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

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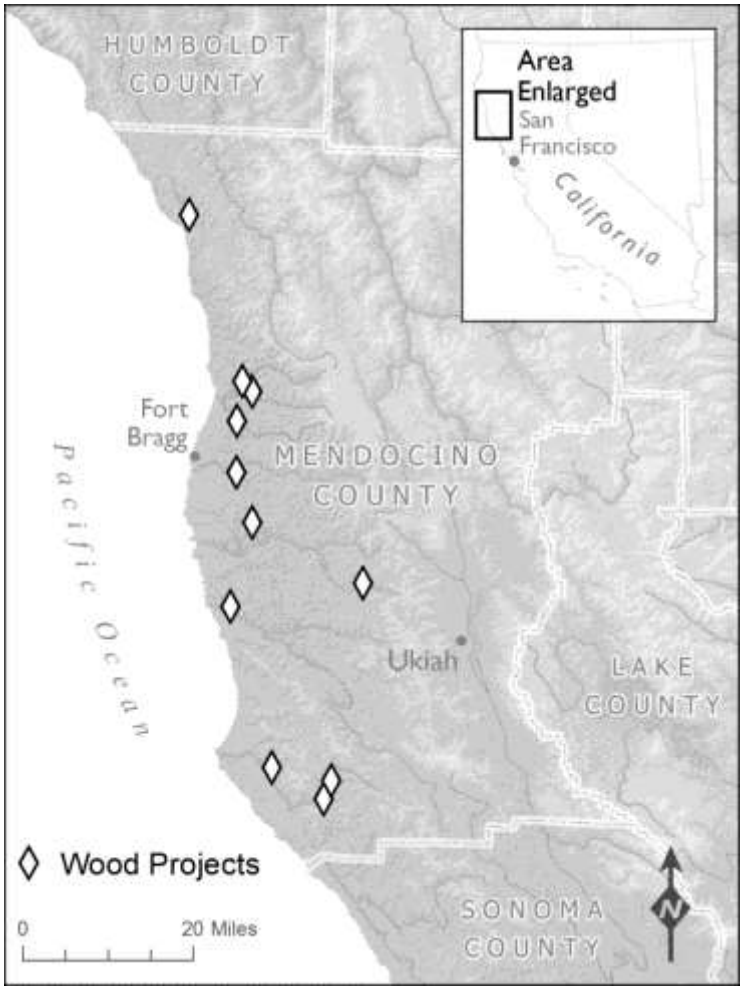
Do more for less (?)

