

Riparian Ecosystems: challenges to understanding, managing and restoring a continental-scale resource

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Uniformity of habitat



Oldman River



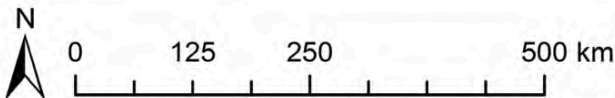
Bill Williams River



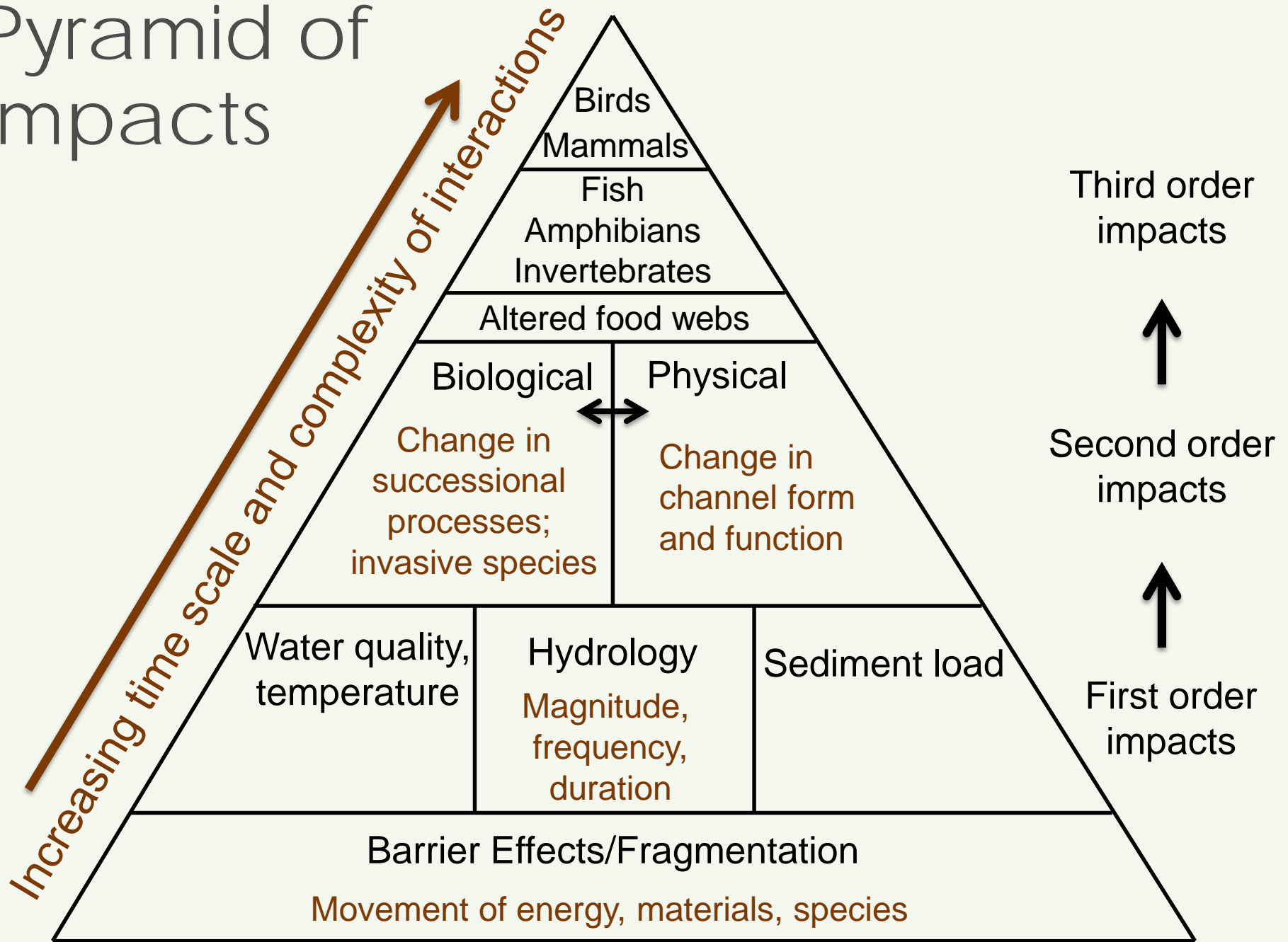
Rio Sonora



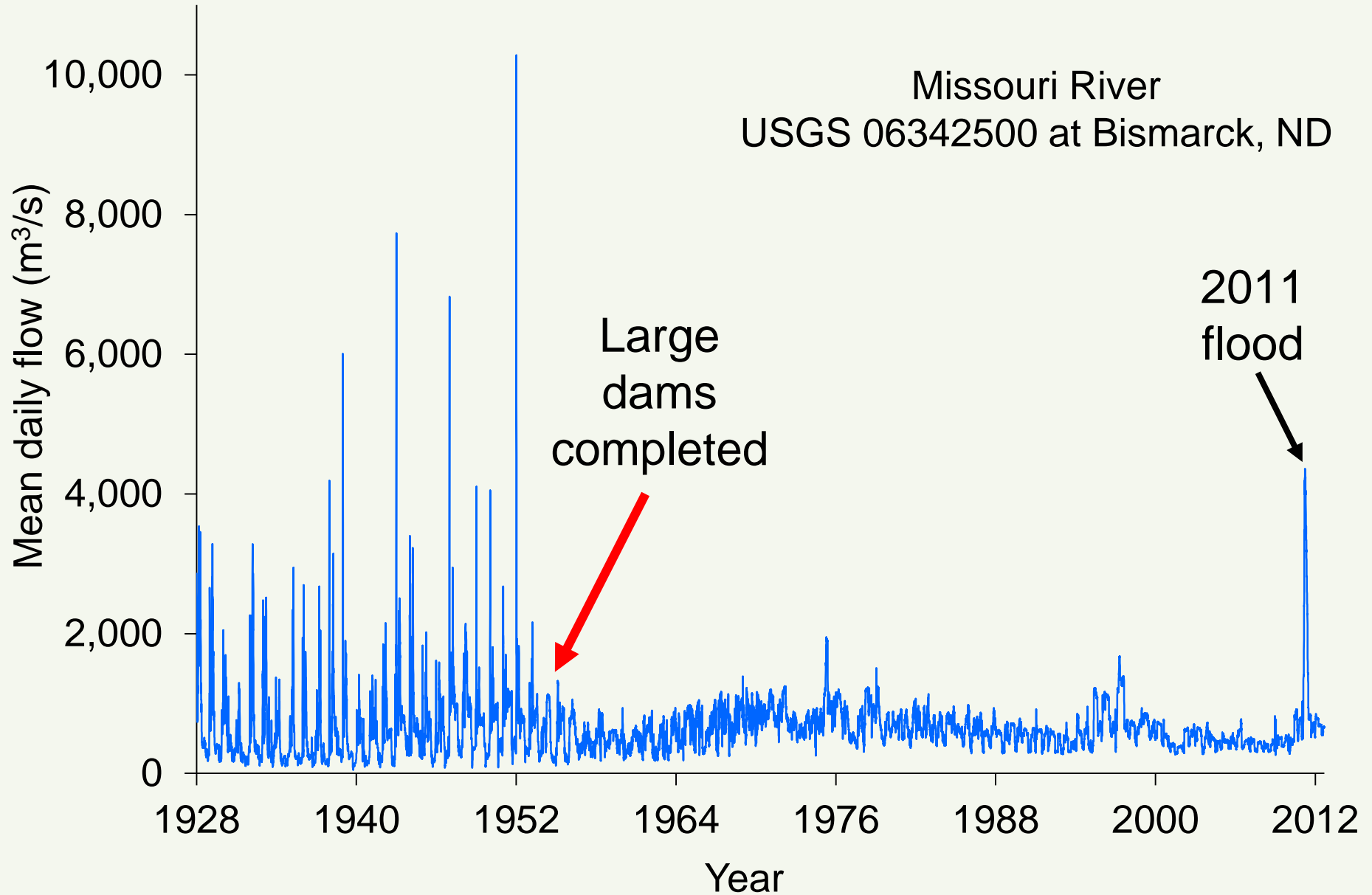
