

Process-based Restoration of Depositional Stream Reaches— A Paradigm Shift to Stage 0

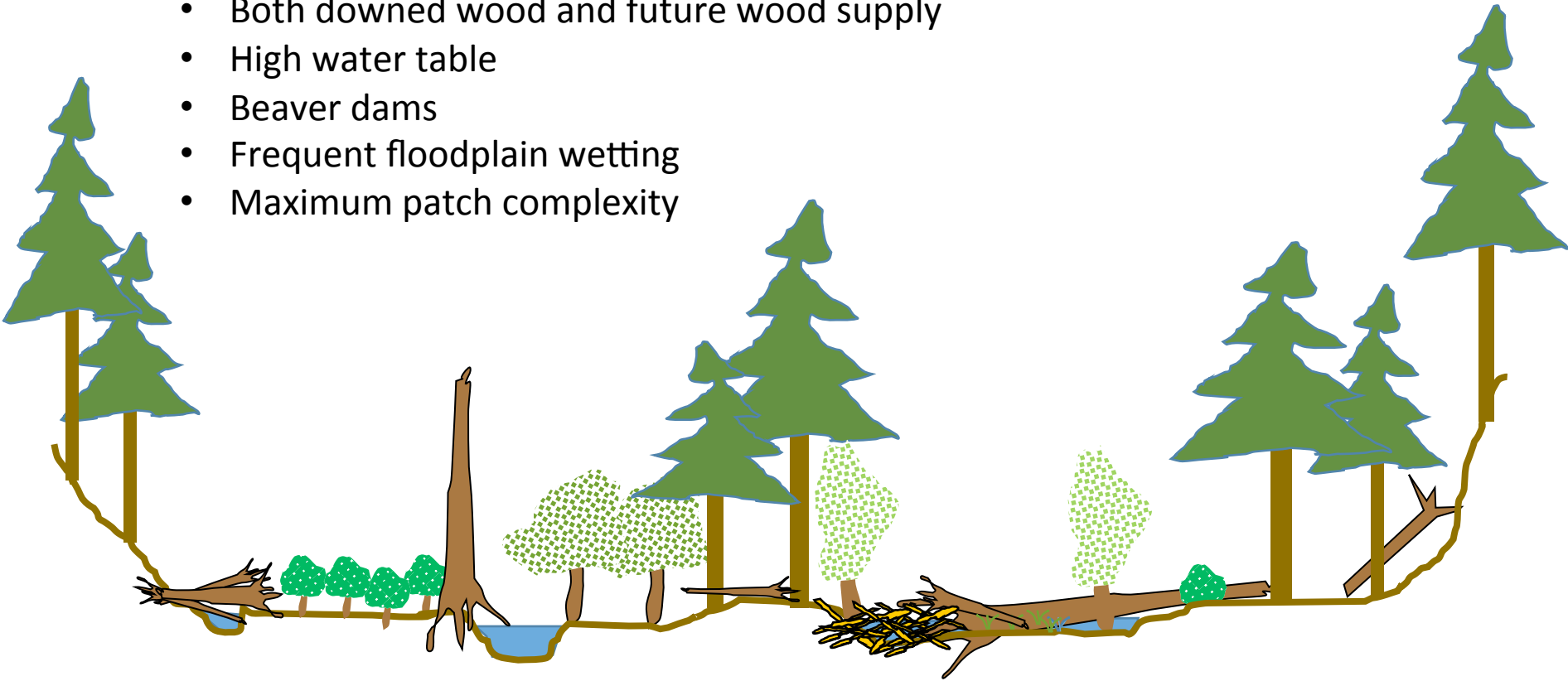


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Willamette National Forest

- Historical Conditions
- Disturbance History
- Evolution of Restoration in the Pacific Northwest (particularly Oregon)
- Paradigm Shift to Stage 0 projects

