The Use of Large Wood in Stream Habitat Restoration

go BIG or go home

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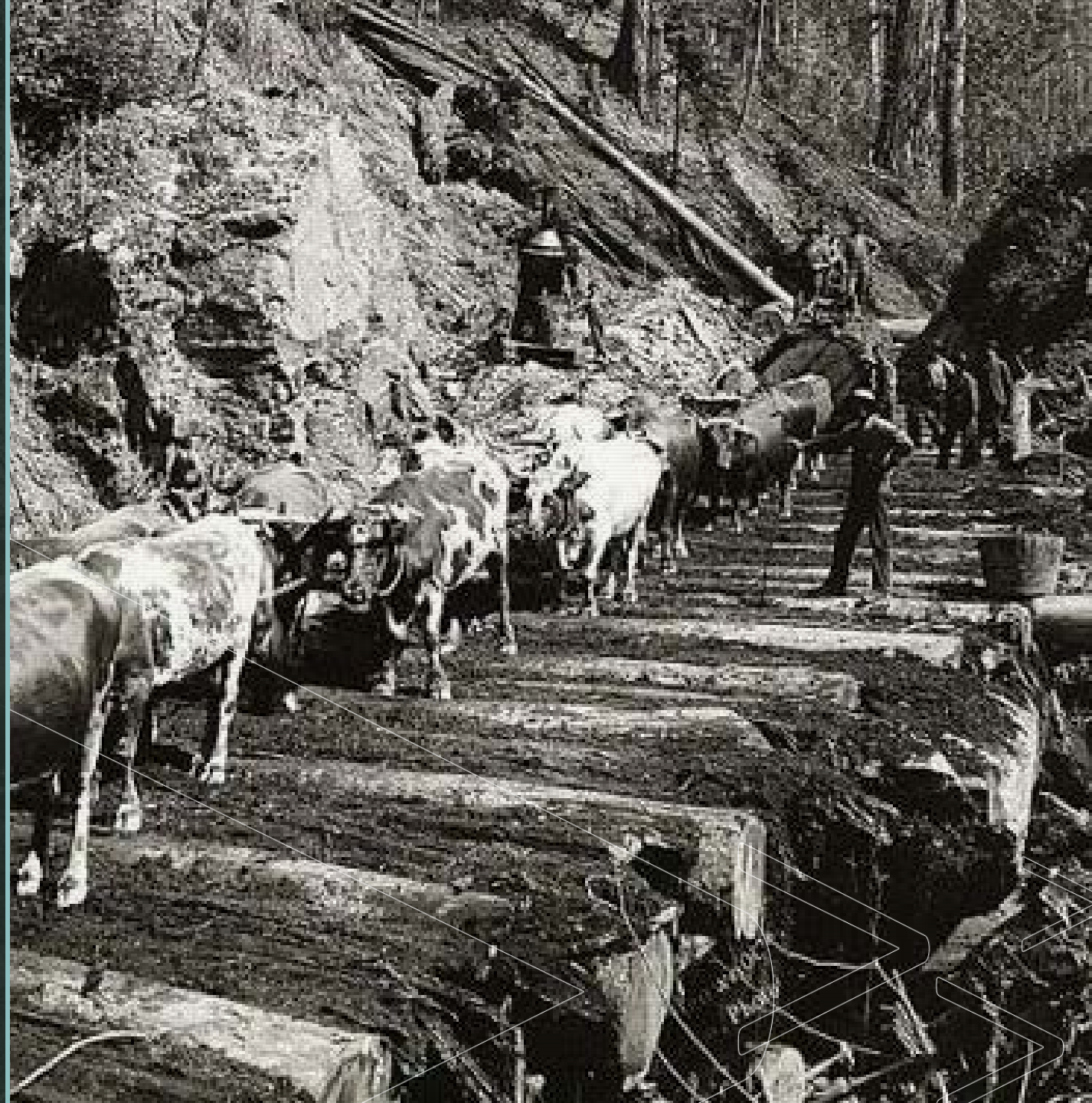
Overview

- Historic and Ecological Context of systems today
- Goal of Large Wood projects
- Site selection/characterization is an important for all projects to clearly define goals
- Risk must be assessed
- Go Big – Be aggressive
  - Don’t avoid complex structures or high-risk settings
  - Craft significant geomorphic change

Historical Context of Large Wood in Streams

- Role of instream wood – geomorphic → biologic
- Log transport: splash dams, skid roads
- Timber harvesting of riparian
- Channel clearing for navigation, anadromous fish passage, or flood control



Ecological Context of Large Wood in Streams

- Large wood improves channel and floodplain function
- Provide habitat to salmonids
- Add nutrients to the system
- Accelerate natural recovery

Go Big?
Goal of Large Wood Projects

Improved geomorphic function - Reverse impacts of channel incision - where unnatural state

