Riparian Ecological Functions

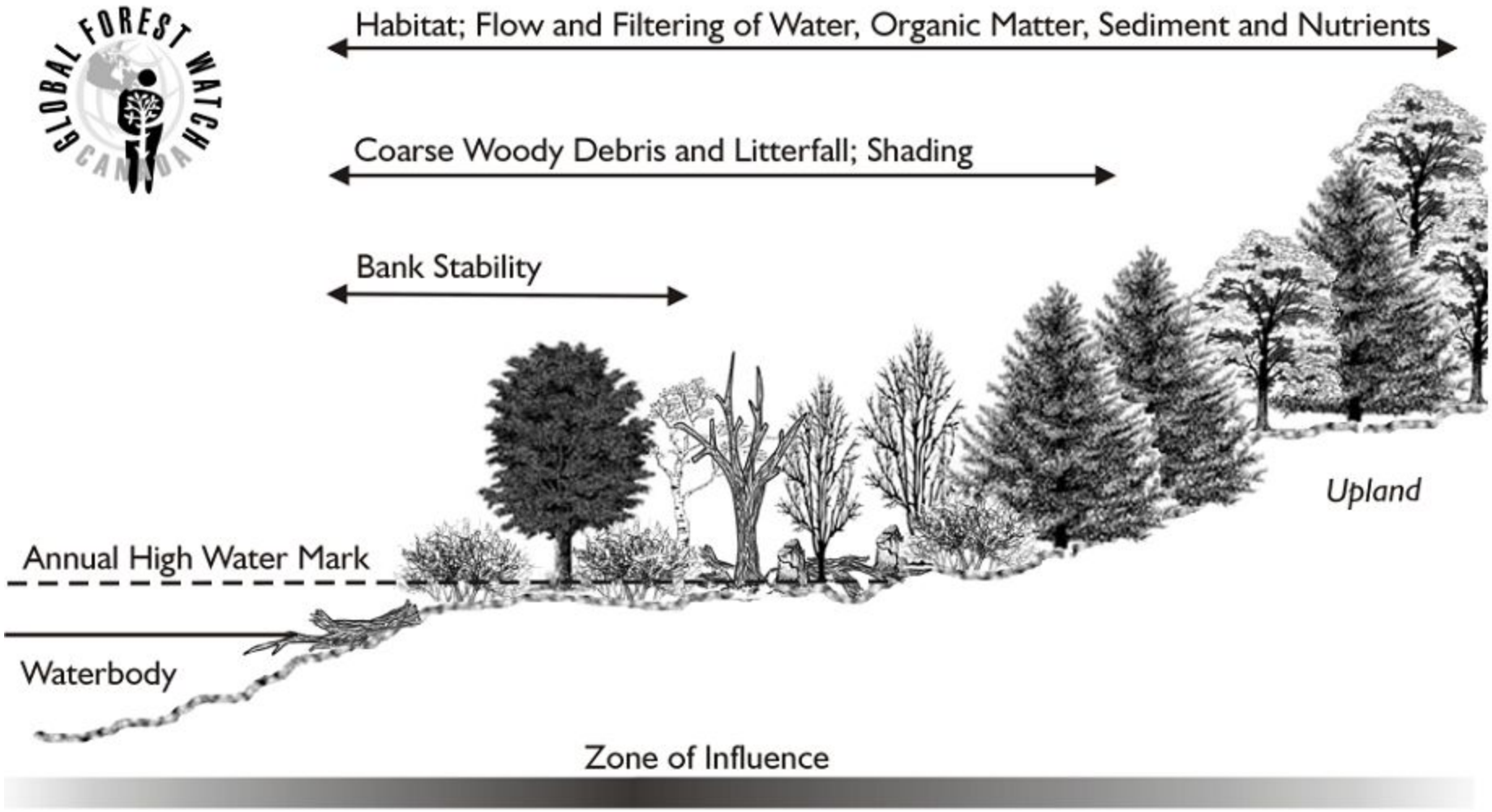
Introduction

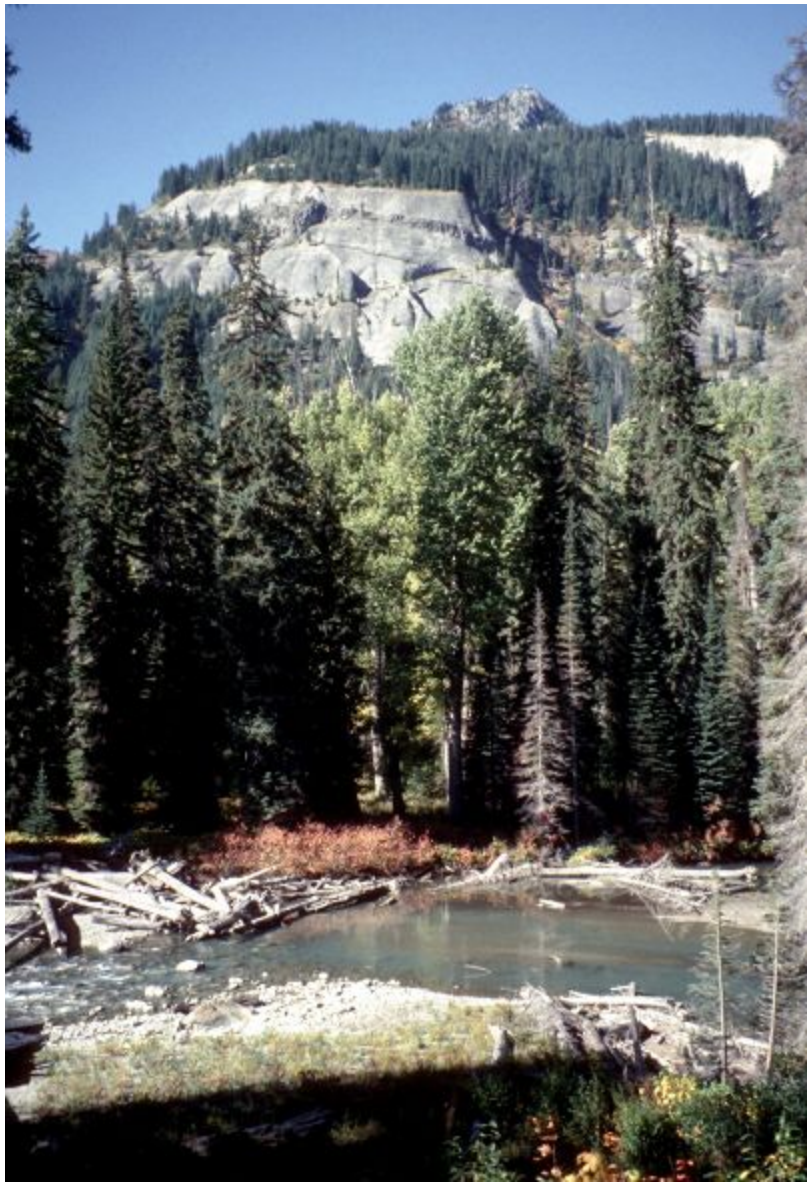
Ecological processes

Natural disturbances

Landscape considerations

Riparian zones link terrestrial and aquatic ecosystems





Importance to fish

Physical habitat

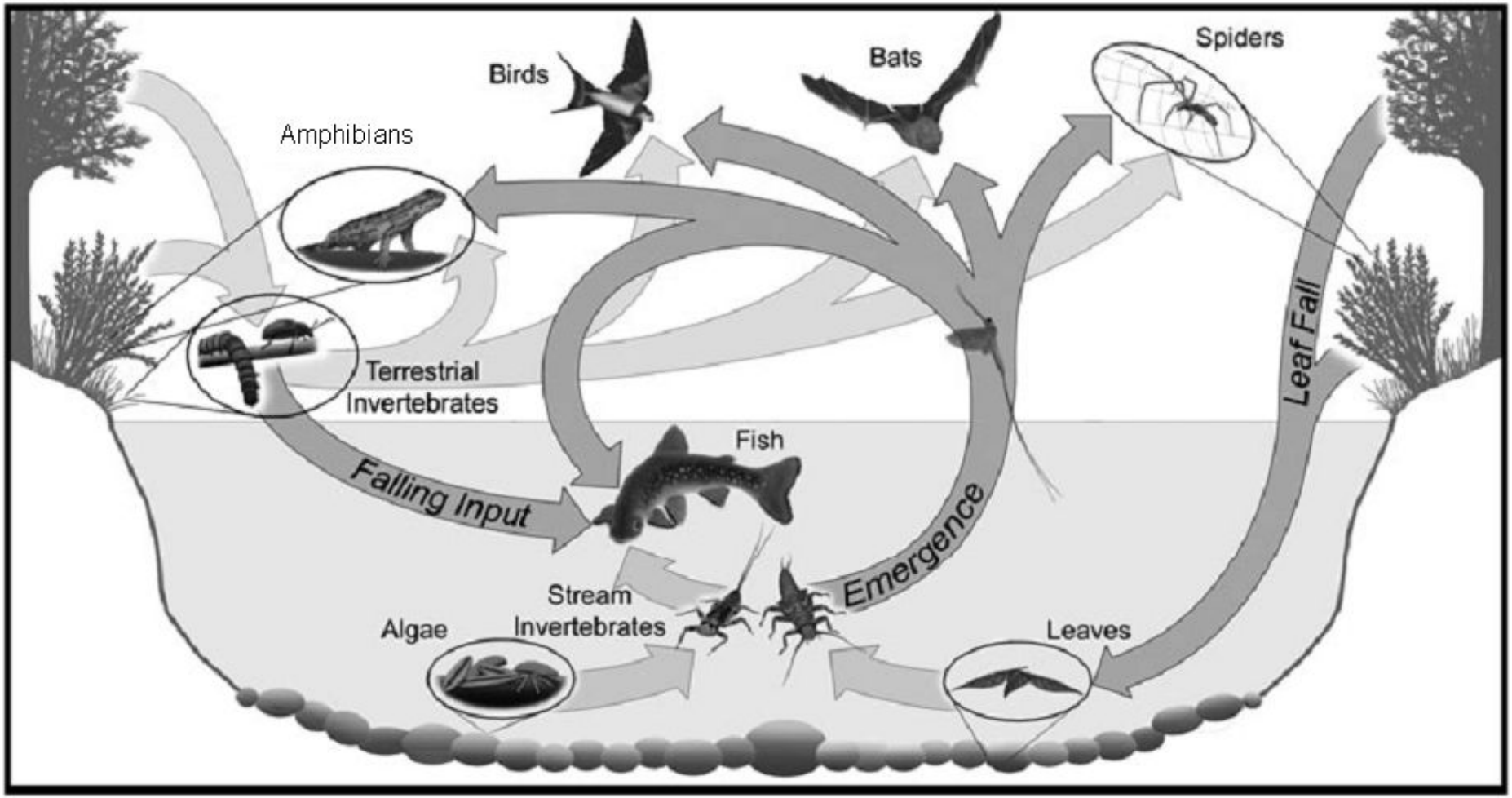
Water quality

Seasonal habitats

Shade

Streambank stability

Food webs


Birds
Bats
Spiders
Amphibians
Terrestrial
Invertebrates
Fish
Falling Input
Emergence
Leaf Fall
Stream
