

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

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Watershed Management

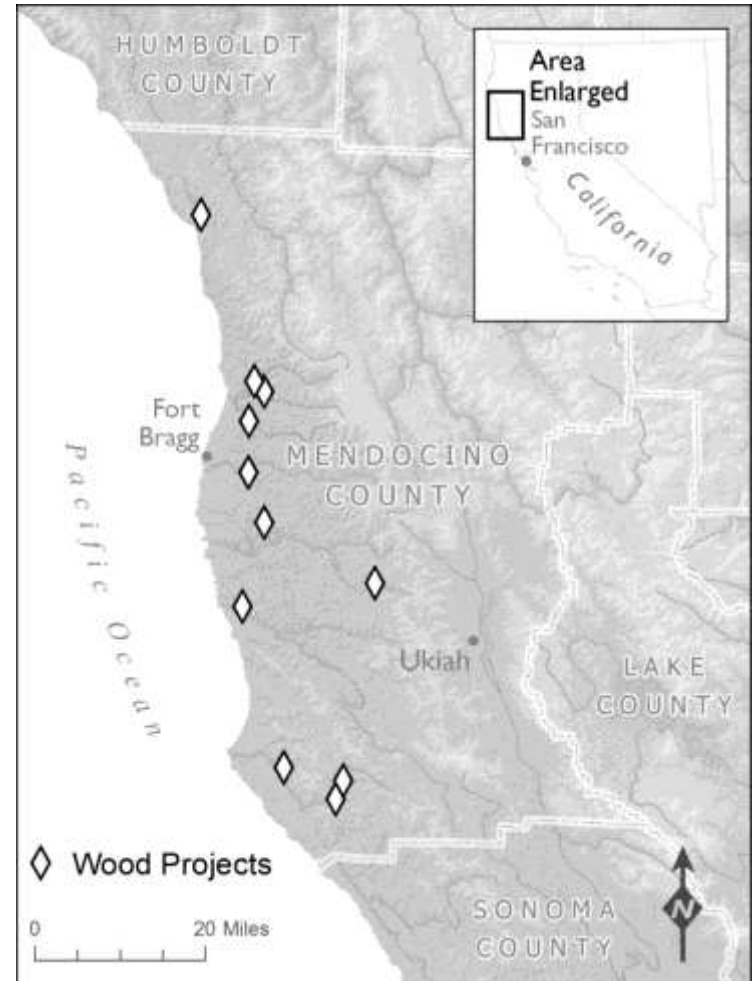
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Do more for less (?)