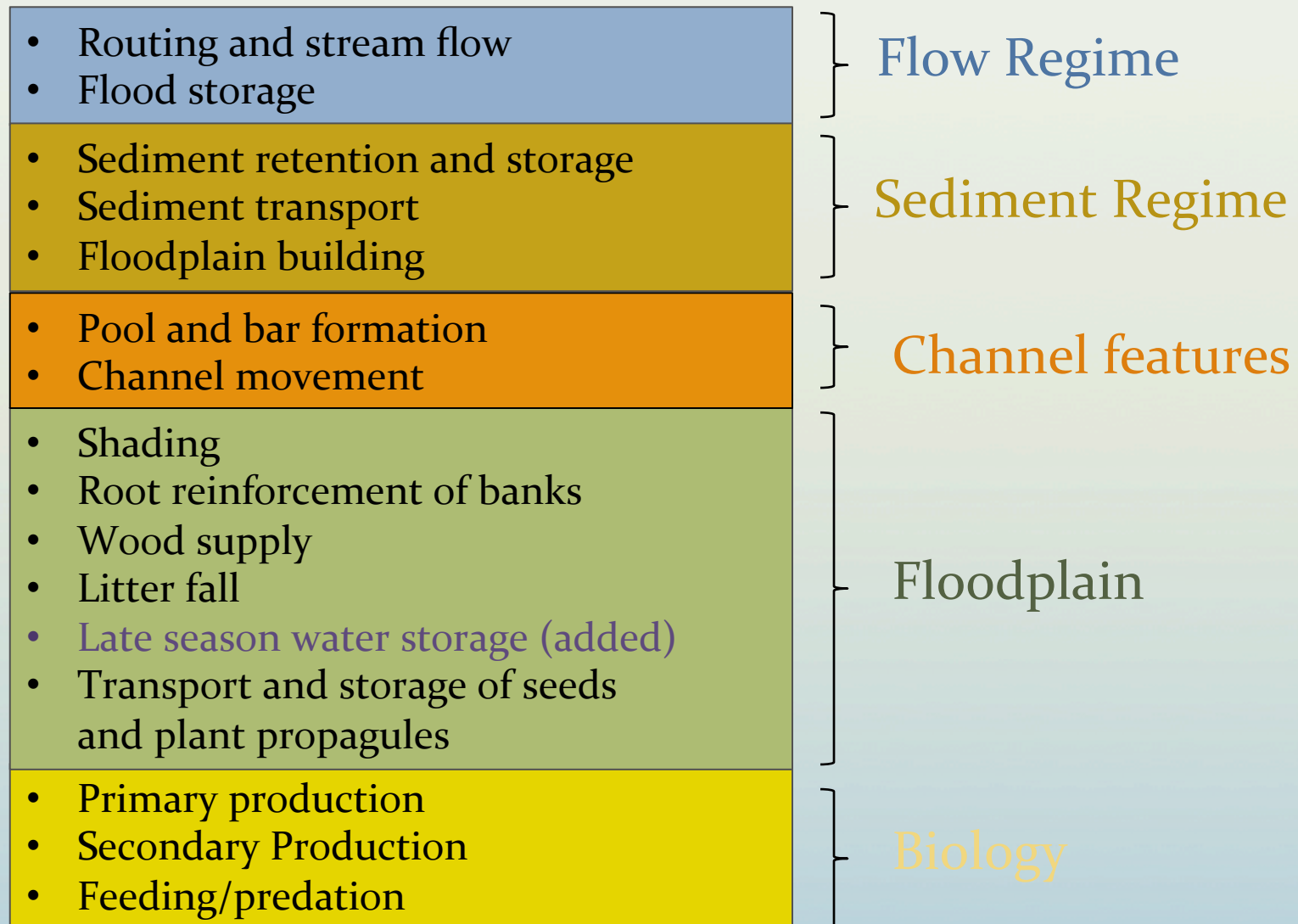
Historic Floodplain Condition in Depositional Environments

- Vegetation diversity
- Elevational diversity
- Multiple flow paths
- Both downed wood and future wood supply
- High water table
- Beaver dams
- Frequent floodplain wetting
- Maximum patch complexity