Missouri River: fragmentation



Pyramid of impacts



Drivers of decline: flow regulation

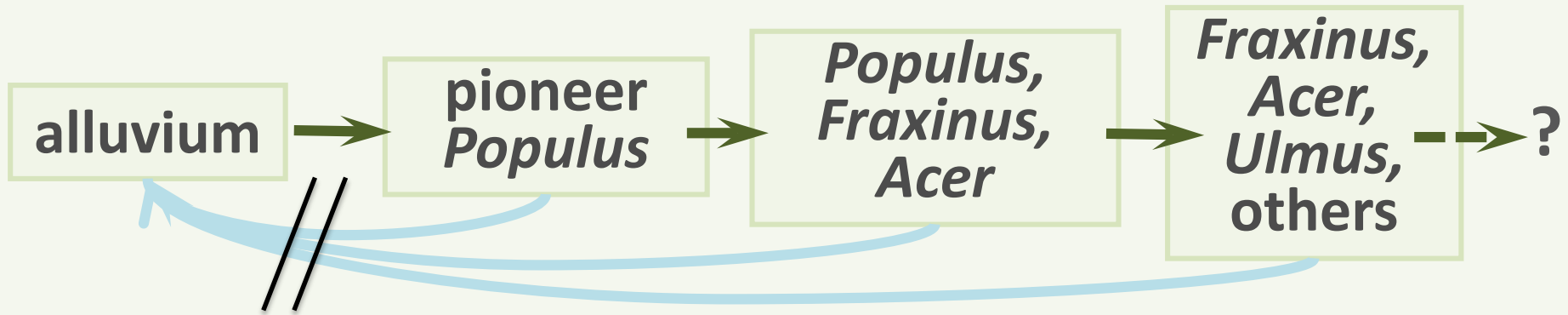


Change in channel form and function: Colorado River