Invertebrates
Algae
Leaves

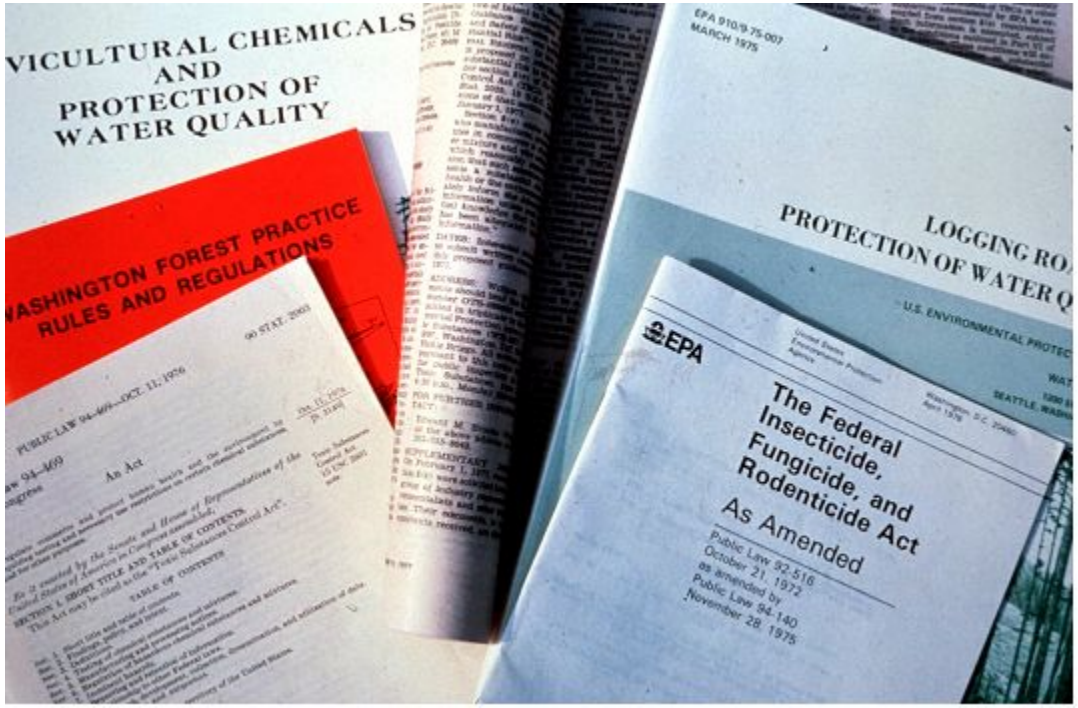
1970s

Temperature

Sediment

Forest chemicals

Fish passage



1980s

Large wood (LOD, LWD, CWD)

Experimental watersheds

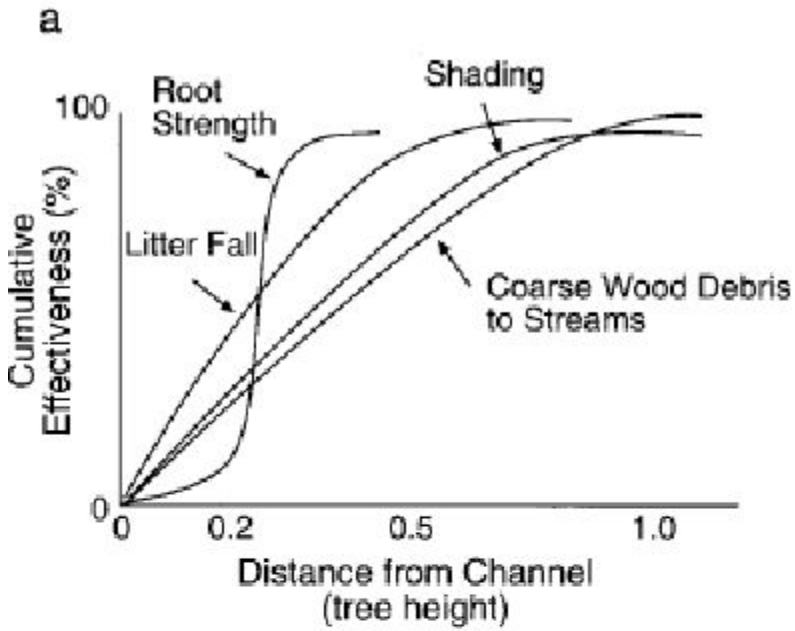
TFW – 1987; watershed analysis

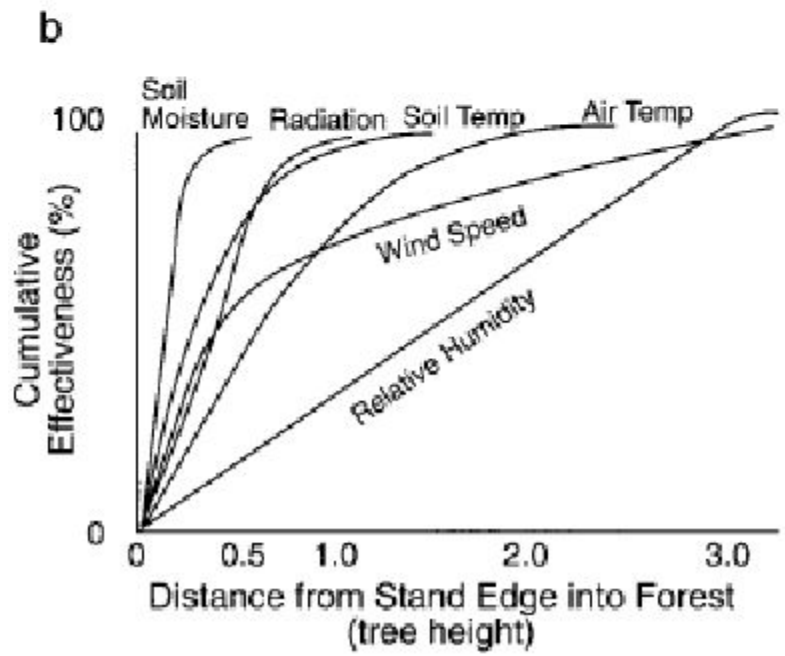
1990s

Endangered species

Northwest Forest Plan

Forests and Fish Plan





Buffers related to riparian ecological functions

Widths of buffers indexed to height of dominant trees and lateral extent of floodplain