Cluer and Thorne, 2013 – “STAGE 0” of the Stream Evolution Model

Reach-scale processes from Roni and Beechie, 2013*



* **Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats**

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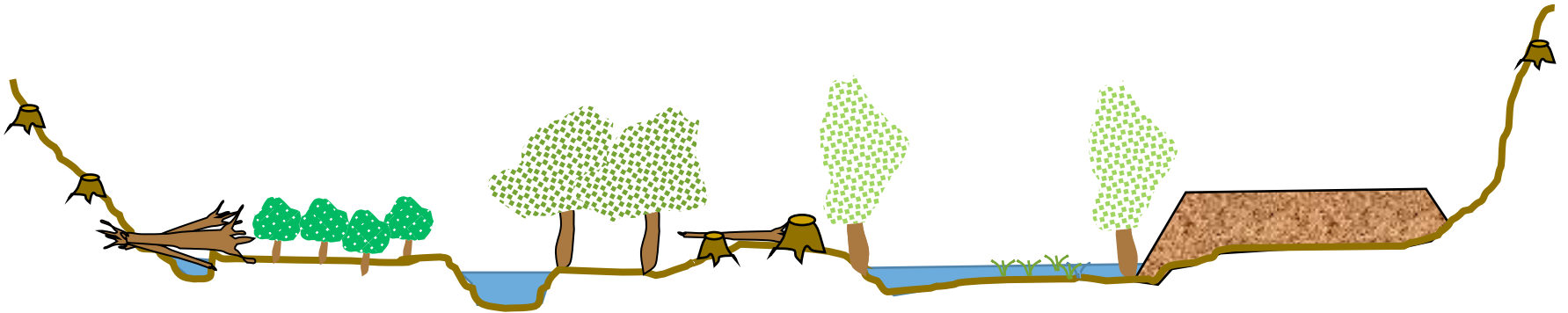
Changed Condition in Depositional Environments

- Road building



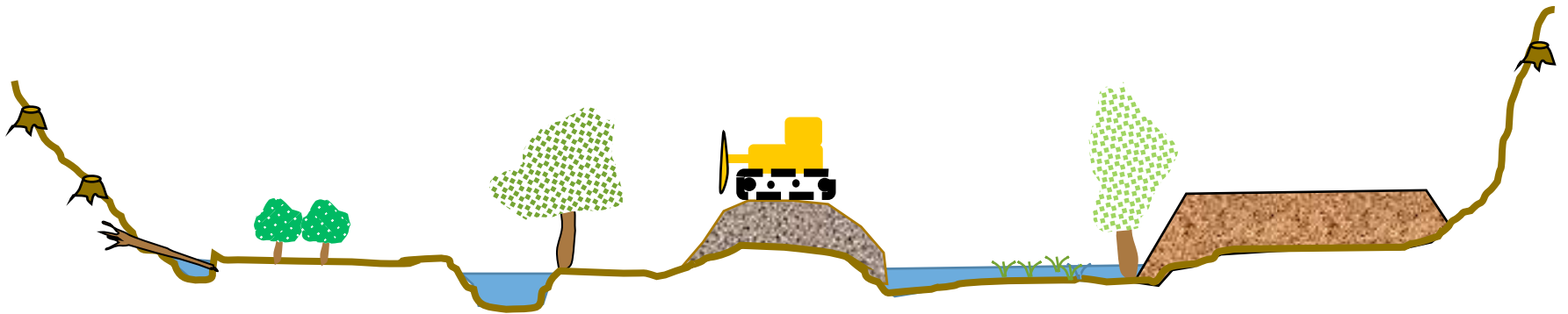
Changed Condition in Depositional Environments

- Road building
- Conifer harvest



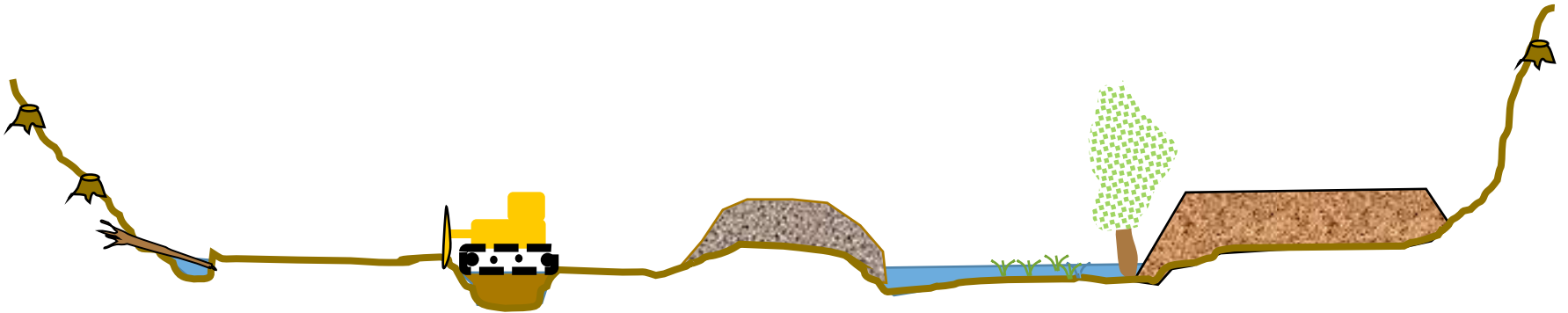
Changed Condition in Depositional Environments