2010

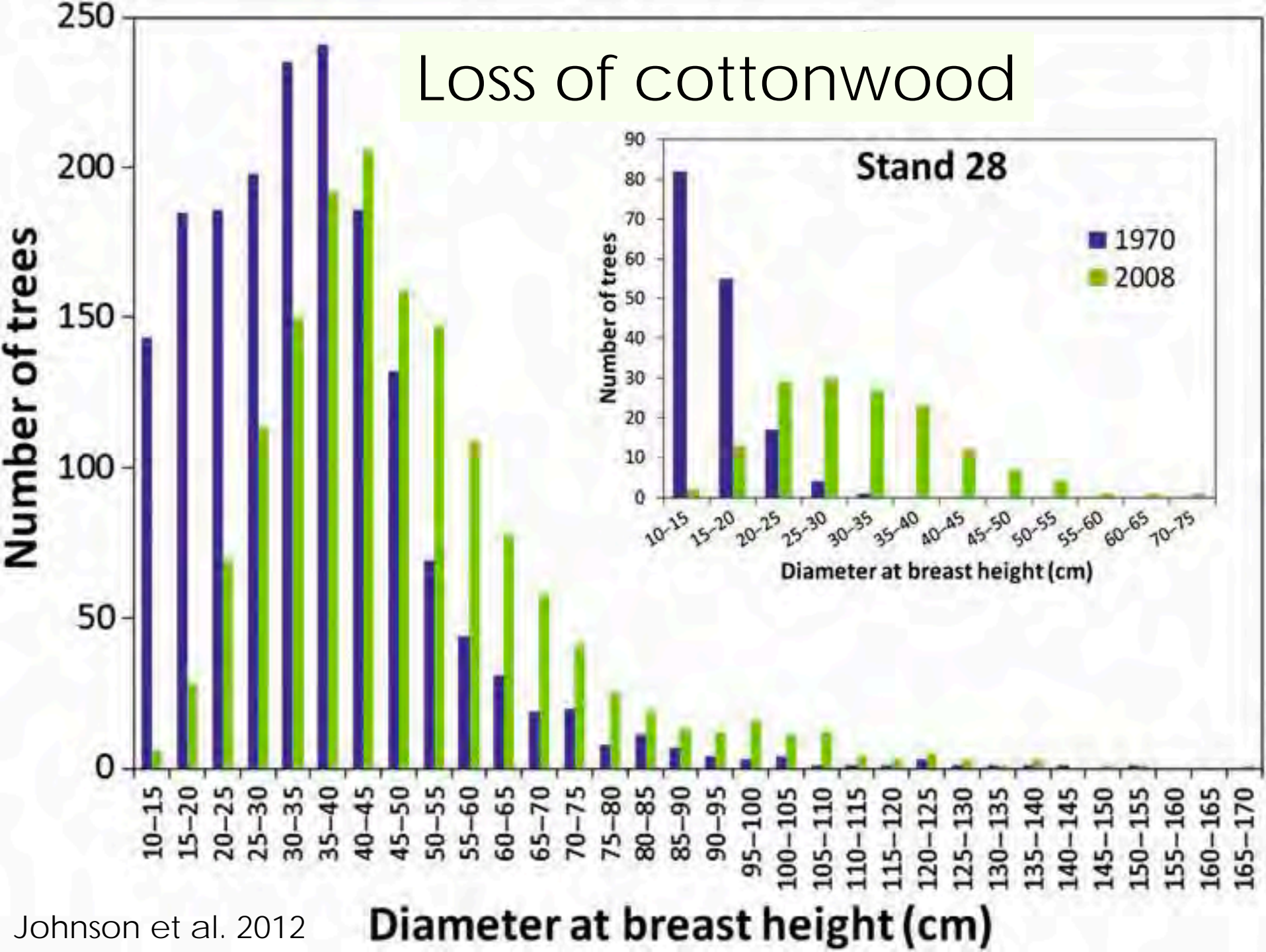


Successional processes

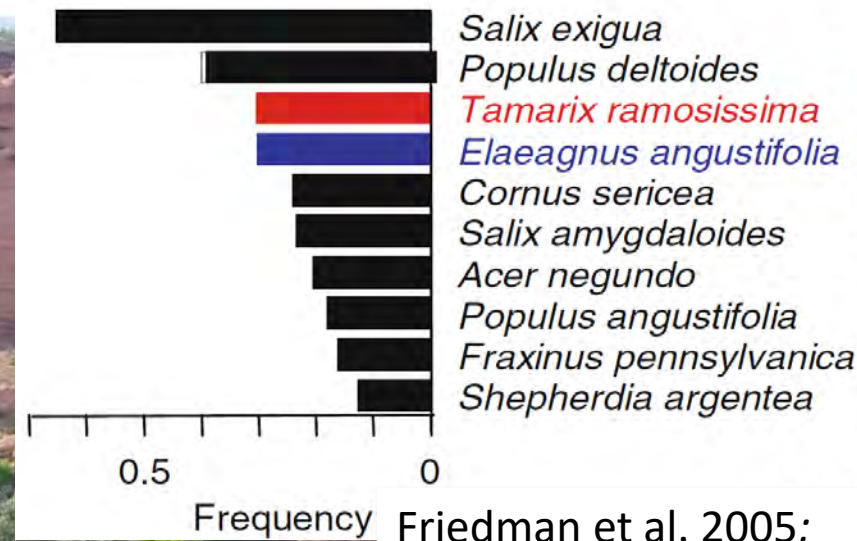
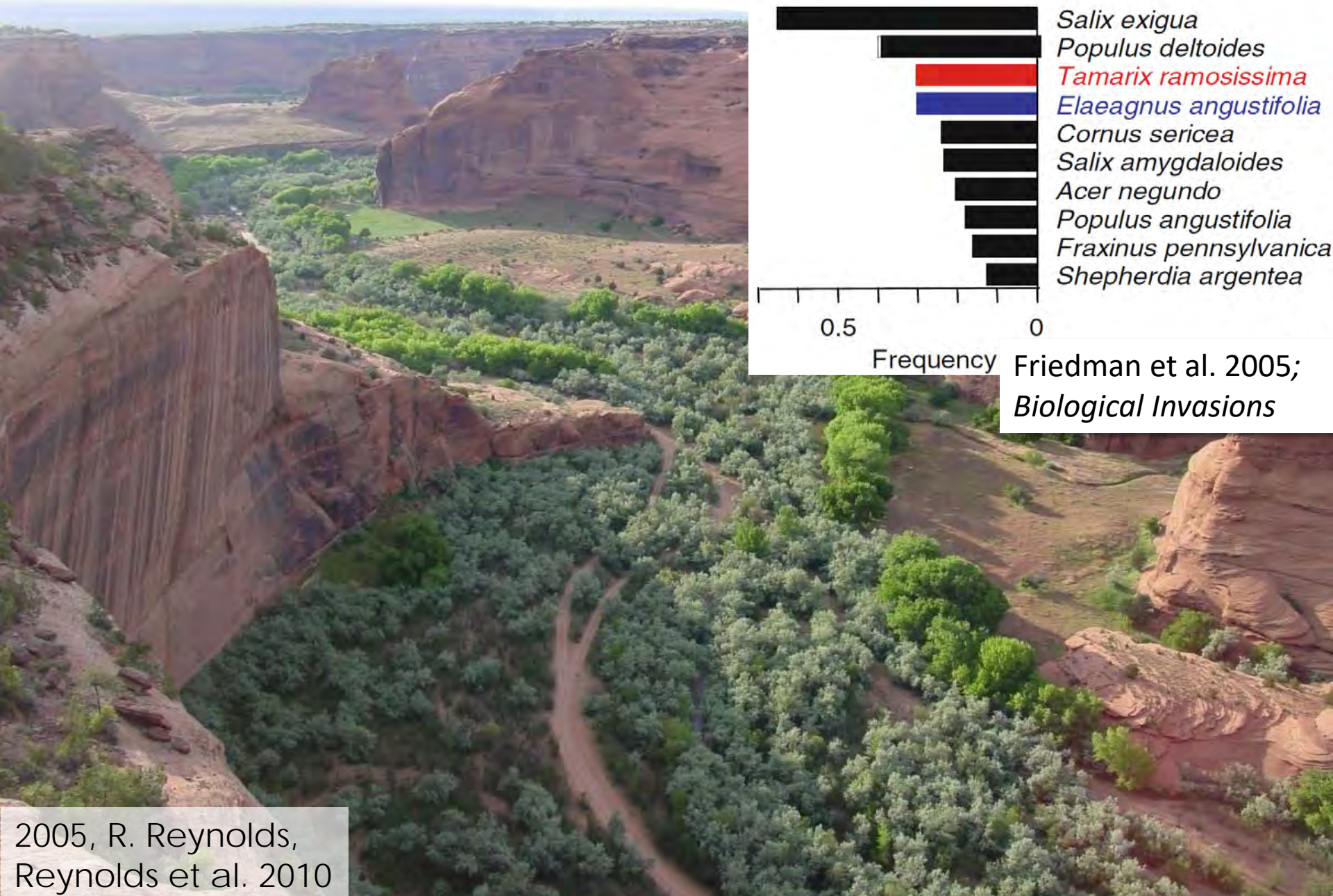