Ecological Processes – Large Wood Recruitment

Adjacent riparian zone

Riparian areas

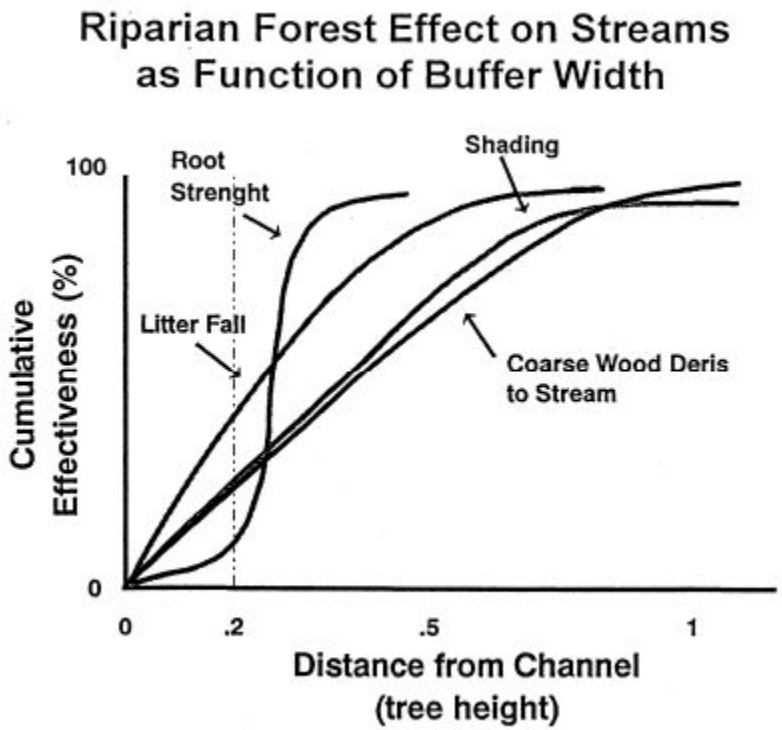
Excavation of buried wood by lateral channel movement

Ecological Processes – Large Wood Recruitment

Landslides

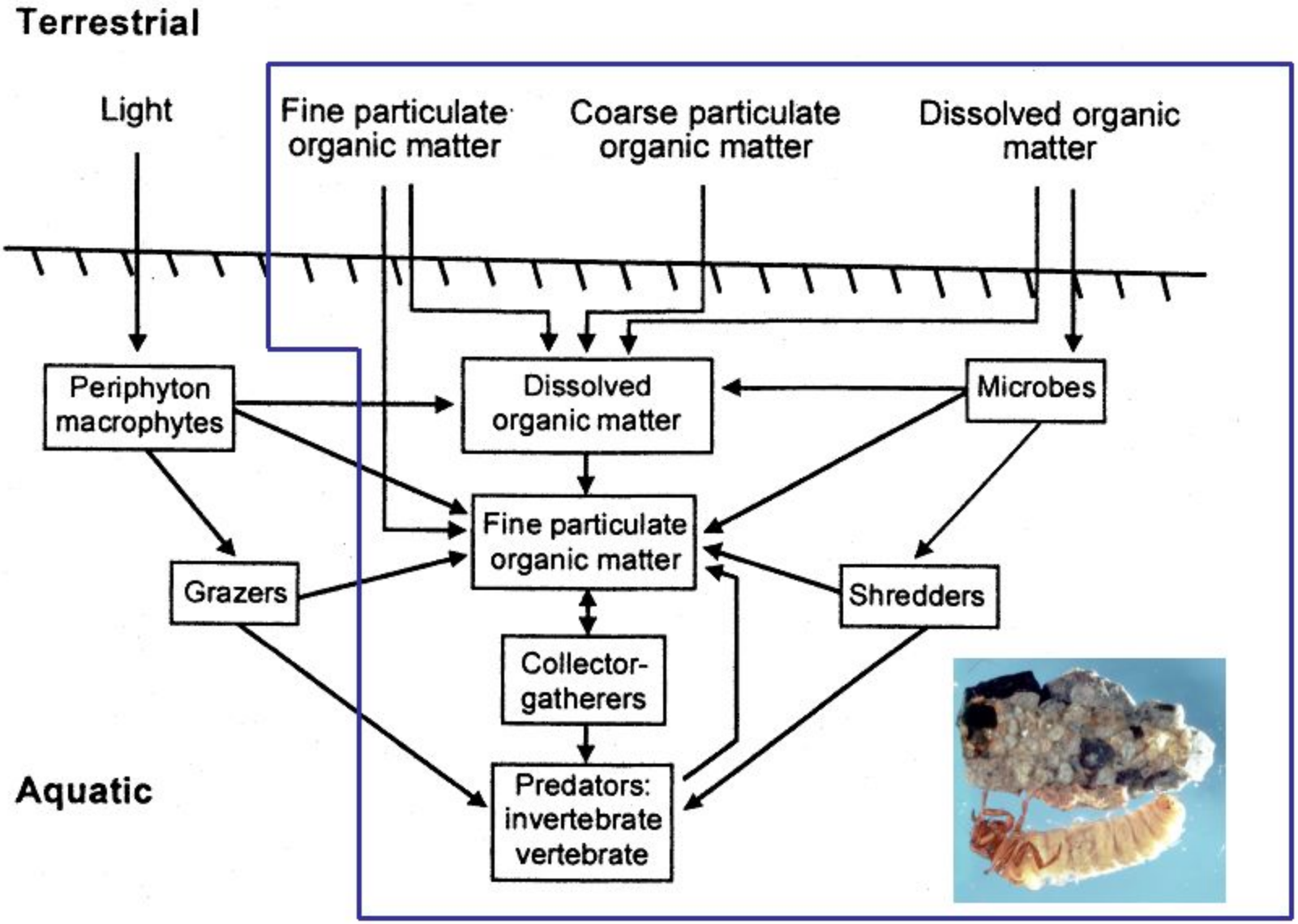
Beavers

Organic Matter Inputs



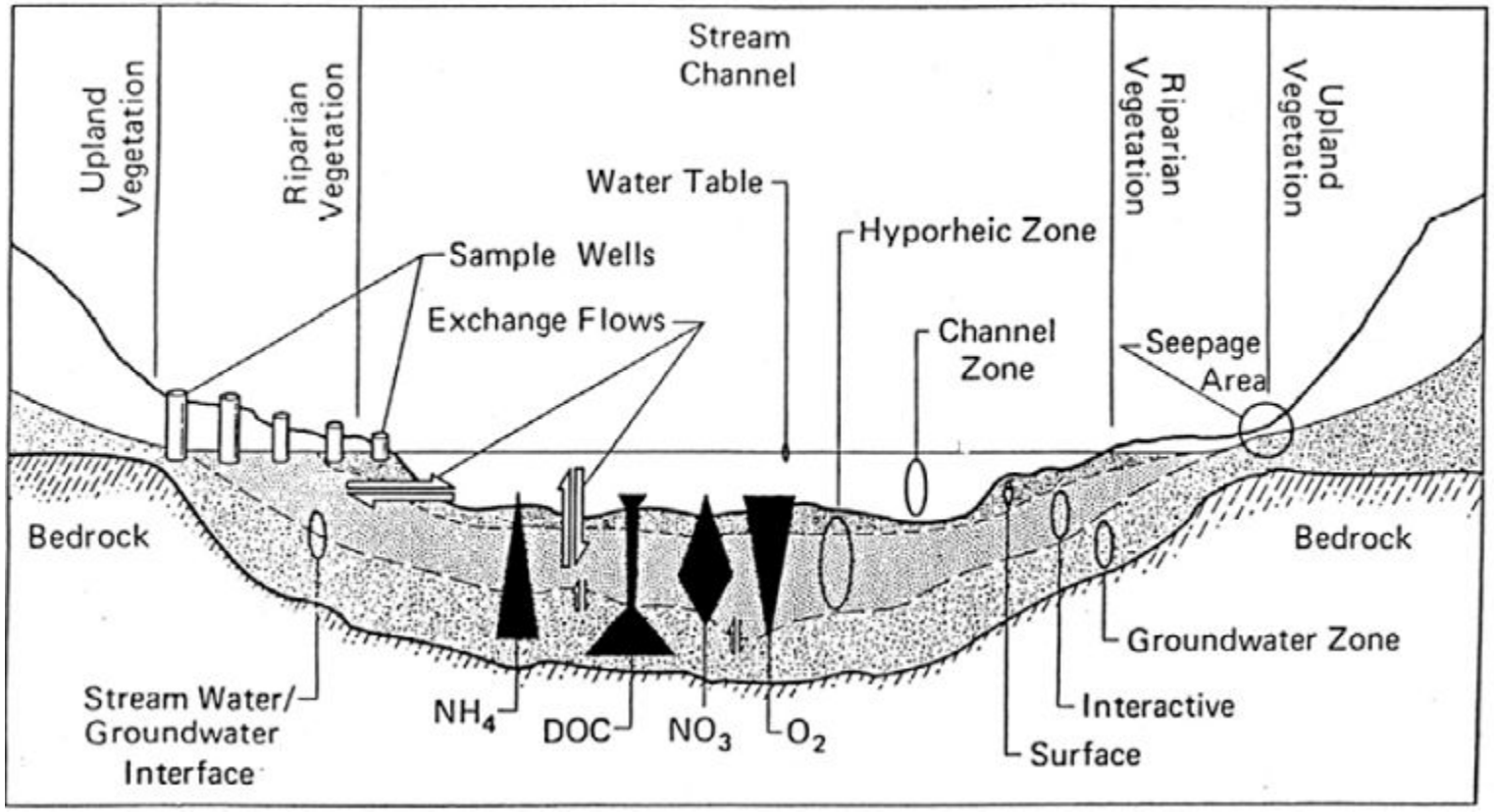
Majority of litter inputs usually originate within 100 ft of the stream

