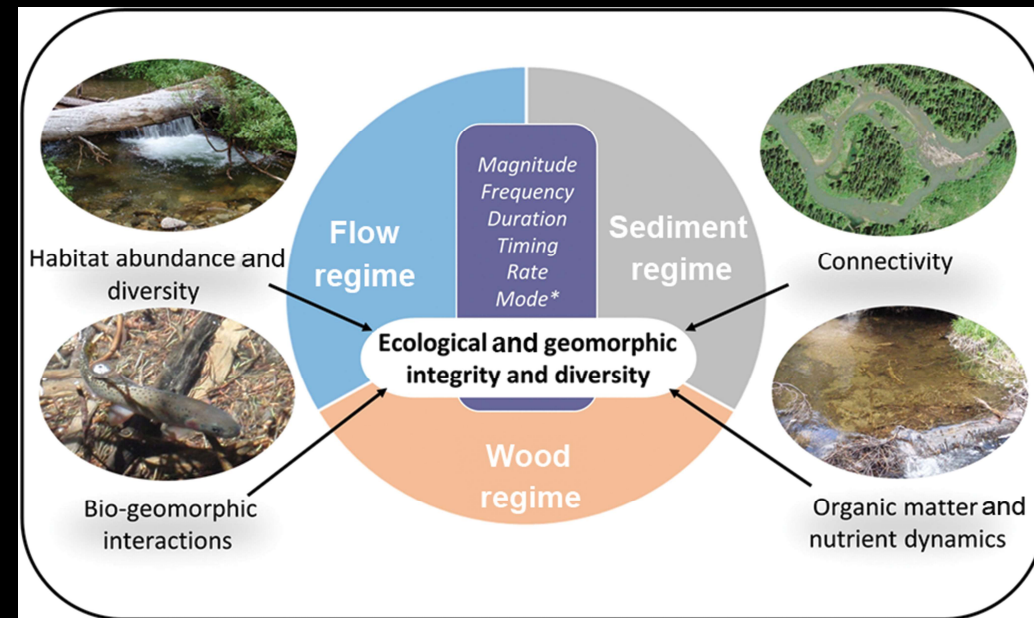
Implications for Restoration

Passive & active restoration; reconfigure & reconnect

Importance of context (natural setting & human constraints)

Climate change

- water/sediment/wood regimes
- disturbance regime
- species ranges
- biotic communities



Wohl et al., 2019, *BioScience*