flood-caused erosion/deposition

Loss of cottonwood

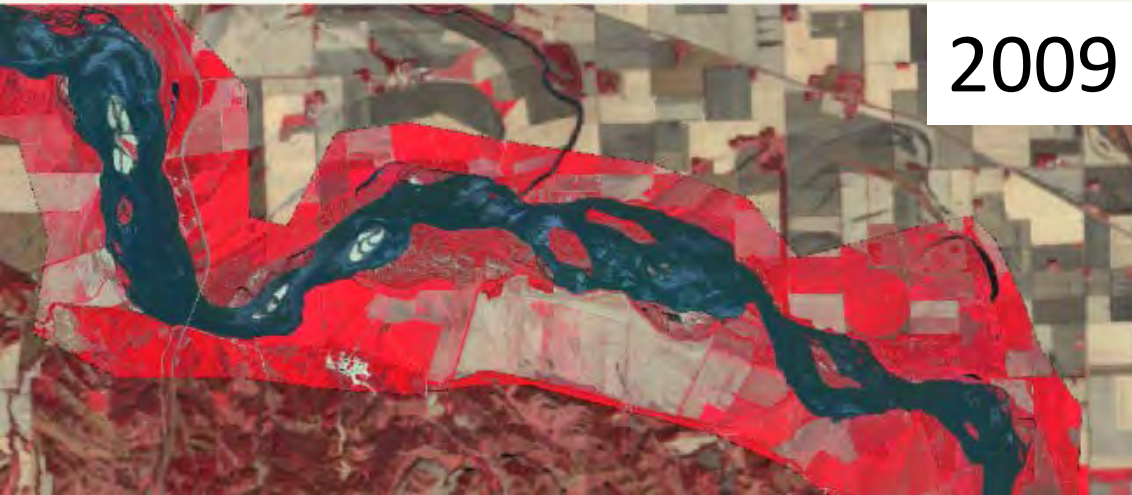


Russian-olive invasion: Canyon de Chelly, AZ



2005, R. Reynolds,
Reynolds et al. 2010

The 2011 Missouri River flood



- Large increases in sandbar area
- Little channel migration
- Loss of young *Populus* stands



