Low-cost restoration techniques for rapidly increasing wood cover in coastal coho salmon streams

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Do more for less (?)
Study Area

- 6 coastal watersheds; 5 ownerships; 11 reaches
- Private land; little development
- Forestry = dominant land use
- Intensively logged
- Stream cleaning
Study Area

- Coho, steelhead, Chinook
- Reaches identified by CDFW/NMFS coho recovery plans, and other watershed assessments/plans, as wood deficient
- Deficiency confirmed with field surveys
- CDFW/NMFS coho recovery plans: add wood to summer/winter habitat
Study Area

- Drainage areas – 8,400-115,000 acres
- Coastal streams
- Bankfull widths 13-70ft
- All <3% gradient; most ≤1%
Wood Augmentation

1. Protect and restore riparian forests and processes
   - Riparian buffers
   - Selective management
   - Natural wood recruitment is the goal
Problem?

Sedell et al. 1988

Public Draft Recovery Plan for the ESU of CCC Coho Salmon (NMFS 2010)
Wood Augmentation

2. Accelerated recruitment of wood as a stop-gap measure
Methods

1. Placement of whole trees or parts of trees using heavy equipment
Equipment placement

- Skidder (with winch) on existing trails; does not enter wetted channel
- Log length ≥ 1.5-2 times bankfull width
- Wedged & mobile pieces
- No hard anchoring
- Usually trees from outside the riparian zone
- Excavation/salvage
- Suitable where riparian stocking is low or there are few riparian trees suitable for falling
Methods

2. Directionally falling riparian trees
Direct falling

- No equipment access needed
- Riparian trees where canopy sufficient
- Log length $\geq 1.5\text{-}2$ times bankfull width
- Wedged & mobile pieces
- Trimming of larger limbs
- Breakage/trim left instream
Design considerations

- Channel morphology (gradient, bank conditions, thalweg orientation, substrate, etc.)
- Infrastructure, roads
- Equipment access
- Riparian stocking, wood availability
- Layout and tree position; log length
- BMPs re: canopy, wildlife, wildlife trees, future natural wood recruitment
- Safety
Methods

Effectiveness Monitoring

• Pre- and post-treatment surveys
  – Habitat typing
  – Wood density and distribution
  – Photo points
  – Long. profiles
Methods

Compare core design & construction costs

– Anchored (n=8), unanchored (n=11)
– Projects in streams of similar size, same region, same goals
– Design & implementation, non-wood materials, equip. rental, trans. & fuel, travel, project admin.
– No wood, monitoring, permitting
Results

• 45 miles – 2007-2012
• ~2,000 trees or wood pieces
• Retention rates: mean=92% (SD=11%)
• Wood volume ↑: mean=95% (SD=80%)
## Results

<table>
<thead>
<tr>
<th></th>
<th>Pool habitat</th>
<th>Wood ≤ 20ft</th>
<th>Wood &gt;20ft</th>
<th>Pools ≤ 4ft</th>
<th>Pools &gt; 4ft</th>
<th>Shelter</th>
<th>LWD shelter</th>
<th>SWD shelter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median (IQR)</strong></td>
<td>24 (19)</td>
<td><strong>22 (59)</strong></td>
<td><strong>113 (262)</strong></td>
<td><strong>11 (67)</strong></td>
<td><strong>33 (69)</strong></td>
<td><strong>36 (55)</strong></td>
<td><strong>78 (230)</strong></td>
<td><strong>47 (569)</strong></td>
</tr>
</tbody>
</table>
Results

Cost per log ($)

Wood loading method

Anchored

Unanchored
Results

Design/impl.*

Non-wood*

 Equip. rent. *

Trans./fuel*

Proj. admin.

Travel
Accelerated Recruitment

- Pool habitat increases
- Shelter and structure values increase
- Wood volume increases
- Large wood is retained in the channel
- Accelerated Recruitment is 22% the cost of traditional anchoring
Do more for less (!)
Limitations/Considerations

• It is only one tool
• Site- and watershed- specific ecological & social factors (e.g. downstream infrastructure/development, channel size, etc)
• Experience/expertise matters
• Trade-offs – losing a tree that will be a future recruit?
• Restoring physical & ecological processes essential to long-term recovery
Outstanding Questions

• Are there differences in long-term effectiveness of anchored vs. unanchored loading?
• How much wood is enough?
• Long-term retention rates?
• Are we making more fish?
Instream wood volume in redwood forests (ft³/acre)

Keller and Tally observed these volumes in Prairie and Little Lost Man Creeks in the 70's.

Wooster and Hilton observed these volumes in OG forests...which had been previously cleared.

Is this the “good wood zone?”

What other have observed in managed timberlands.
The Pudding Creek Project: a BACI Study

• A partnership between CG, CDFW, TNC, TU
• Six years of baseline data on coho life history metrics
• Approximately 80% of the fish bearing habitat will be treated using mostly accelerated recruitment
• Caspar Creek, a similar watershed with a similar monitoring history, will be the control stream
• Changes in biological (e.g., spawner to smolt) and physical indices will be closely monitored for six years after treatment
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