# 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  $\leq 1\%$

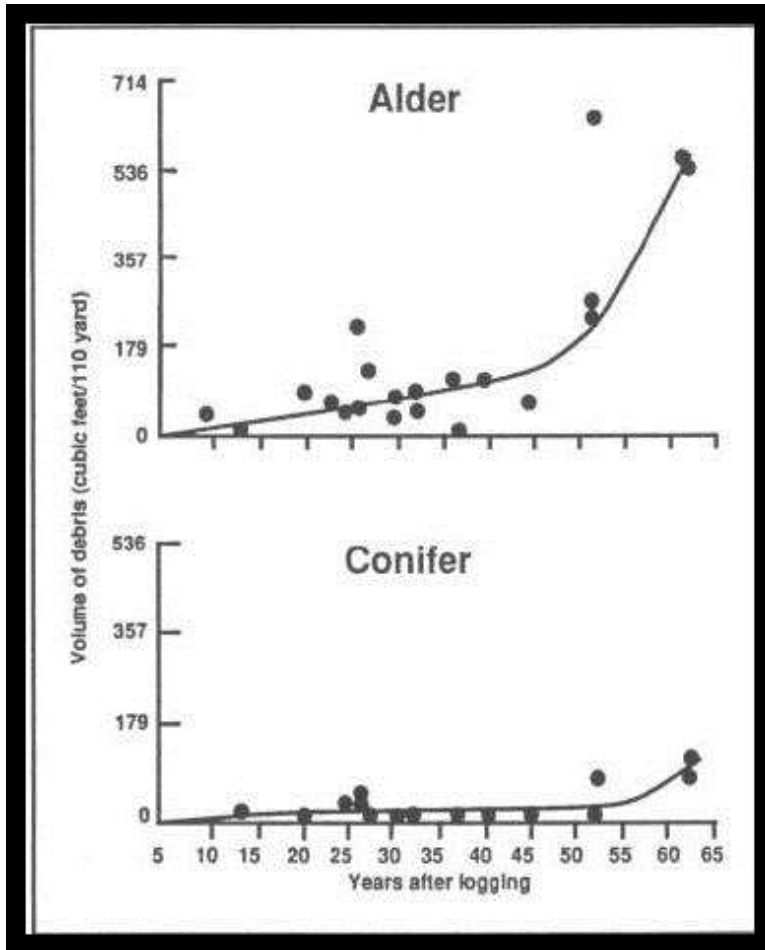


# Wood Augmentation

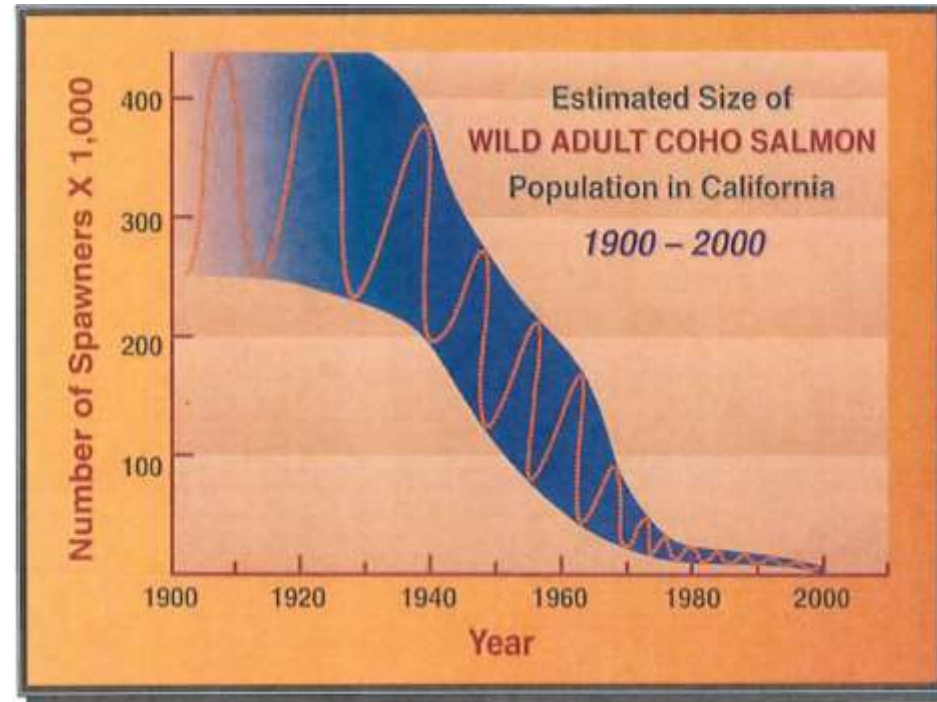
1. Protect and restore riparian forests and processes
  - Riparian buffers
  - Selective management
  - Natural wood recruitment is the goal



# 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  $\geq$  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  $\geq 1.5-2$  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

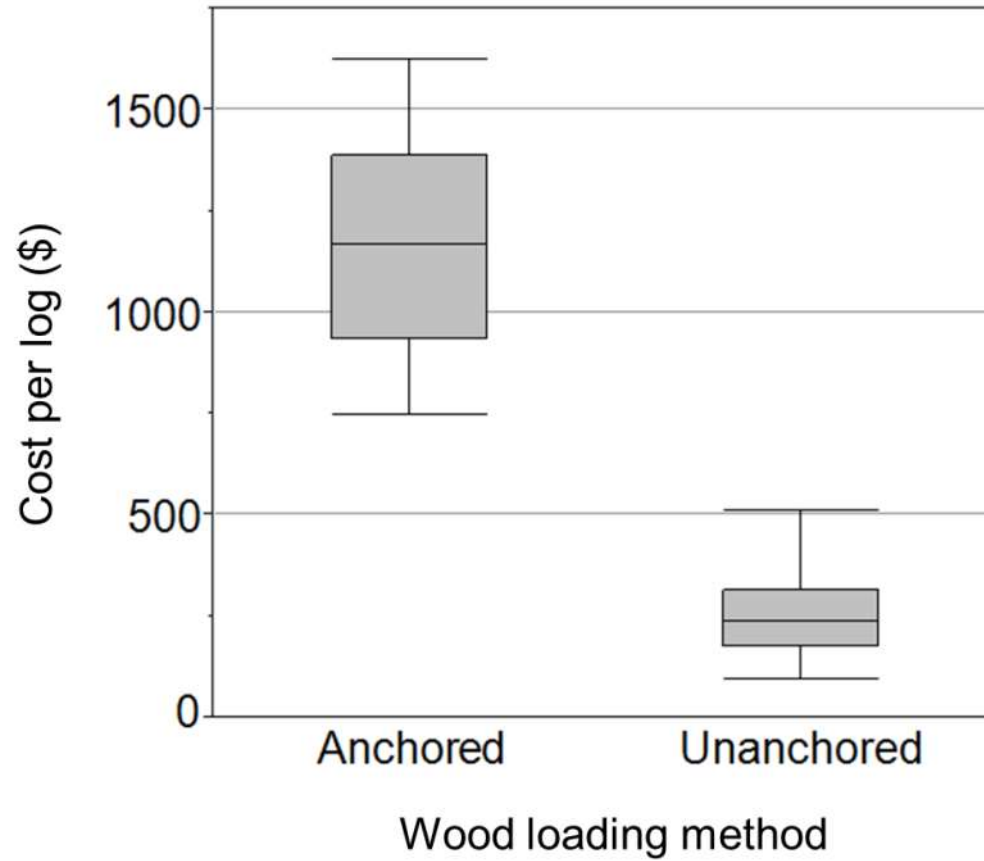
- 45 miles – 2007-2012
- ~2,000 trees or wood pieces
- Retention rates: mean=92% (SD=11%)
- Wood volume ↑: mean=95% (SD=80%)