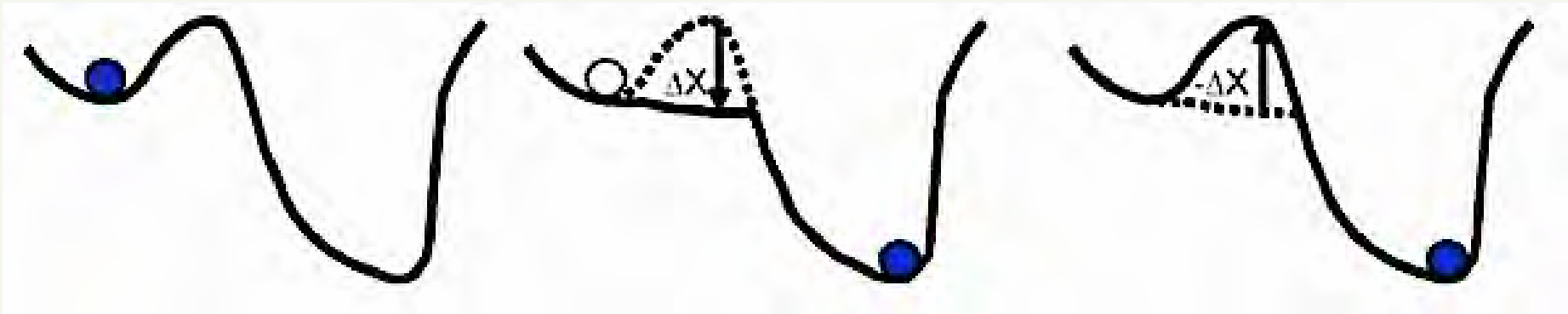
- Little cottonwood recruitment in flood and subsequent years
- New geomorphic and ecological stable state