Forest litter is a primary component of the food web of streams

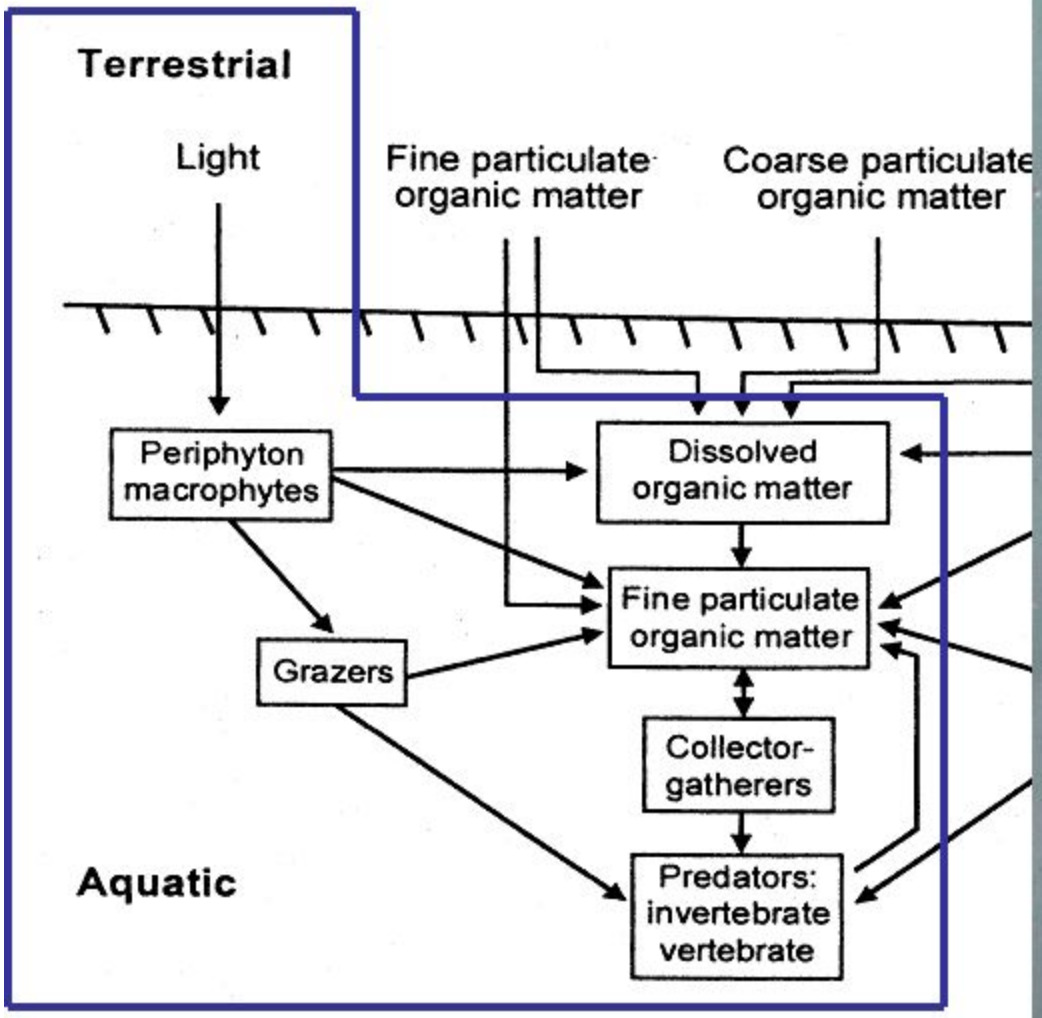


Nutrients

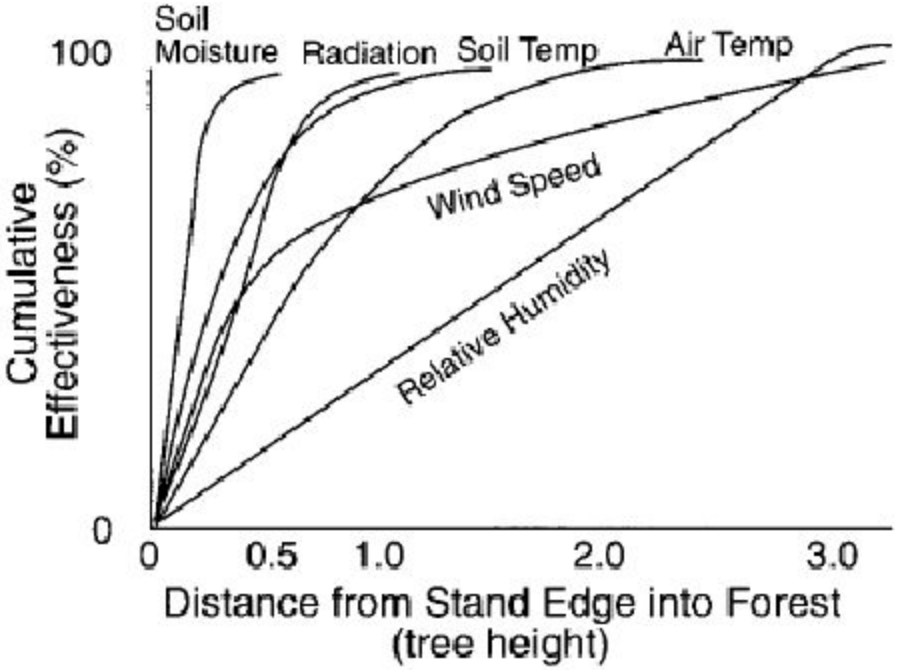
Riparian zones strongly influence nitrogen dynamics



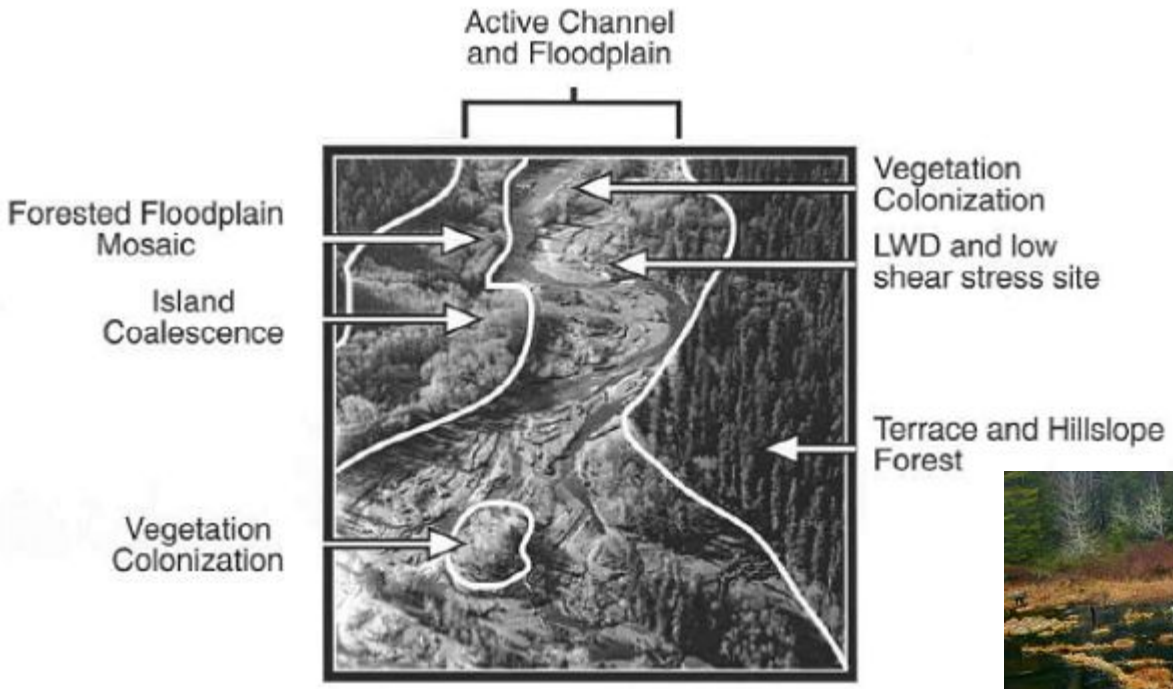
Dissolved nutrients can limit primary productivity in nutrient-poor streams