# Results

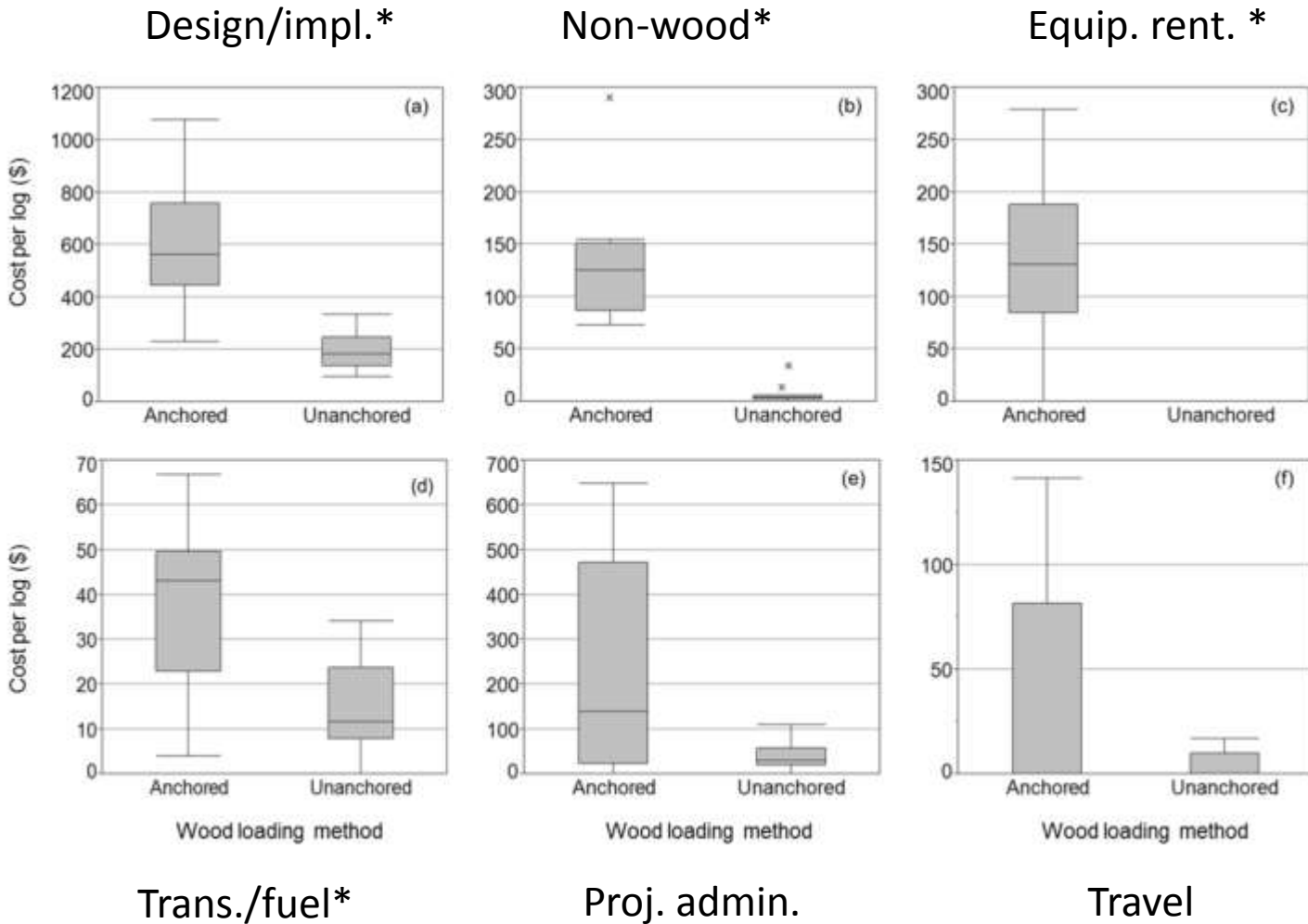
	Pool habitat	Wood $\leq$ 20ft	Wood $>$ 20ft	Pools $\leq$ 4ft	Pools $>$ 4ft	Shelter	LWD shelter	SWD shelter
<b>Median (IQR)</b>	<b>24 (19)</b>	<b>22 (59)</b>	<b>113 (262)</b>	<b>11 (67)</b>	<b>33 (69)</b>	<b>36 (55)</b>	<b>78 (230)</b>	<b>47 (569)</b>