- Road building
- Conifer harvest
- Diking and channelization



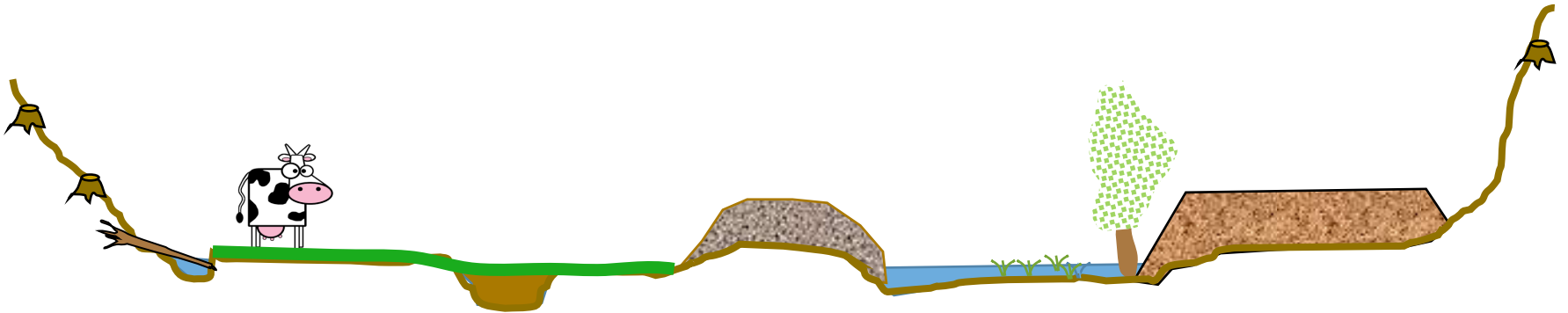
Changed Condition in Depositional Environments

- Road building
- Conifer harvest
- Diking and channelization
- Blocking or filling side channels



Changed Condition in Depositional Environments

- Road building
- Conifer harvest
- Diking and channelization
- Blocking or filling side channels
- Grazing and farming