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

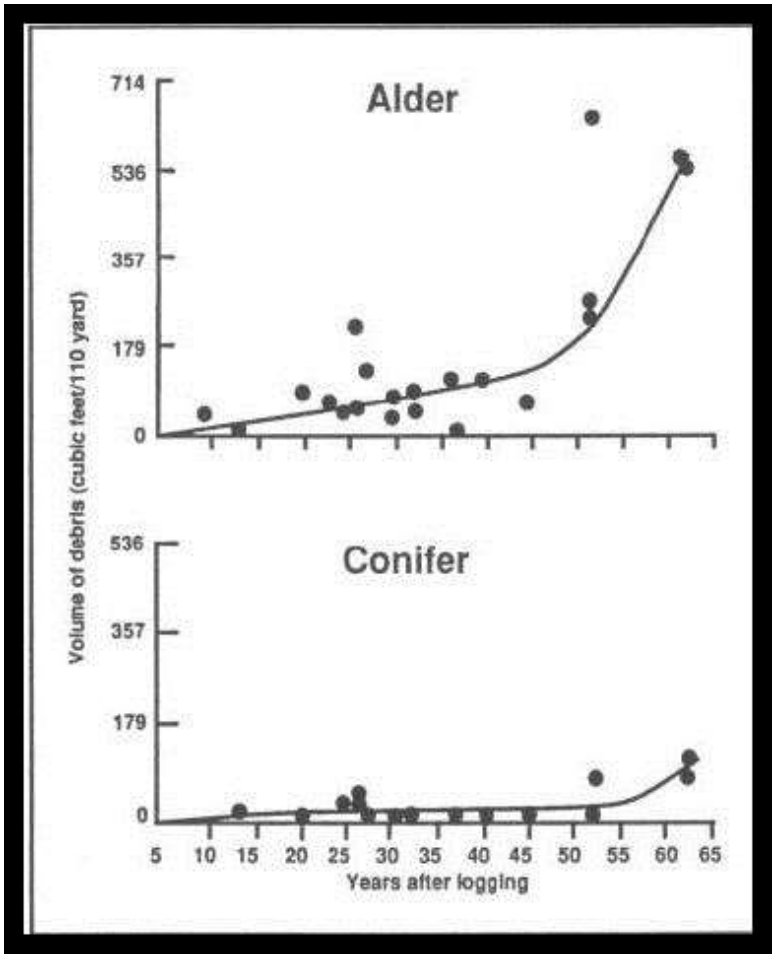
Study Area

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

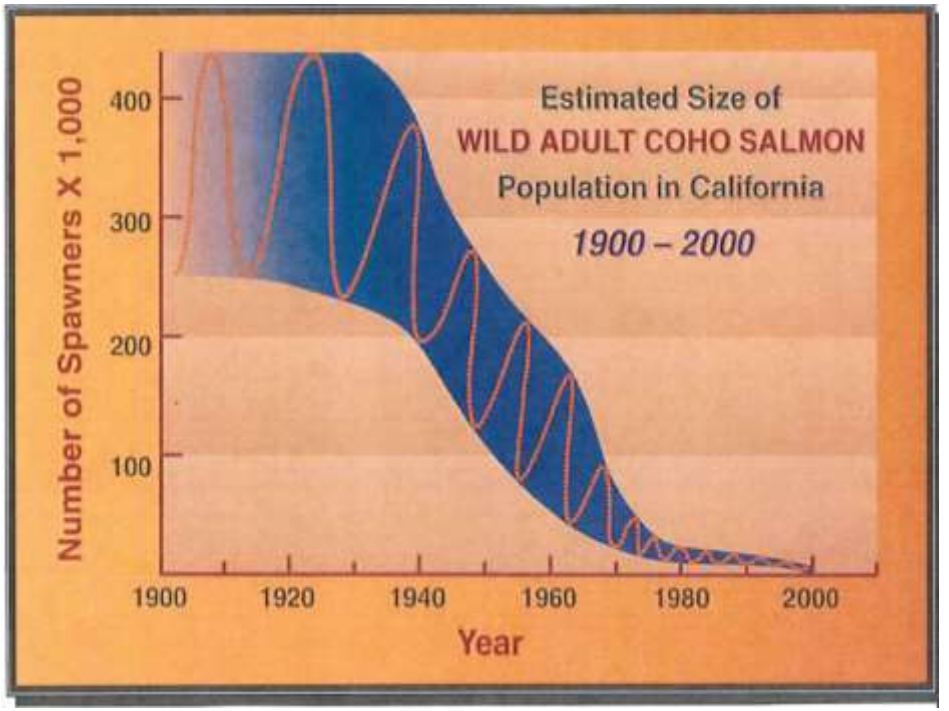
Wood Augmentation

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

Inman Creek/TNC-TCF - October 2009

South Fork Ten Mile/CG - July 2008

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

South Fork Ten Mile/CTM - July 2008

NF Ten Mile, CTM 2011

Direct falling

- No equipment access needed
- Riparian trees where canopy sufficient
- Log length ≥ 1.5-2 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