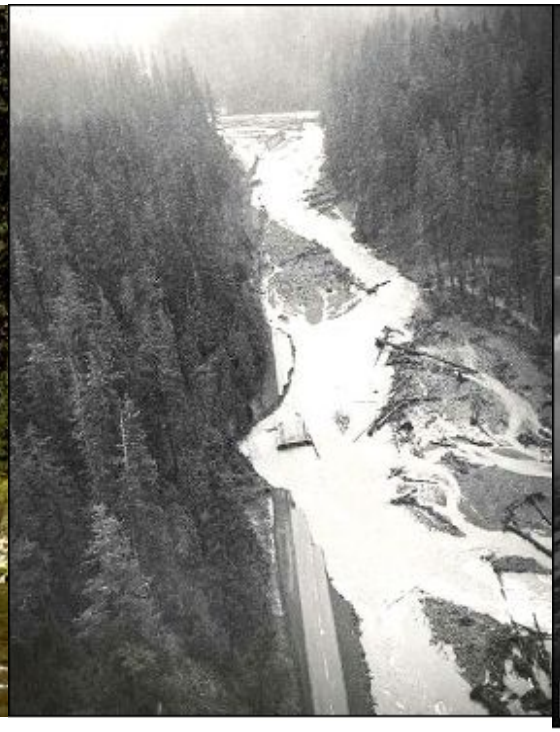
Shade and Microclimate



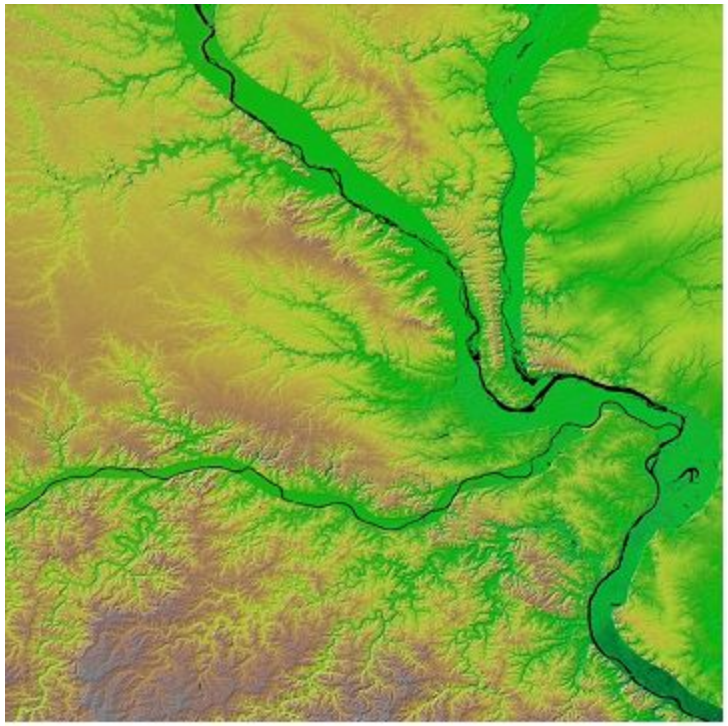
Channel Migration

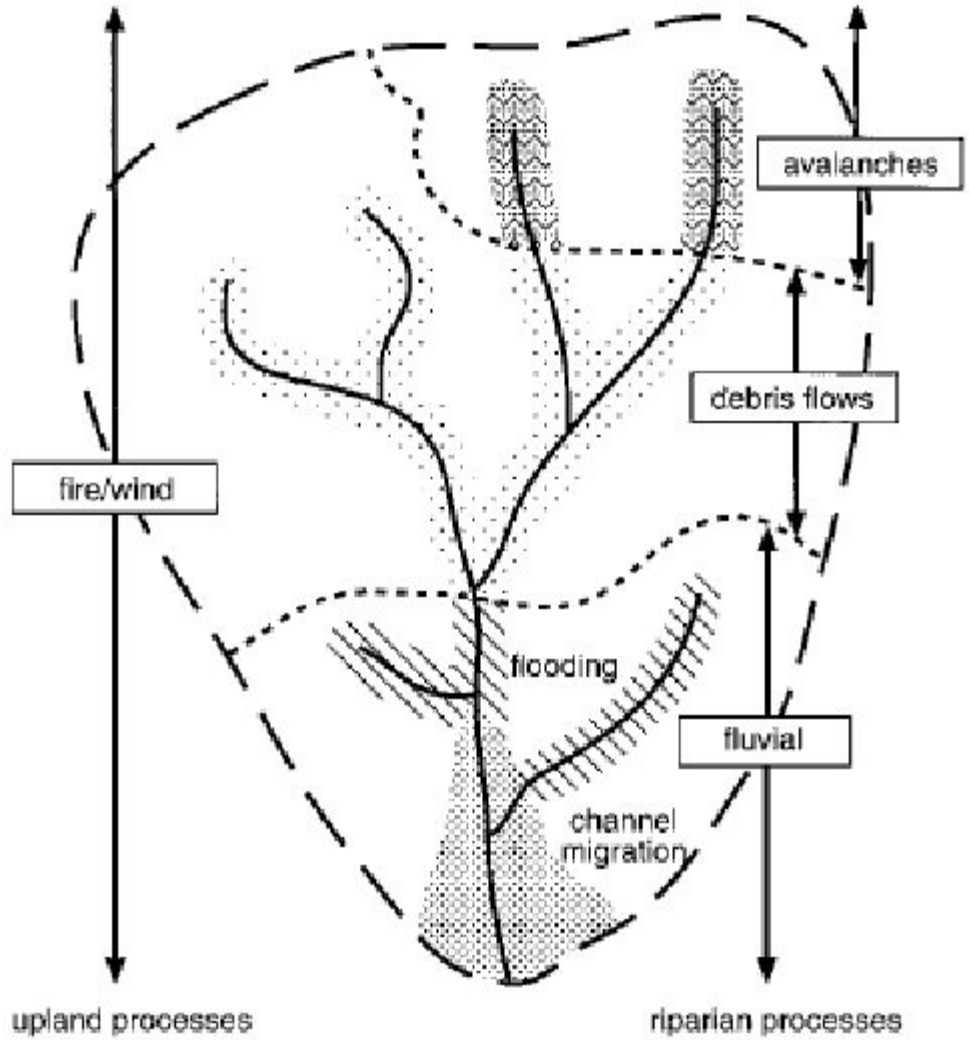


Natural Riparian Disturbances

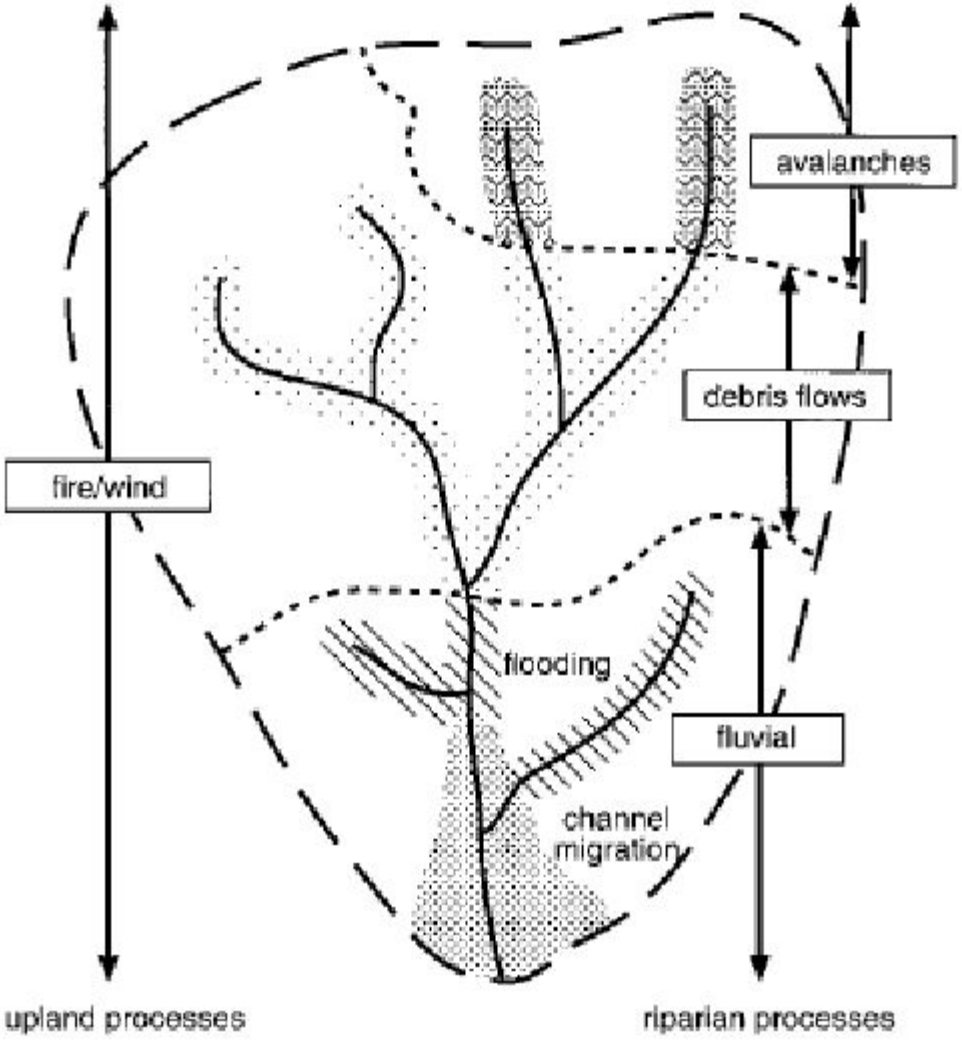


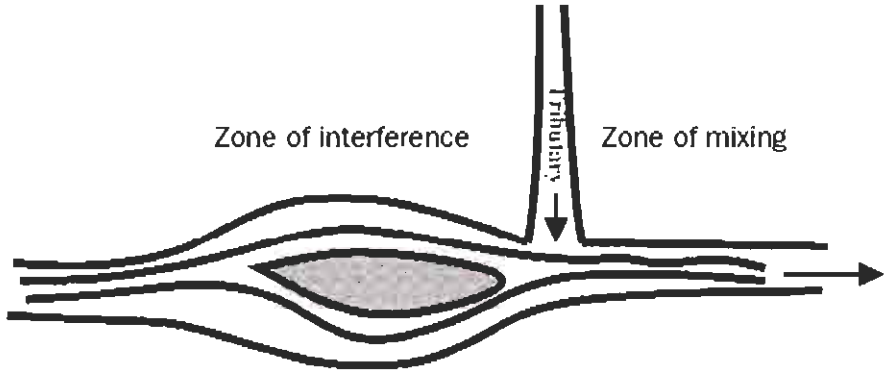
Flood Disturbances





Mass Wasting



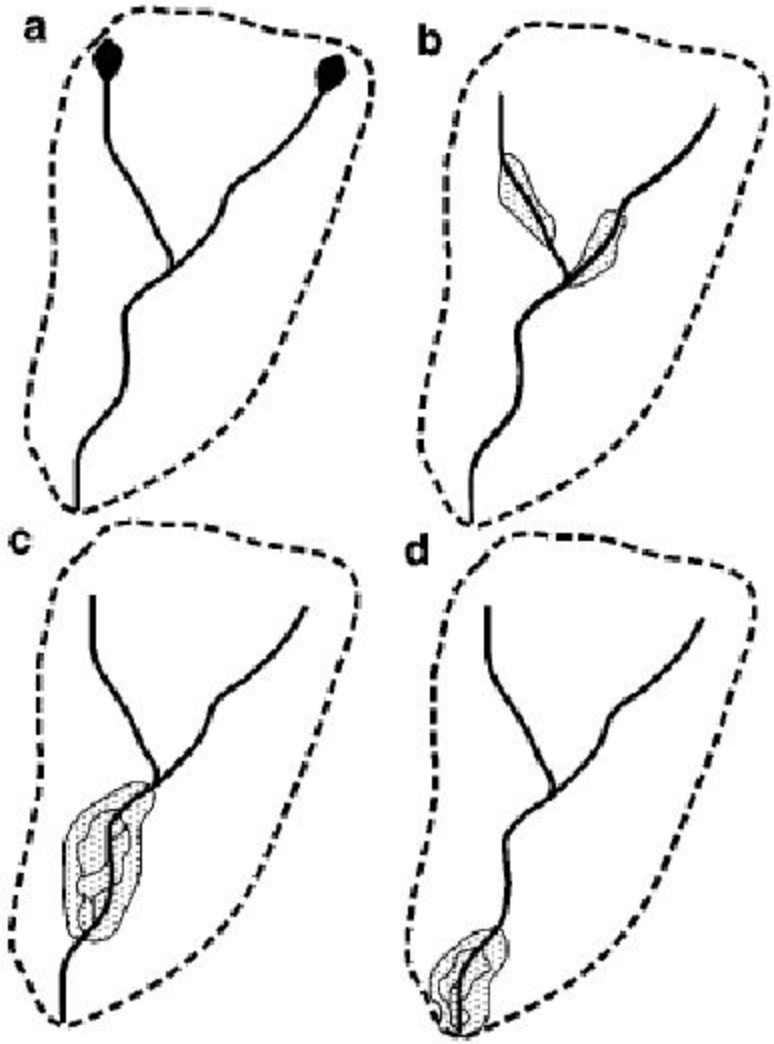