Alternative stable states and return to initial conditions

Initial state

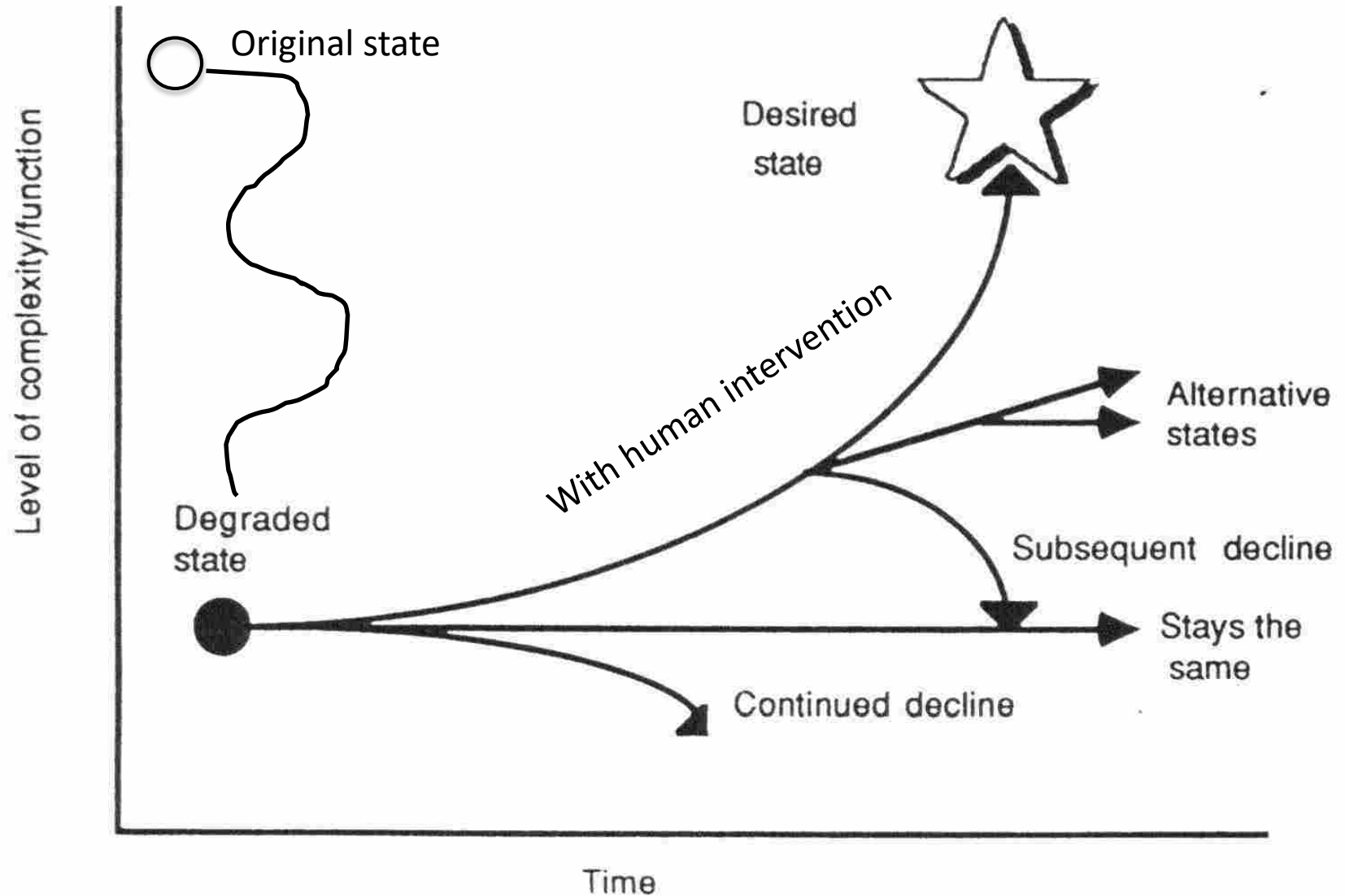
Perturbation to
ecological driver

Removal of
perturbation

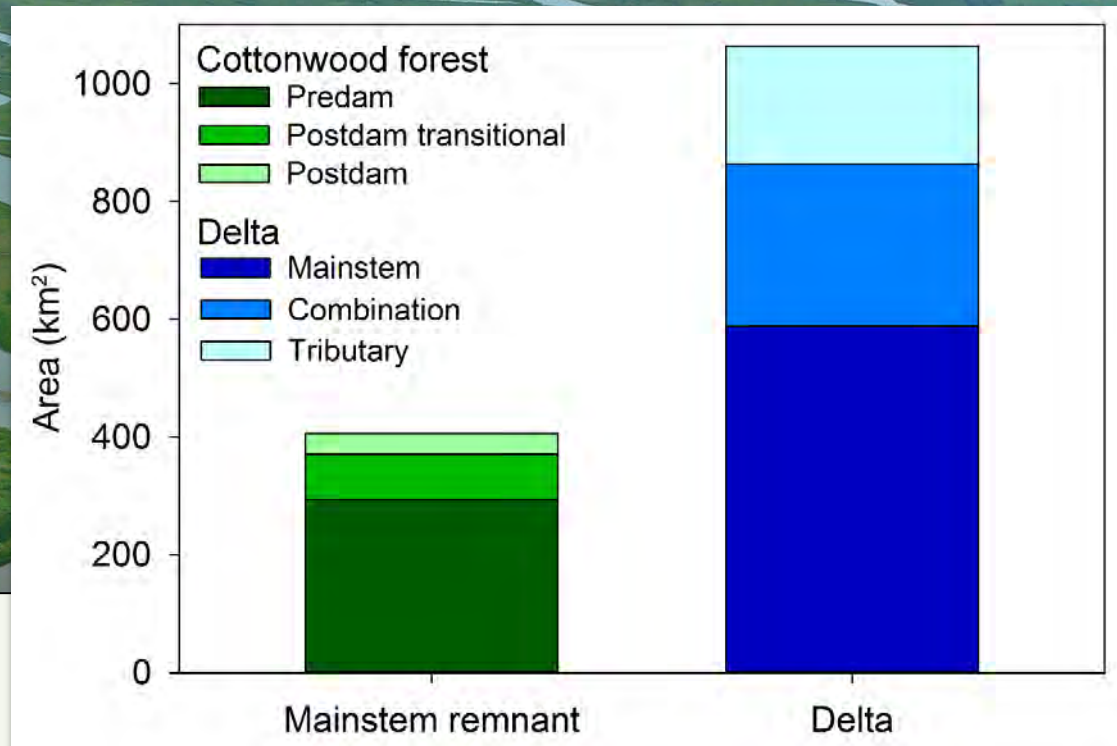
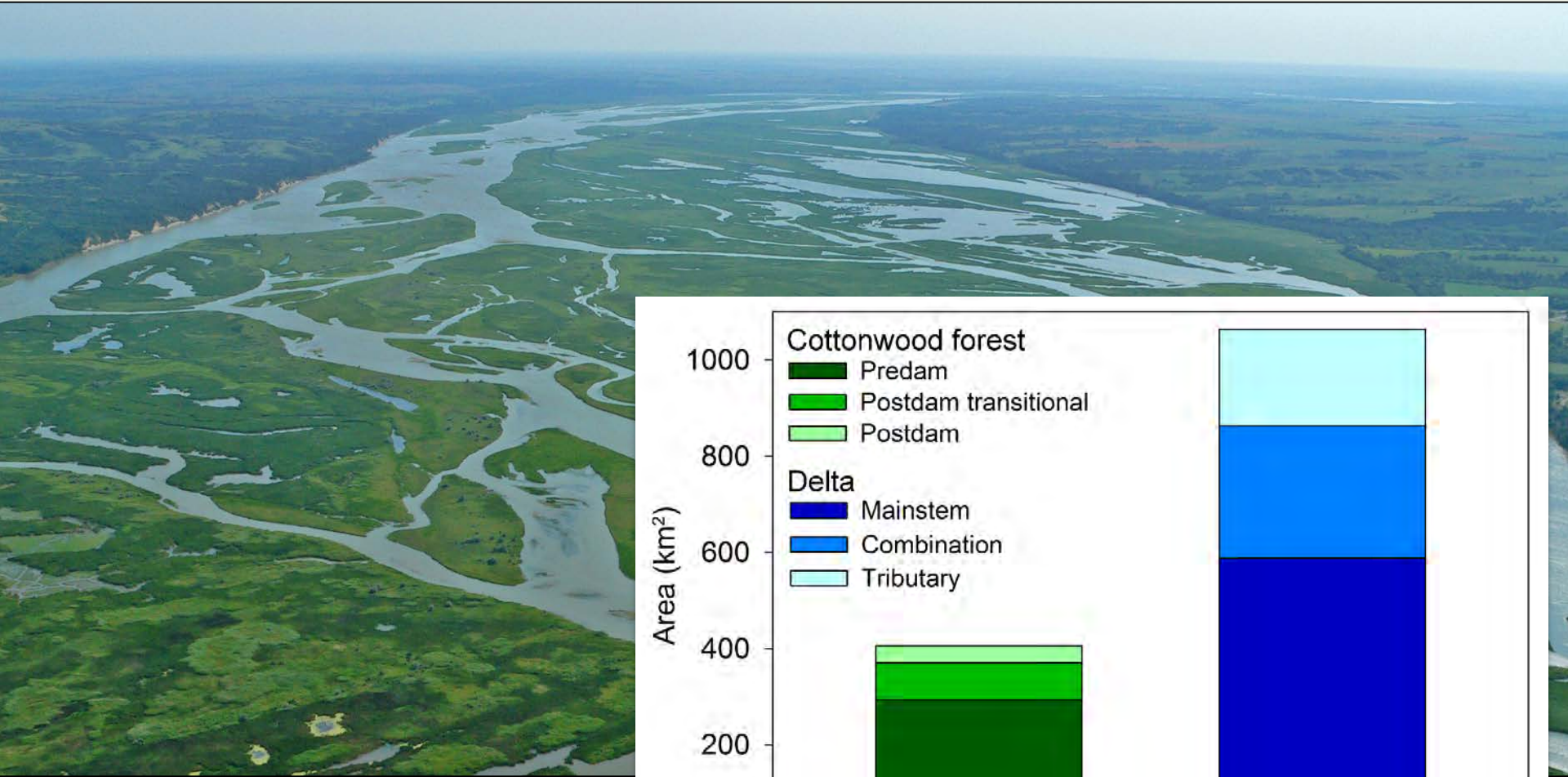


New stable
state?

Predicting restoration trajectories



Restoration: reservoir deltas: A bright spot?



Restoration: dam removal, Elwha R.



Management/restoration challenges

- Issues and challenges
 - Fragmentation
 - Loss of flow variability
 - Altered channel processes, successional trajectories, state changes
 - Invasive species
 - Climate warming
- Process-based restoration (i.e., prescribed flooding)
 - Overcoming channel incision, bank stabilization, encroaching infrastructure, possible ecological state changes
 - Restoring flows and sediment flux
 - Not physically or politically likely on many large US rivers
- Management conflicts limit large-scale restoration options
 - Multiple stakeholders and goals (flood control, land use)
 - Regressive, anti-government local or regional politics
- Restoration opportunities: dam removal; novel habitats, such as reservoir deltas
 - Deltas occupy large areas and are geomorphically dynamic
 - Many feature early successional *Populus* forests but remain unstudied
 - New technologies and modeling approaches needed for restoration

“Maybe the song that is to be sung through us is the most beautiful requiem for an irreplaceable planet or maybe it’s a song of joyous rebirth...”

— Joanna Macy