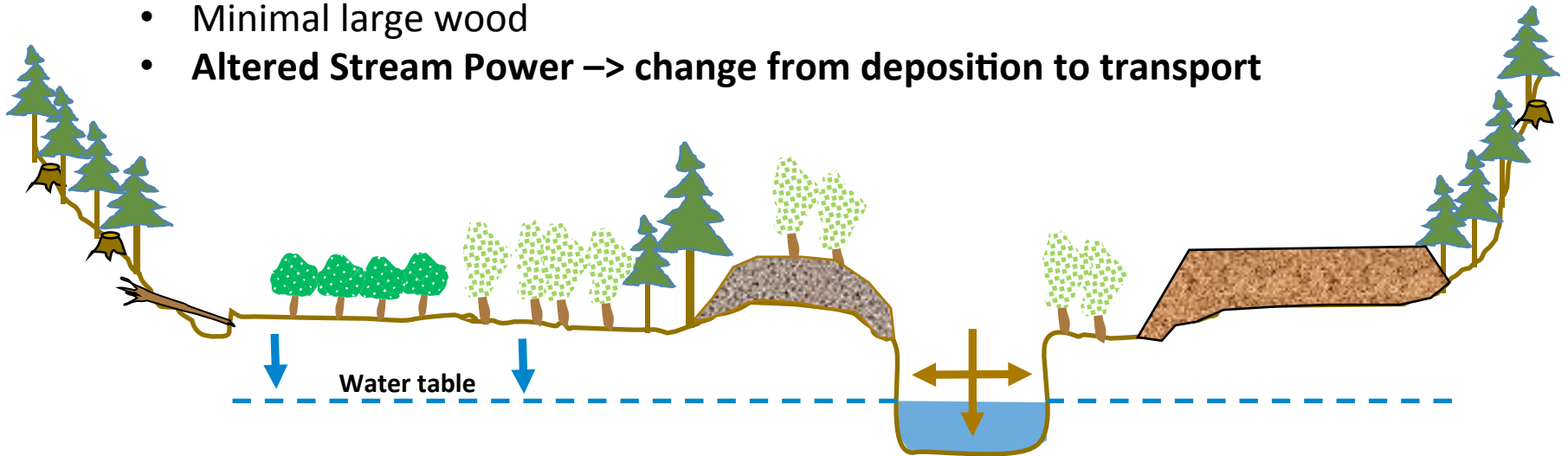


Changed Condition in Depositional Environments

- Road building
- Conifer harvest
- Diking and channelization
- Blocking or filling side channels
- Grazing and farming

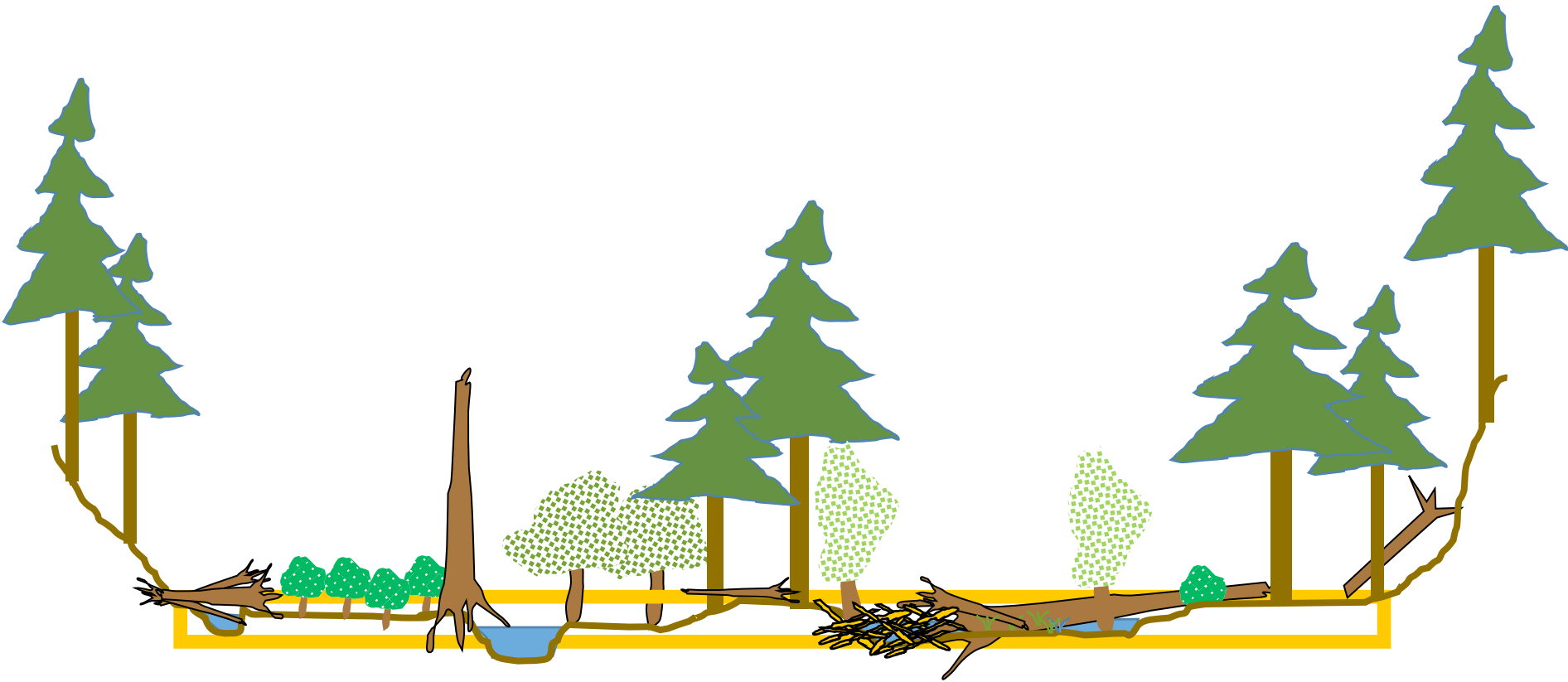
Leads to:

- Single incised channel
- Loss of water table/wetlands
- Altered vegetation types
- Minimal large wood
- **Altered Stream Power → change from deposition to transport**



Stream Evolution Model, Stages 2-4
Cluer and Thorne, 2013

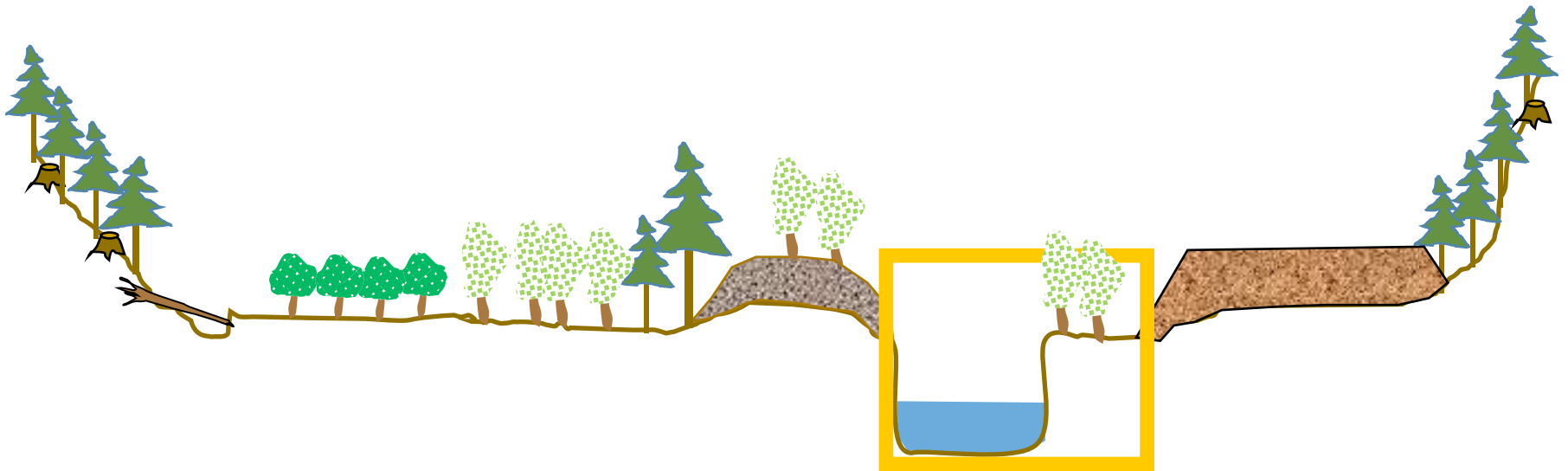
Historic Floodplain Condition in Depositional Environments