# Results



# Results



# 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 (!)

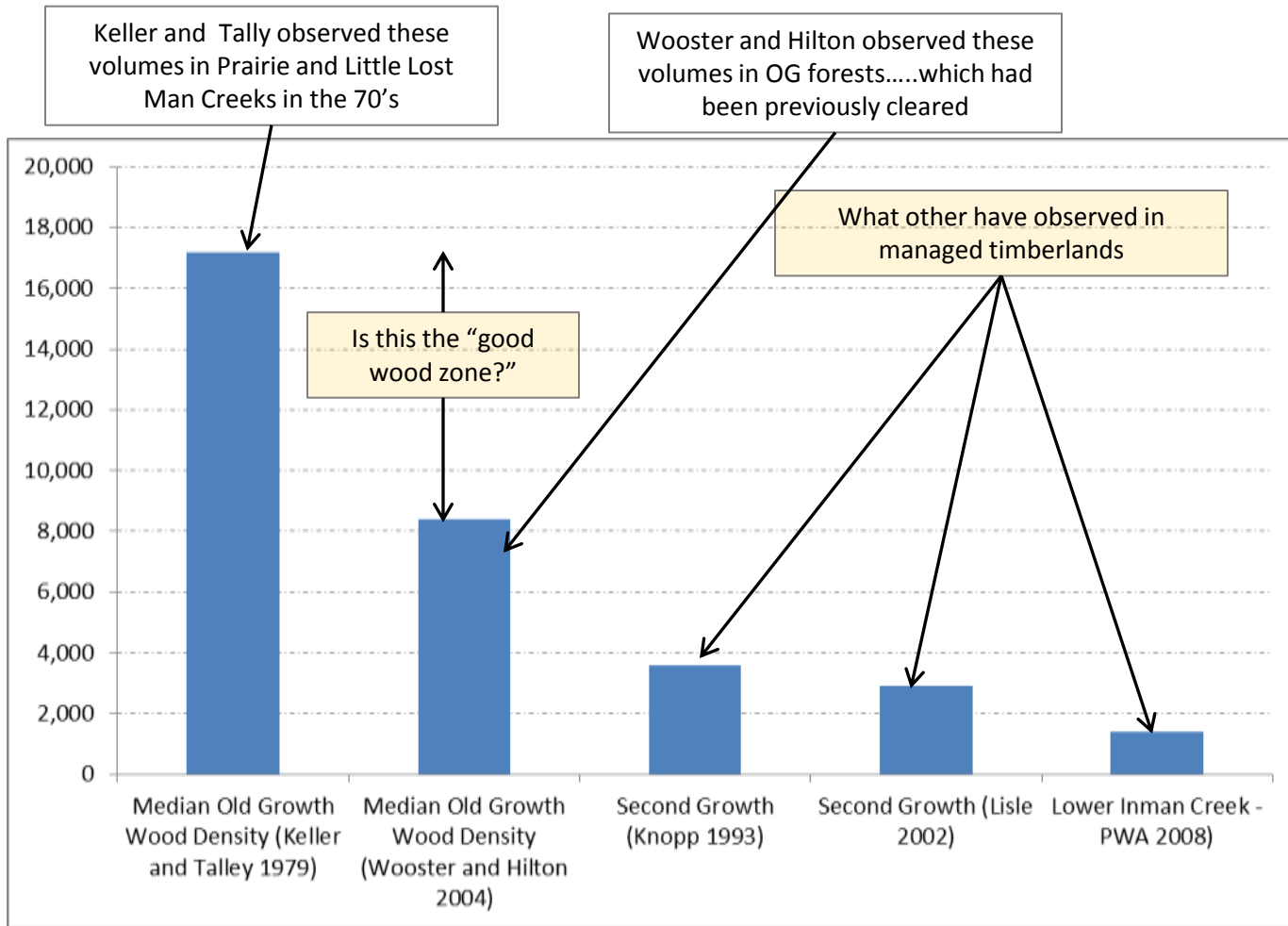
# Limitations/Considerations

- 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<sup>3</sup>/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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