Morphological consequences

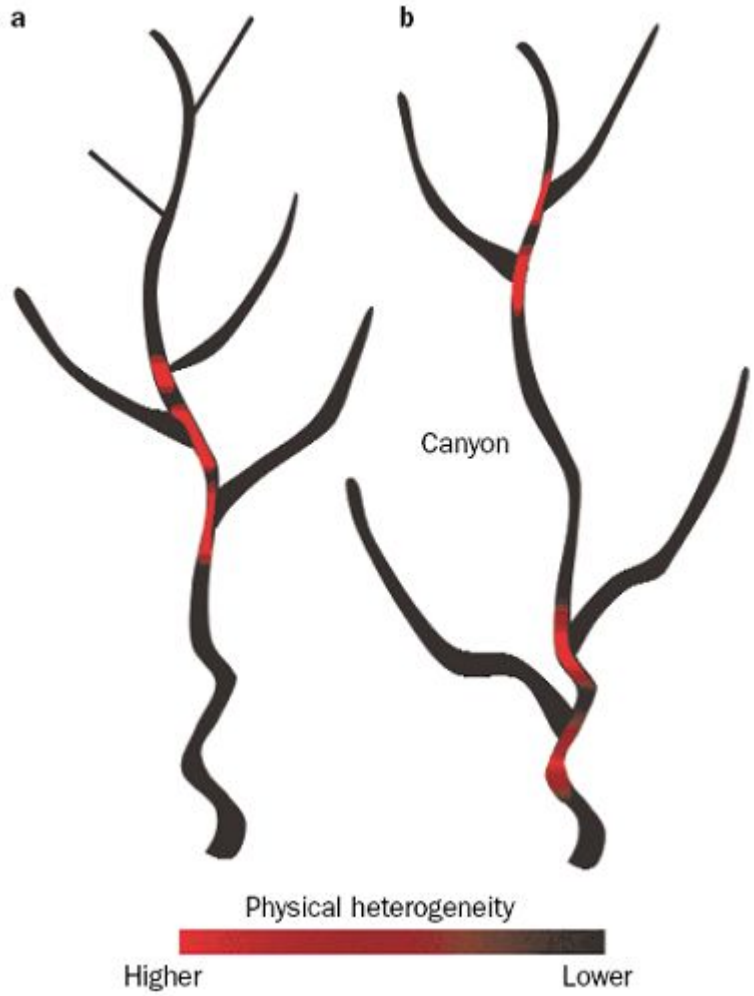
- Lower gradient
- Wider channel/floodplain
- Increased bank erosion
- Increased wood recruitment
- Finer substrates
- Greater lateral connectivity
- Higher disturbance magnitude

- Higher gradient
- Larger substrate sizes
- Deeper pools
- More bars
- Higher frequency and magnitude of disturbance