- Stream, floodplain, side channels and riparian zone
- Functioning stream is good Salmonid habitat

Restore Physical Processes
Functioning stream is good Salmonid habitat

Raising the bed to reconnect to floodplains and side channels will

- Reduce stream power
- Deposit finer sediment such as gravel
- Allow pools to form at lower flows and scour deeper
- Retain spawning gravels
- Channels and floodplains become habitat again
- Food sources - invertebrate production
- Recover groundwater levels and increase summer base flows

Project Planning

FRGP Guidelines 2020/2021

- Data Requirements
  - Purpose and Site Selection – Clearly define project goals
  - Risk and Uncertainty Analysis
  - As-builts map and details –inspection monitoring
  - Inspection monitoring program

Site Characterization for ***All*** Projects

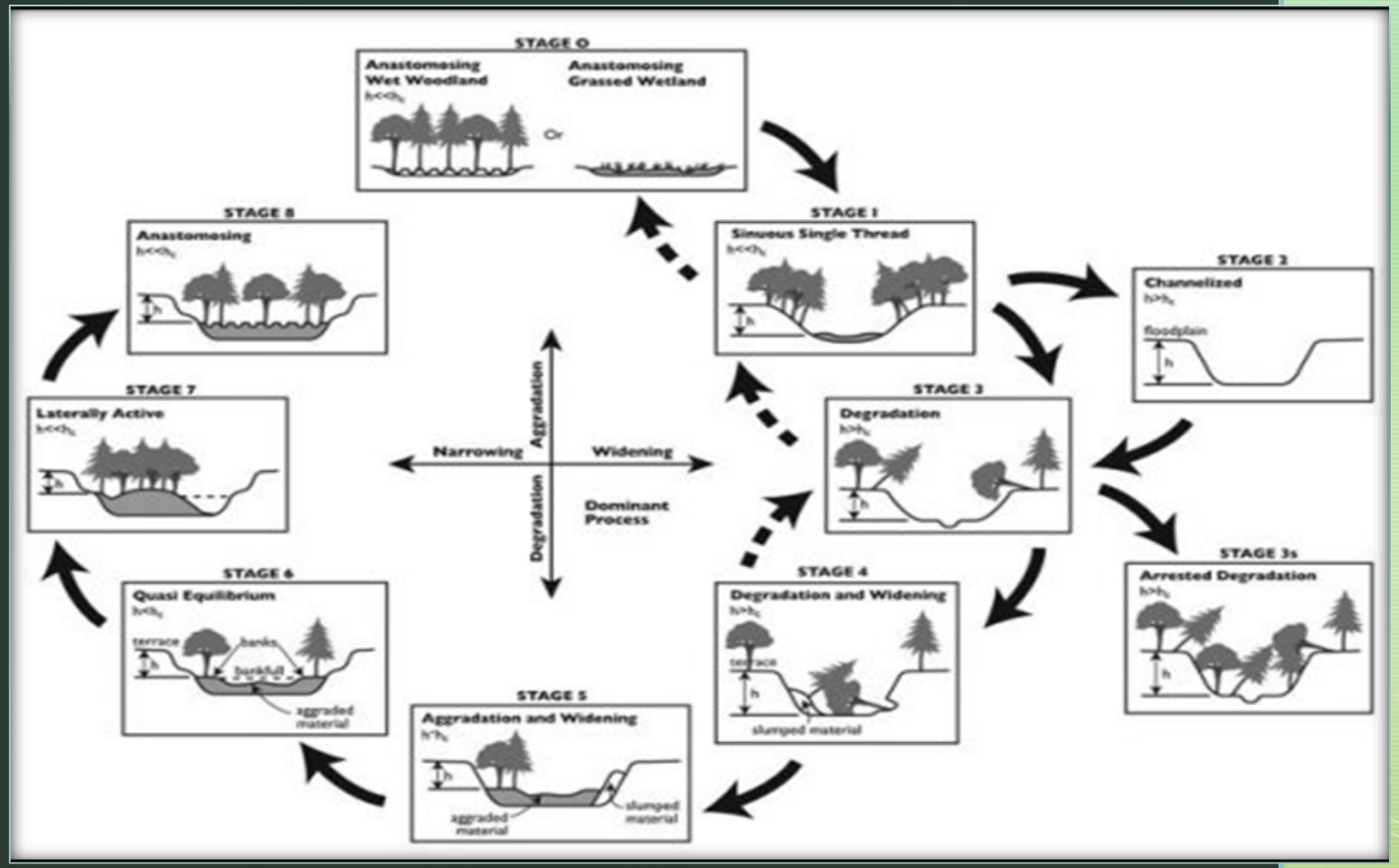
- Identify specific stream reaches
- Geomorphic description of the stream reach
  - Planform, confinement, bed forms, floodplain, slope
  - Stable - aggrading or degrading – cause?
  - Substrate composition – scour potential, bedrock, subsurface
  - Streambank composition
  - Riparian vegetation / sources of wood
  - Construction access

Site Characterization for ***High-risk*** Projects

- Additional studies required
  - Geomorphic study
  - Topographic survey
  - Hydrologic and hydraulic analysis
    - Scour and stability calculations
    - Re-connecting floodplain or side channel

What Stage?