Stream Power Per Unit Width - Low

- Flow distributed throughout a roughened surface

Changed Condition from Depositional to Transport Environments

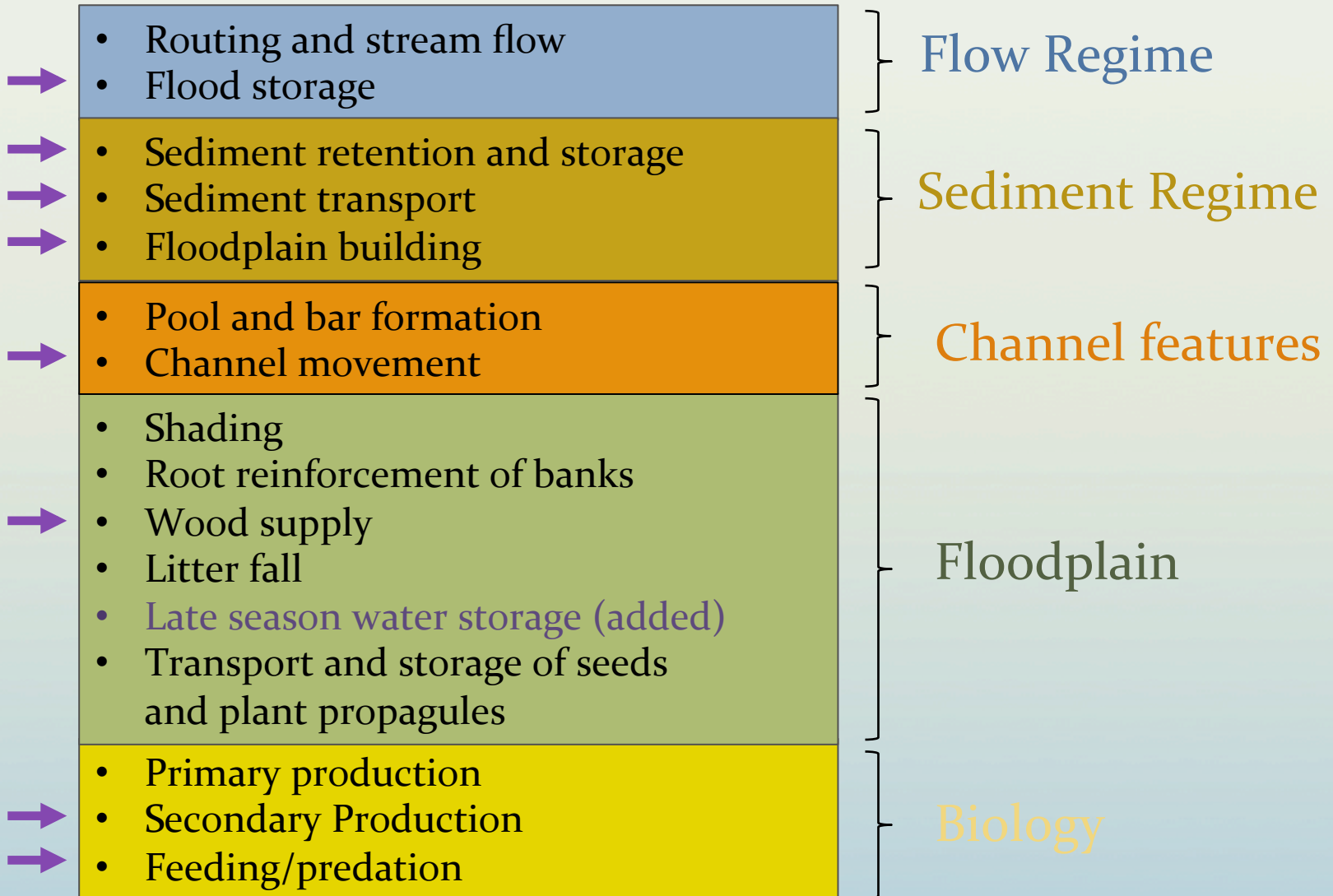


Stream Power Per Unit Width - High
"fire hose effect"

Reach-scale processes from Rohlf and Beechie,

2013

Critical to Native Aquatic Species



Restoration Solutions

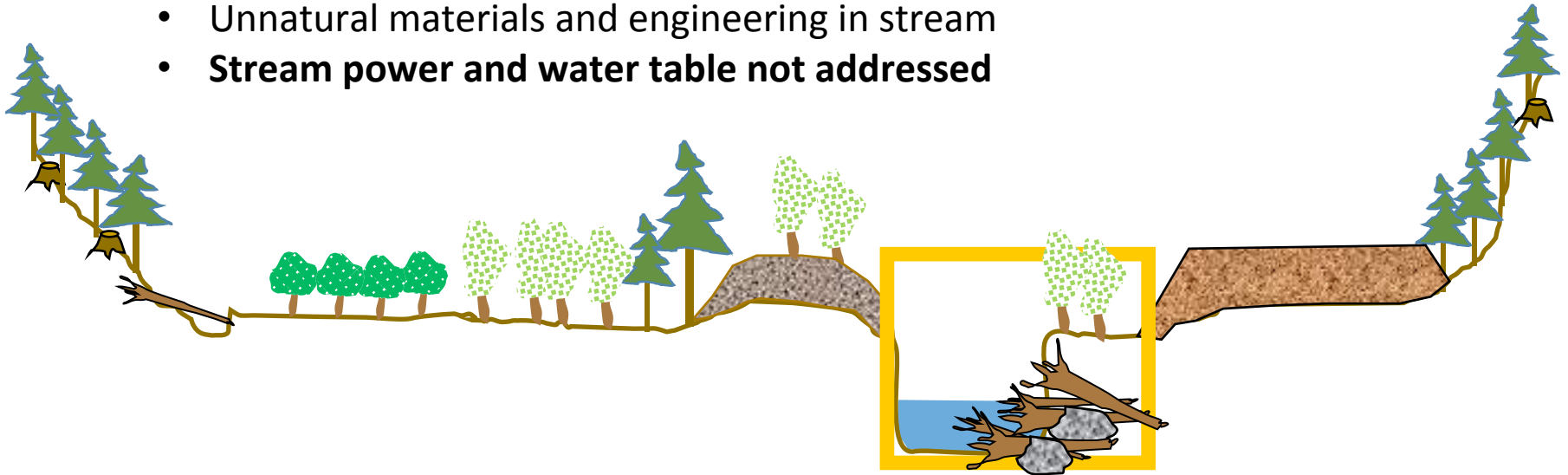
Channel-centric, form-based restoration (1980s to present)