Sediment waves



Trib junctions as ecological hotspots

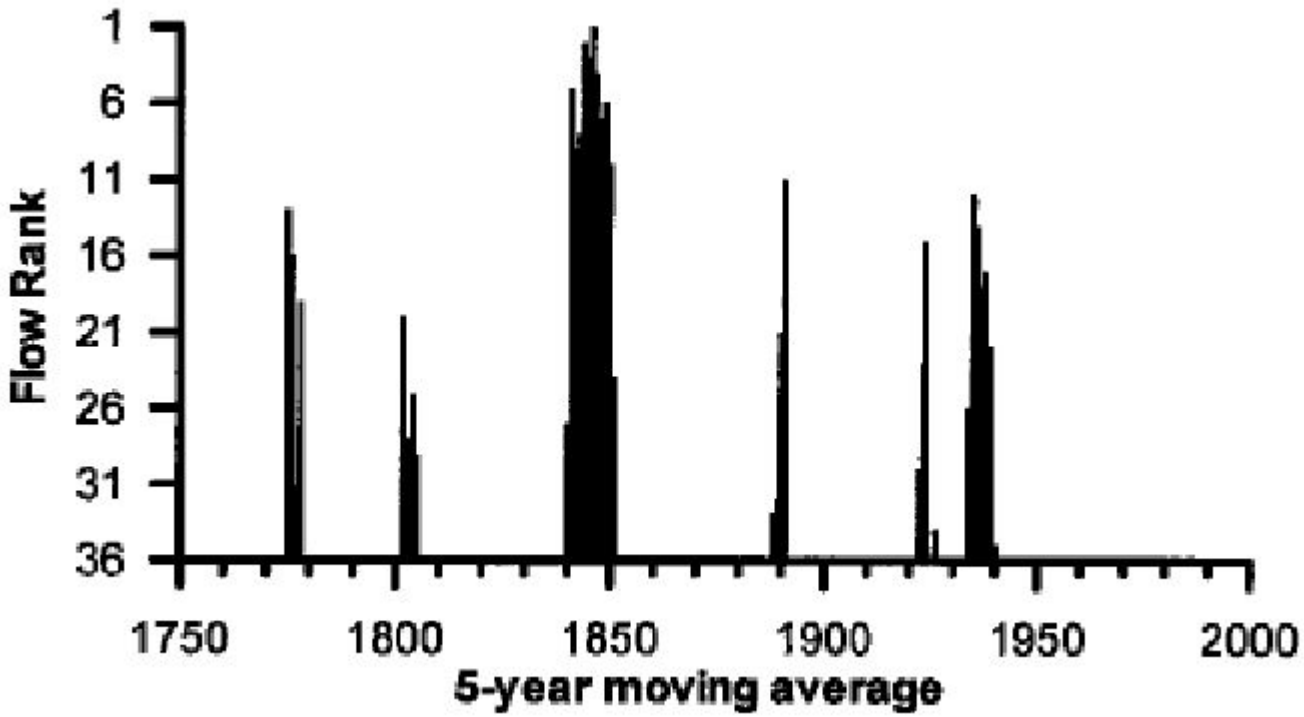


Windthrow

Wildfire

Sol Duc River valley, early 1930s

Droughts



Flows in the Columbia River suggest multi-year drought episodes

Fish in Mount St. Helens streams

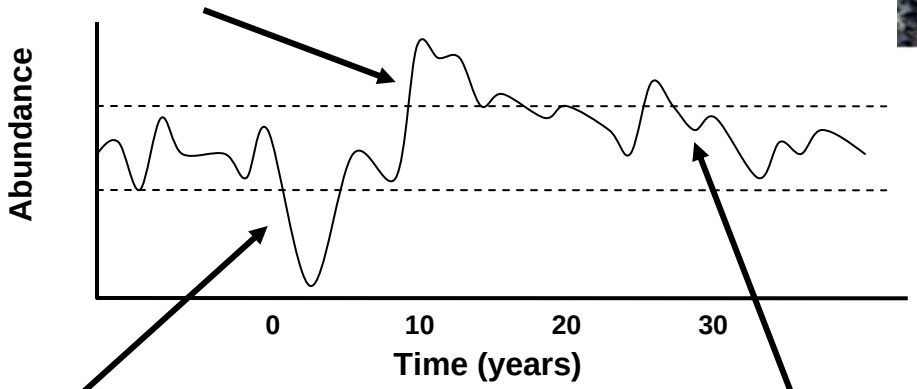
Post-disturbance rebound

lack of significant competitors and predators

high primary productivity

abundant terrestrial invertebrates

abundant aquatic invertebrates



Initial population crash

direct mortality

exposure to high sediment levels

high and variable temperatures

loss of cover

destruction of food resources

Return to natural range

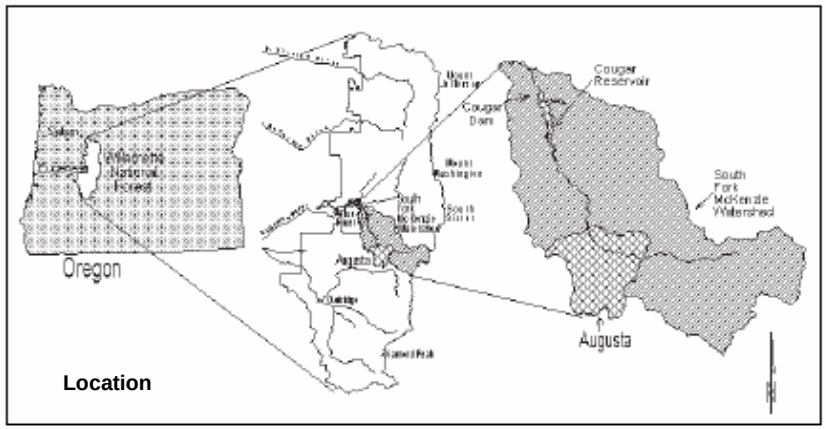
reduced primary productivity as riparian vegetation recovers

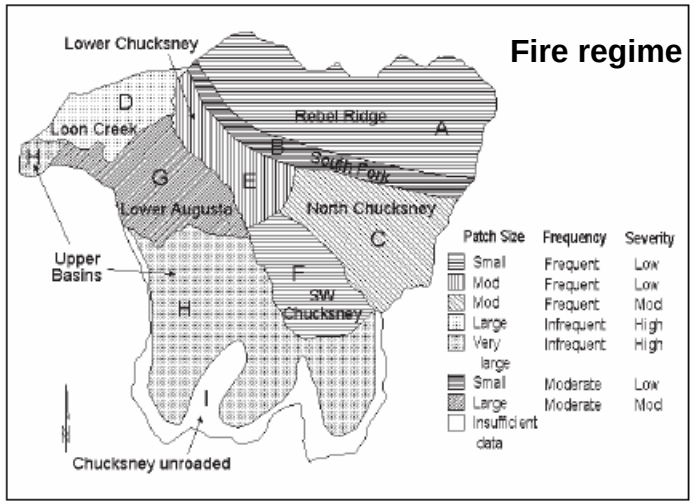
reduced availability of both aquatic and terrestrial food

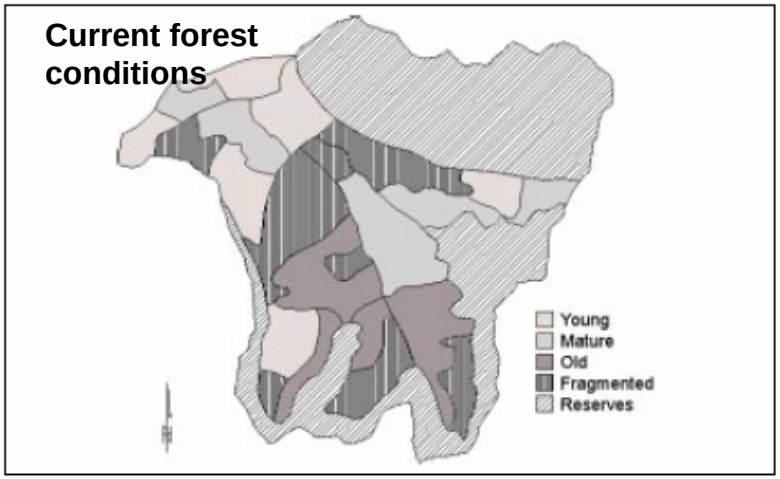
water quality gradually returns to normal