- LW projects to restore stream channel to Stage 0 or Stage 1
  - If you don't address the drivers of incision, it won't last
- Beware of stabilizing banks in Stage 4
  - Material for aggradation
- Stage 3 may result from lack of sediment
  - No supply = no aggradation



The Stream Evolution Model (Cluer and Thorne 2013)

Risk and Uncertainty Analysis

- Professional liability for damages
  - Minimize by rigorous and defensible analyses of risk
- Risk assessment
  - RiverRAT (Skidmore, et al, 2011)
  - Washington Manual (Cramer, 2012)
  - Large Woody Material-Risk Based Design Guidelines (USBR, 2014)

RiverRAT (Skidmore, et al, 2011)

Low-risk Projects vs. High-risk

- Low-risk
  - Little or no consequence of failure
  - Low-risk to public safety, infrastructure, or private property
  - Structures with key piece sized logs with no added stability
- High-risk
  - Where there is risk to public safety, infrastructure, or private property
  - Complex structures – added stability (even in "low-risk" setting)
    - Require stability calculations-Licensed engineer

When Risk is Low “Go BIG”

- Key piece logs or anchored to existing trees or bedrock
- Best location/ orientation to achieve goal
- Accelerated recruitment
- Mix in more tools such as BDAs
- Control the water surface – make sure you meet your goal

When Low-risk Requires Complex Structure

- Ideal geomorphic location for a structure may lack anchor points
  - No trees on the bank at a bend
  - Need a structure mid channel
- Stream is too wide to have opposing structures meet
- Entrenchment Ratio is less than 1.4 and stream power can rotate or break logs
- Control the water surface – make sure you meet your goal

Key Piece Logs

Key Piece Logs – independently stable

- Length
  - With root wads 1.5x bankfull
  - No root wad 2x bankfull
- Diameter
  - ½ depth at bankfull or 12 inches, whichever is greater
- Preferred species (In coastal N. CA)
  - Second growth redwood (durability 10yrs +)
  - Douglas fir (durability 25yrs +)

Table 2. Minimum log diameter for key log piece (Adapted from ODFW 2010).

Bankfull Width in Feet	Minimum **Diameter in** Inches
<10	12
10 to <20	16
20 to <32	18
>32	22

Structure Locations and Configurations

With the clearly defined goal of the project

- Avoid unstable streambanks – unless part of larger effort
- Geomorphic complexity – typically obstruct streamflow
- Floodplain re-connectivity
- Re-engaging side channels
- Promote scour and collect additional wood-upstream angle
- Equipment access

Structure Locations and Configurations

Low-risk - Upper Noyo River

Wood placed at an upstream angle

- promote scour
- collects additional large and small wood.

Same feature after the first winter.

Photos courtesy of Alan Ader, (CCC).

Structure Locations and Configurations

Low-risk location

Hardened banks, entrenched, disconnected from floodplain

- Channel spanning features
- Simple structures placed closely
- Restricting flow
- Collects additional debris

Albion
Photos courtesy of Scott Monday (CDFW)

Low-risk

Redwood Creek, Upper Noyo River

Photos courtesy of Brett Leonard (CCC)

Structure Locations and Configurations

Large wood cut may be a result of stream clearing efforts in 80s. Small logs installed by Chris Blencowe and anchored by CCC.

Multiple pieces need to make up difference

Upper Noyo River above Burbeck Creek (Oct 2016)

Structure Locations and Configurations

Low-risk required complex structure

Cottaneva Creek 2018
Photos courtesy of Margie Caisley (CDFW)

Vertical post used in a bend

- Captured large and small wood
- Gravel deposition and sorting both upstream and downstream
- Increasing sinuosity

Structure Locations and Configurations

Low-risk

The “Wing” Redwood Creek Noyo River
Photos courtesy of Brett Leonard (CCC)

- Smaller BFW stream with properly sized, good placement and anchoring
- Height help captured large and small wood
- Gravel deposition and sorting both upstream and downstream

The same location on Redwood Creek in summer

Conclusions

- Streams are deficient in large wood necessary to maintain salmonid habitat
- Go Big – Be aggressive
  - Don’t avoid complex structures or high-risk settings
  - Craft significant change
  - Stream reach approach
- Site selection/characterization is an important for all projects to clearly define goals
- Risk must be assessed
  - High-risk must be designed before implementation
  - 65% design can be developed within a year - for late summer early fall funding programs