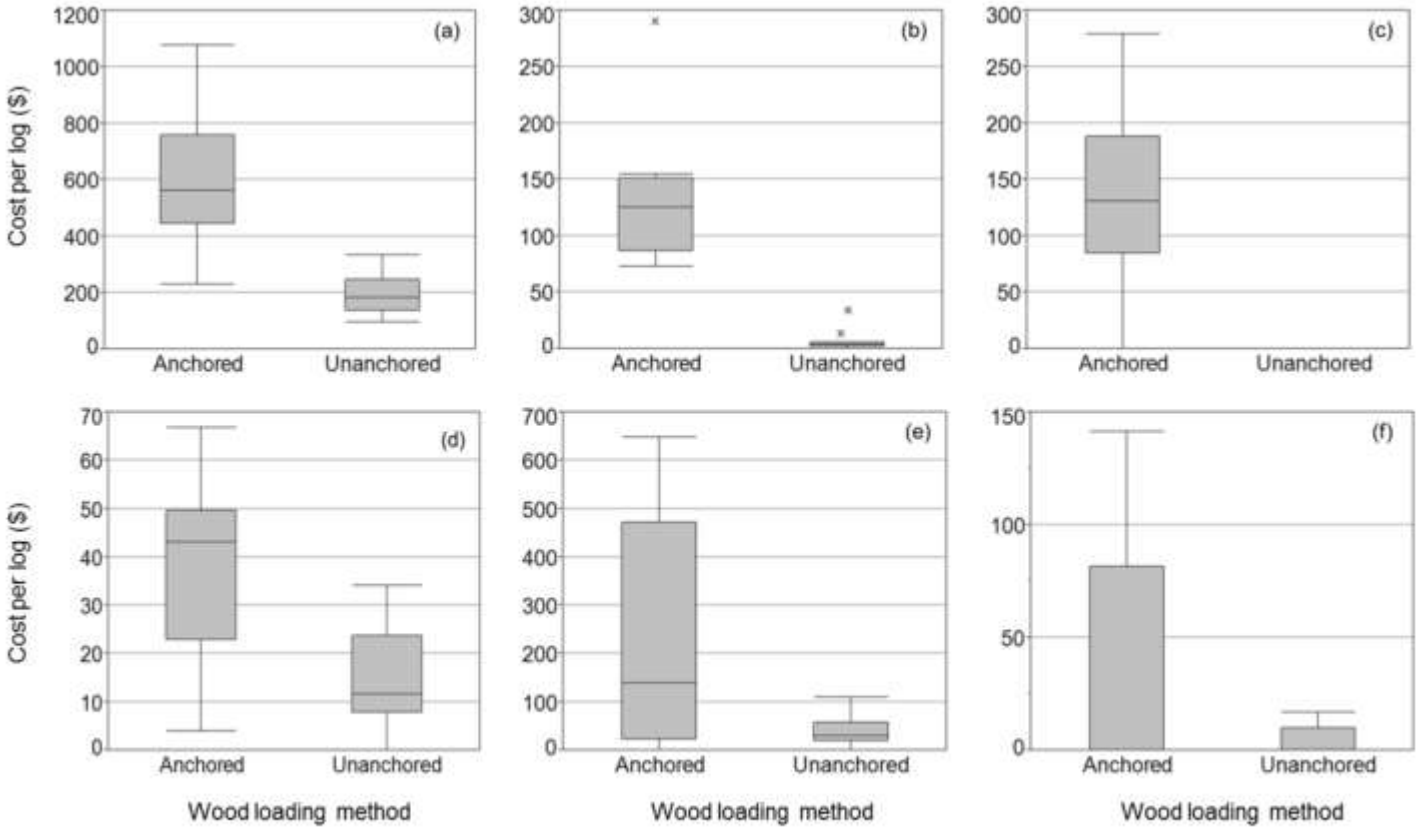
	Pool habitat	Wood ≤ 20ft	Wood >20ft	Pools ≤ 4ft	Pools > 4ft	Shelter	LWD shelter	SWD shelter
Median (IQR)	**24** (19)	**22** (59)	**113** (262)	**11** (67)	**33** (69)	**36** (55)	**78** (230)	**47** (569)

Results


1500
1000
500
0
Cost per log ($)
Anchored
Unanchored
Wood loading method

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 (!)