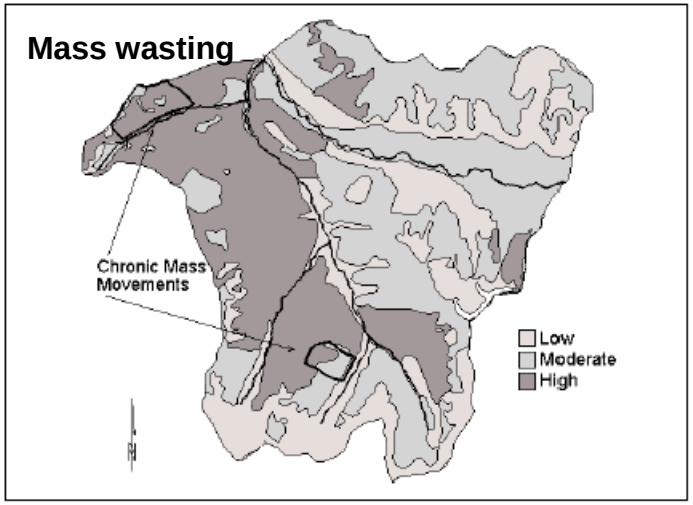
increased predators and competitors

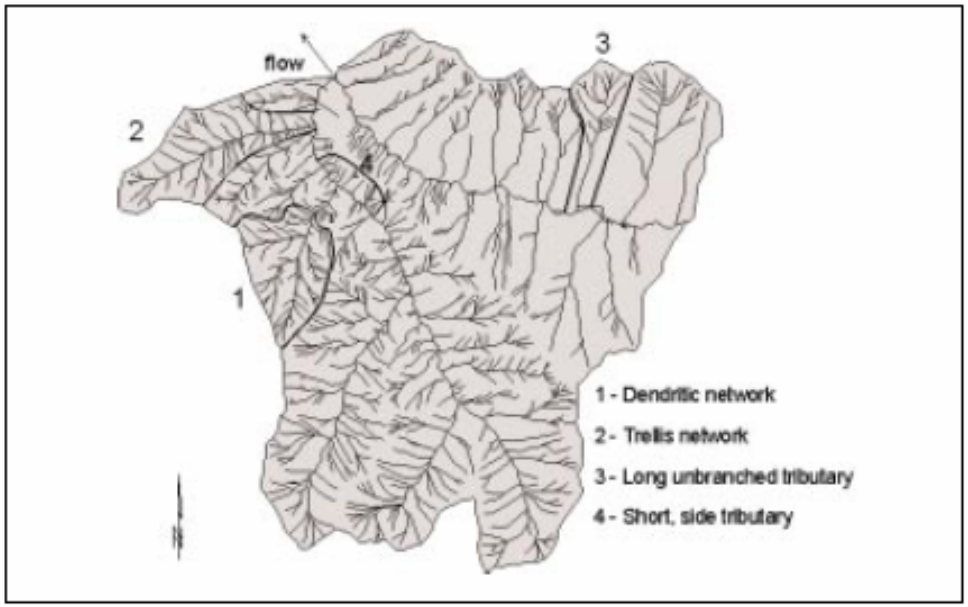
Desired Future Conditions – Augusta Creek example



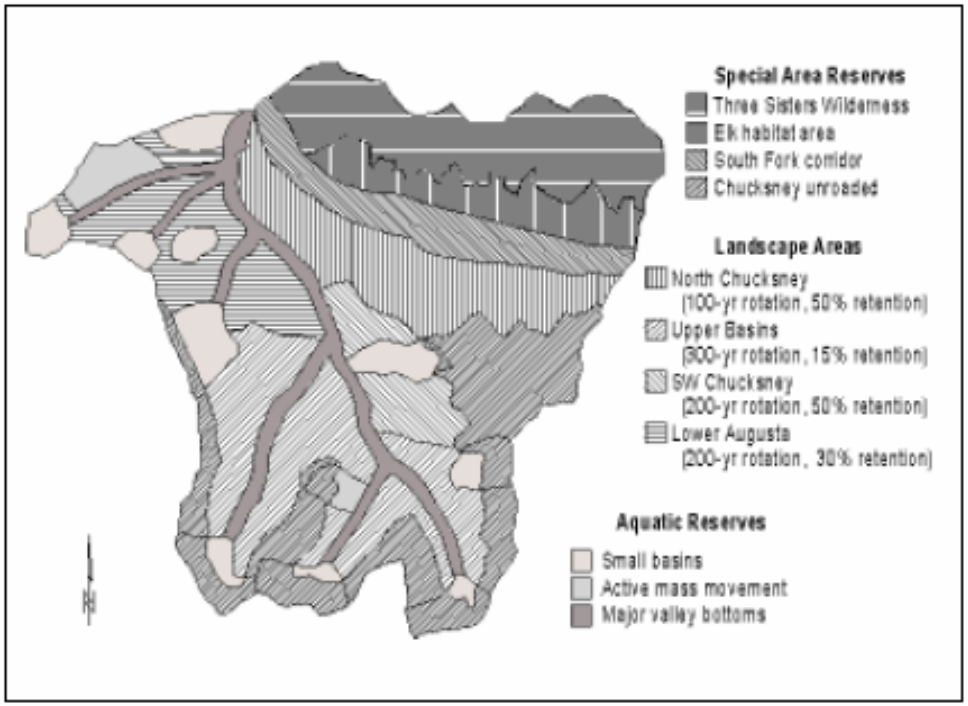




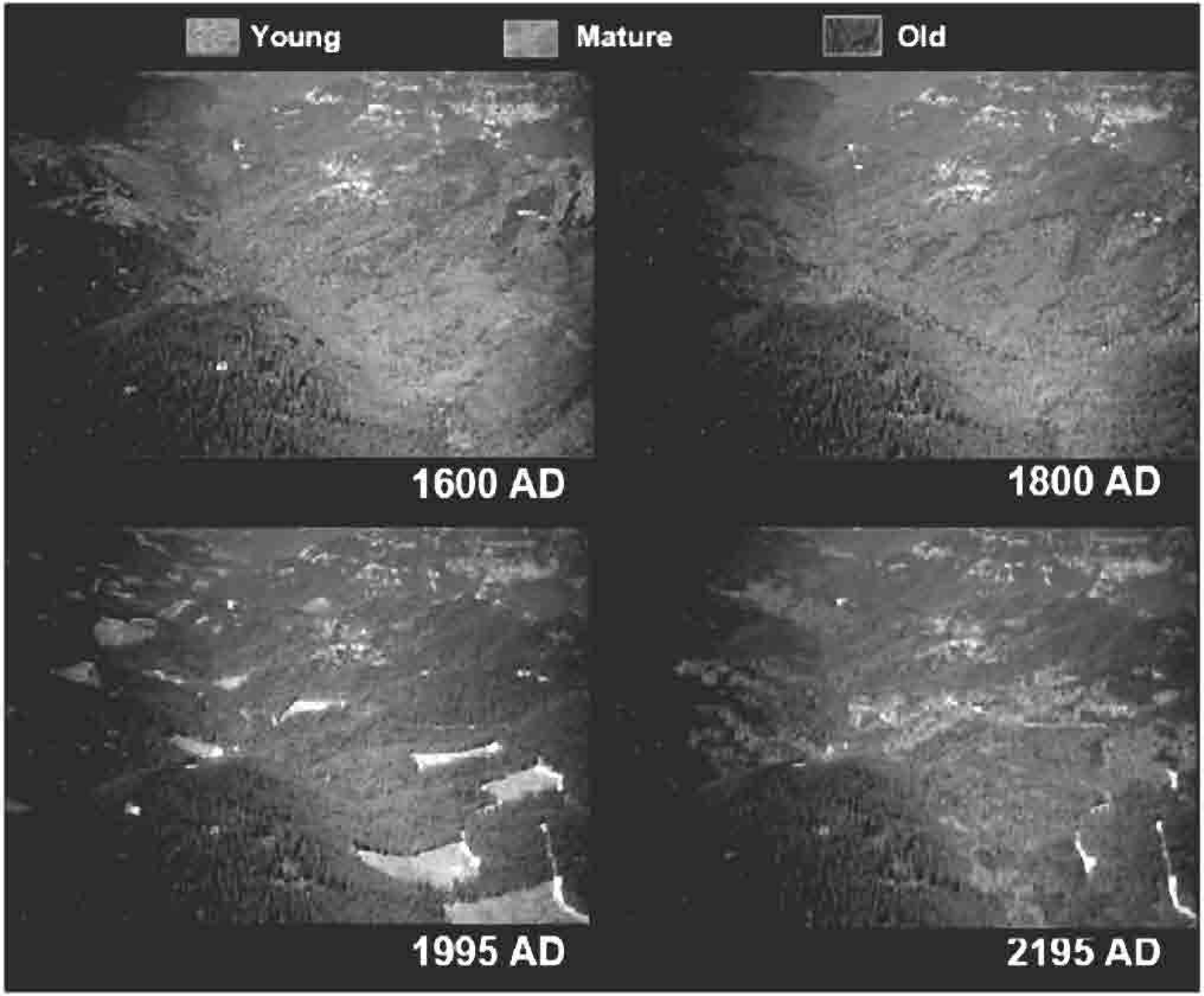




Drainage network



Landscape management plan


Young
Mature
Old
1600 AD
1800 AD
1995 AD
2195 AD

Monitoring the effects of a riparian treatment

Meta-data analysis of monitoring studies carried out at the reach or watershed scale

Interannual coefficient of variation

	Adult	Juvenile	Smolt
Coho	72 (21)	53 (35)	50 (11)
Steelhead	60 (3)	66 (6)	50 (5)
Sea-run cutthroat	92 (1)	54 (6)	64 (3)

"…interannual variation in estimates of salmon population densities routinely can be very high. It is possible to calculate the time periods of monitoring necessary to detect the effects of a management intervention with respect to this level of natural variation. *Detecting a 50% difference would require 26 years of monitoring, a 30% difference 70 years, and a 10% difference 620 years*."

Report of the Validation Monitoring Panel to the Olympic Natural Resources Center

THE SCIENTIFIC BASIS FOR VALIDATION MONITORING OF SALMON FOR CONSERVATION AND RESTORATION PLANS