Effects of Forest Management & Wood Utilization on Carbon Sequestration & Storage in California: Update on project status

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Background

- Establish baseline forest conditions and carbon stocks grounded in FIA data
- Estimate a baseline rate of forest disturbances (land use change, management, and natural disturbance)
- Identify treatable acres that would benefit from wildfire resilience treatments, considering forest type, owner and ecoregion (Needs Assessment)
    - Approx. 11 M acres in need of wildfire hazard reduction treatments (1/3 of all forests)
    - Treatable acres limited to 7.4 M acres
- Model forest carbon storage outcomes based on:
    - Business-as-usual (BAU) management + static climate (existing growth and natural disturbances)
    - BAU management + future climate (climate-adjusted growth, natural disturbances, post-fire regen failure)
    - Alternative forest management and wood utilization scenarios + future climate
    - Whole-sector approach: ecosystem + wood products + substitution + leakage + **economics**

Scenarios

Scenario	Acres/yr*
Business-as-usual (2000-2021 avg) – 235k ac/yr harvest/thinning; 45k ac/yr understory/pile burn	280,000
Landscape restoration - Post-fire salvage/reforestation of backlog by 2030 per reforestation strategy and future high severity fire areas w/in 3-5 yrs per Westerling/Davis data on future fire/regen failure	247,000**
Fire resilience tx including MOG - Mech up to 50% slope, HT, follow-up RX fire, and standalone RX fire per landscape resilience needs assessment	822,000 ***
Forest conservation - Reduced deforestation, i.e., no net loss per LUC from NLCD	13,000
Silvopasture - Low density native plantings in pasture per TNC reforestation hub data on opportunity	9,500
Extended (50 → 80 yrs) **or altered rotations** (extended on public, 50→40 on pvt due to fire hazard concerns) - Applied to BAU even-aged acres	115,000
Innovative wood products - Excess material from fire resilience tx to mass timber, transportation fuels or biochar	

*average during 10-year treatment pulse (represents peak)

2023 **forest accomplishments are 80,000 acres in the Interagency Treatment Tracker

***2023 **forest** accomplishments are 786,000 acres in the Interagency Treatment Tracker

Portfolios

Scenario Portfolios	**Acres/yr***
Ramp up = BAU + reforestation/resilience tx + innovative wood products trifecta	1.3 M
Max Natural Climate Solutions (Max NCS) = BAU + Ramp up + reduced deforestation + silvopasture + extended rotations (applied to some BAU acres) + innovative wood product trifecta	1.4 M

*average during 10-year treatment pulse (represents peak)

Key Findings

- Modeling climate impacts suggests ~50% forest area and carbon stocks losses due to high-severity wildfire and post-fire regen failure by 2070.
- Aligns w/ CARB study but projects greater losses.

Comparison of net forest/HWP carbon loss, 2014-2045, for this study and CARB Scoping Plan modeling			
Study	**CBAU**	**Preferred scenario**	**Treatment acres/year**
CARB	-7%	-8%	2.3 M ac/yr tx (includes shrub/grass)
This study	-25% (-50% start of model in 2022 to 2071)	-12% (-5% start of model in 2022-2071 – includes leakage, substitution)	1.4M ac/yr tx (Max NCS)

- Active management across a broad range of forest types improves resilience, reduces forest carbon and area losses.
- Forest resilience in future decades requires managing forests to a lower stand density at a landscape scale and conducting extensive post-fire salvage/reforestation activities.
- Wood utilization is necessary to increase forest sector sink strength associated with landscape-scale scenarios; C benefits improved, even when considering emissions/leakage.
- Max NCS + Innovative Wood Utilization portfolio is the only one that gives us a consistently better carbon trajectory than CBAU.

Key Findings – Economics
Sam Evans, FRAP Research Economist

- During 10-year treatment pulse, the resilience and post-fire restoration treatments require up to an **additional** $1.8 billion annually across all ownerships.
  - Pre-fire resilience expenditures are 52-55% of the total additional cost, remainder is post-fire restoration.
  - Costs include in-forest treatment, transportation, and in some cases stumpage payments to landowners.
  - These are high-level estimates at the state-level and do not account for regional or local market conditions.
- Total treatment costs are $2.3B and $2.5B for Max NCS and RU, respectively.

Key Findings – Economics

Sam Evans, FRAP Research Economist

- Depending on timber market conditions, wood product revenues could offset 31% to 94% of these costs.
  - Additional funding sources will still be necessary.
  - Revenues predominantly determined by sawlog value. Biomass revenue contributes very little offsetting the costs, even with optimistic price conditions.

Portfolio	Total pre-fire resilience treatment cost ($ million per year)	HWP revenue ($ million per year)	Fraction of pre-fire resilience treatment cost covered
Ramp Up	$1,008	$412 - $946	41% - 94%
Max NCS	$896	$385 - $884	31% - 70%

Key Findings – Economics
Sam Evans, FRAP Research Economist

- Processing capacity for industrial roundwood and utilized biomass needs to expand significantly to accommodate higher modeled harvest volumes during treatment pulse.
- Number of sawmills need to **nearly double.**
- Biomass facilities need to **more than double.**
- Large regional differences in capacity needs - report estimates capacity increases needed across various wood baskets in California.
- Additional research needed on the exact type of material coming off the landscape (species composition, log size, etc).
    - FVS/Biosum project (FHRP grant) is meant to answer these questions.

Project status update

- Executive briefings provided to CAL FIRE, CNRA/Task Force, USFS last summer/fall
- Report release February 2025
  - Detailed methodology including resilience treatment needs assessment
  - Results by individual and portfolio scenarios, ownership, ecoregion
  - Economic analysis
- Peer-reviewed publication(s) to follow