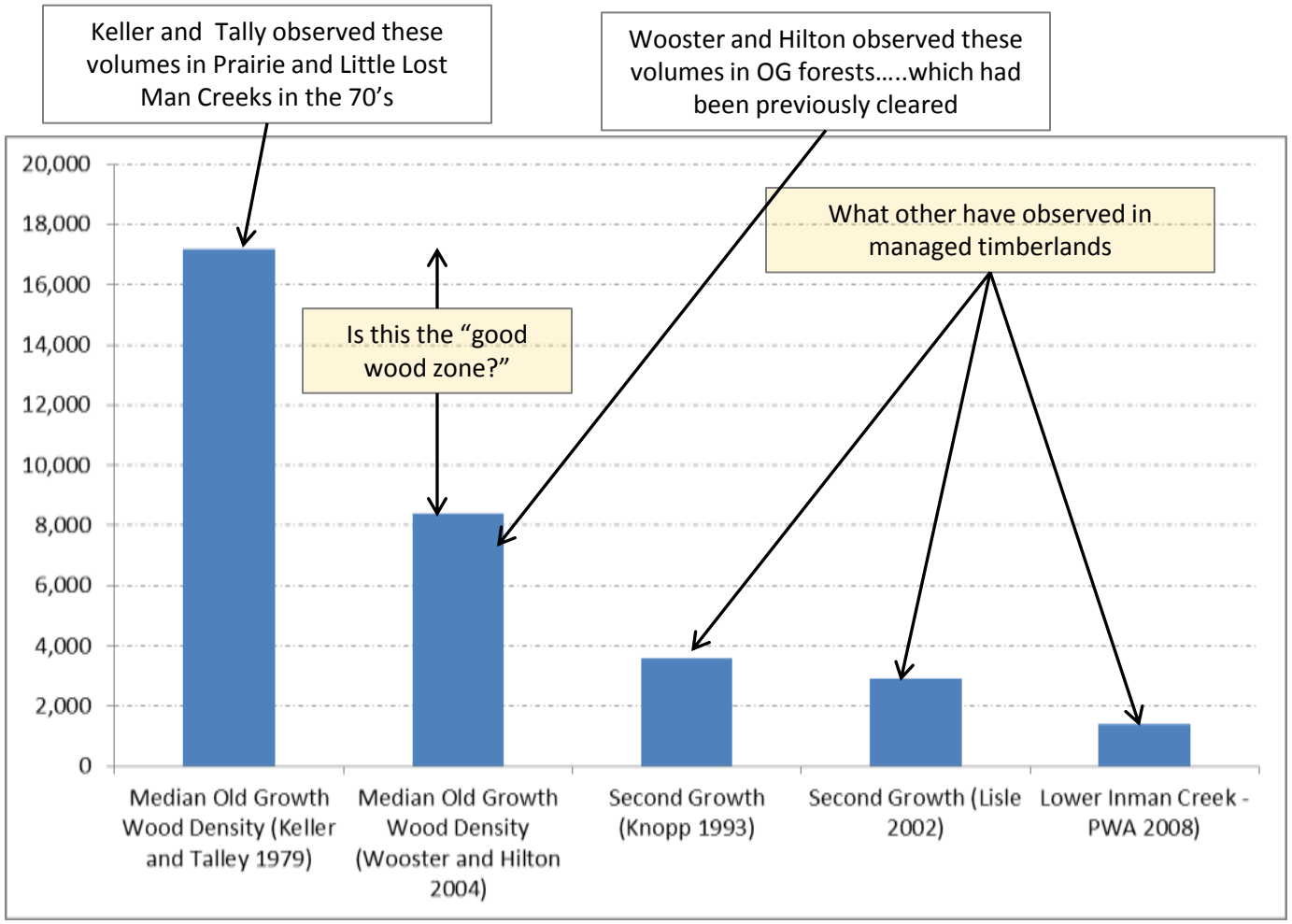
Limitations/Considerations

- 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 (ft^3/acre)



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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