Advantages:

- Easy to count # of structures, pools created and miles treated
- Focused treatment that's relatively inexpensive per site

Disadvantages:

- Process and function minimally addressed
- Blows out in big storms
- Unnatural materials and engineering in stream
- **Stream power and water table not addressed**



Stream Power Per Unit Width - High

- Form-based restoration working against a “fire hose”

Restoration Solutions

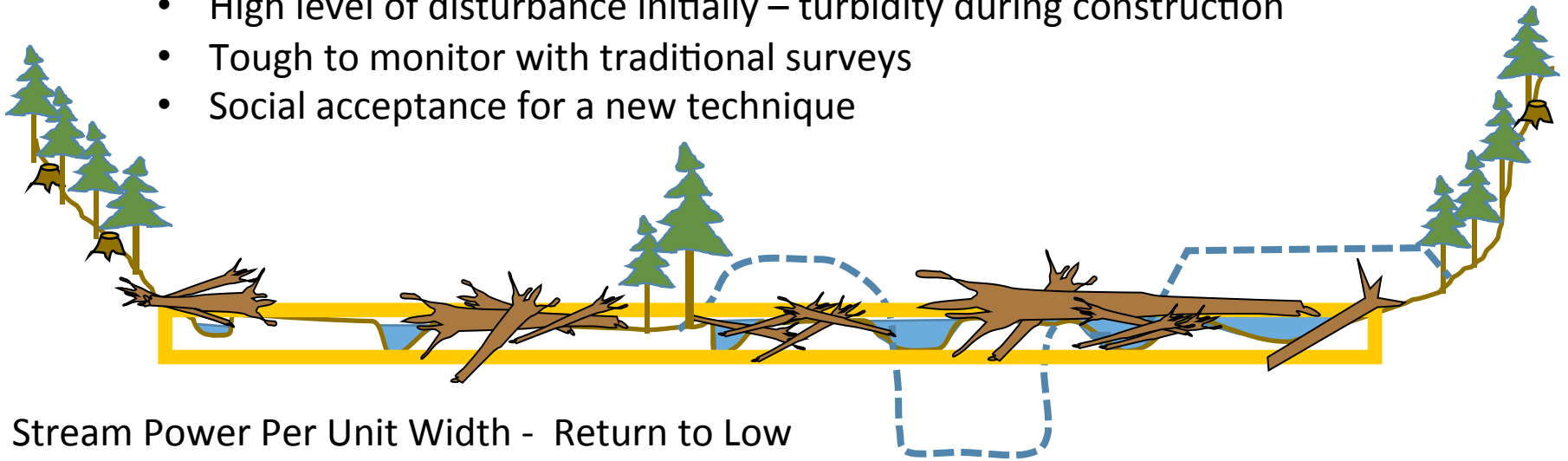
Stage 0 - Valley bottom, process-based restoration (2005 to present)

Advantages:

- Process and function fully addressed for entire floodplain
- Water table restored
- Template created for native vegetation recovery
- Patch complexity maximized with dynamic change anticipated over time
- Large storms welcome (stream energy addressed)

Disadvantages:

- High level of disturbance initially – turbidity during construction
- Tough to monitor with traditional surveys
- Social acceptance for a new technique



Floodplains are good!

