Post-fire Redwood Defect and Merchantability Study

in the Santa Cruz Mountains

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In August 2020, the CZU Lightning Complex Fire burned nearly 87,000 acres in Santa Cruz and San Mateo Counties, including extensive redwood timberland. The resilience of redwood to different fire severities and the lasting implications of the introduced defect on wood quality is not well understood. Additional studies with documented results of various post-fire effects on redwood trees and corresponding internal defect for trees burned at various severities would be helpful to inform management decisions. One such monitoring effort is proposed at San Vicente Redwoods in two thinning projects that are part of the Big Jim THP. In summer 2022, approximately 350 acres of moderate to high burn severity will be thinned from below as a redwood restoration project called "Deadman II". Approximately 4,000 redwood trees are marked for cutting in summer 2022. A subset of these trees could be identified, tagged, and assessed for burn damage. Following cutting they could cut as necessary and graded on-site to develop a correlation between external post-fire effects and internal wood quality decay and merchantability.

A pilot study conducted by Hamey Woods in the "Deadman II" project footprint in April, 2022 (attached) illuminated the internal decay that is present in trees with burn damage such as burned off limbs and dead tops. Some burned trees have developed patches of a white growth on the bark that seems to be the fruiting body of a fungus associated with advanced rot in the sap wood. The bark discoloration appears where there is severe cambium damage and adequate moisture to support the fungus. Very dry, sometimes checked wood is also present throughout certain burned trees when there are multiple quadrants of cambium burned, especially in the quadrants directly above the cambium damage.

While the rot detected in the pilot fall & buck study is mostly in the sapwood, foresters assume that rot beyond a certain damage threshold will advance inward through the tree, causing a large, entombed heart rot for the remainder of the tree's life.

The post-fire effects that may generally be helpful predicting future defect are listed below. An objective of this proposed study is to identify thresholds and combinations of visual indicators of post-fire effects that that are anticipated to yield significant decay and decrease future merchantability in redwood trees. Resources needed to accomplish a study in "Deadman II" would include:

- Measuring post-fire effects in a subset of marked redwoods trees.
- Bucking cut redwood trees at various lengths and grading the logs to determine the percent defect.
- To inform a longer-term study, post-fire effects could be gathered for additional redwood trees and a sub-set of those trees cut in future years to track the evolution of internal decay as correlated to post-fire effects.

Another future thinning project at San Vicente Redwoods that could add data on post-fire effects of low to moderate burn severities and the associated level of internal defect is the 327-acre "Lower Working Forest" Harvest Unit to be thinned in summer 2023. Redwood trees marked for removal will be harvested

and merchantable wood will be sold to Big Creek Lumber Company. These trees exhibit less severe fire damage than the "Deadman II" trees and together the data collected from both study sites will cross the spectrum of burn damage in the fire footprint.

Resources and support needed for a study in the "Lower Working Forest" include:

- Measuring post-fire effects in a sub-set of marked redwoods trees and tagging trees for tracking.
- Tagging individual logs for tracking through the grading process.
- Support from Big Creek Lumber Company tracking individual logs and providing the log scaling information for individually tracked redwood logs to determine the percent defect (or separate grading in the field).
- Analyzing the post-fire effects categories and corresponding grading/scaling summaries to present information on redwood defect and merchantability implications from low-high burn severities.

A draft budget is attached.

Additional research opportunities are present at Swanton Pacific Ranch where Continuous Forest Inventory plots are being re-established post fire and additional funding support could help gather post-fire effects data in advance of thinning treatments planned for 2023. Other landowners impacted by the CZU fire may wish to participate and collect post-fire effects data pre-harvest and track redwood defect post-harvest. Partnering with a sawmill or individuals with the ability to scale logs is a critical component or the study.

With sections of intact cambium, redwood trees can heal over damage caused by fire, sprout new branches and continue to grow. Predicted mortality has been explored previously in the papers *Mortality Assessment of Redwood and Mixed Conifer Forest Types in Santa Cruz County Following Wildfire* (Auten 2012), and *Post-Fire Mortality and Response in a Redwood/Douglas-fir Forest, Santa Cruz Mountains, California* (Andrews 2012). This study aims to increase the understanding of decay in redwoods as a result of varying degrees of burn damage. We will attempt to determine the correlation, if any, to cambium death and bole decay from high severity fire indicators on live redwood, such as fungus growing on the bark.

Previous fires in the burn footprint that still impact redwood defect include the 1948 Pine Mountain Fire and the 2009 Lockheed Fire. Defect introduced as a result of the 1948 Fire translated into an entombed rotten core in some trees, visible as a seam in the bole of the tree and exposed when the tree was cut approximately 60 years later, as shown below.

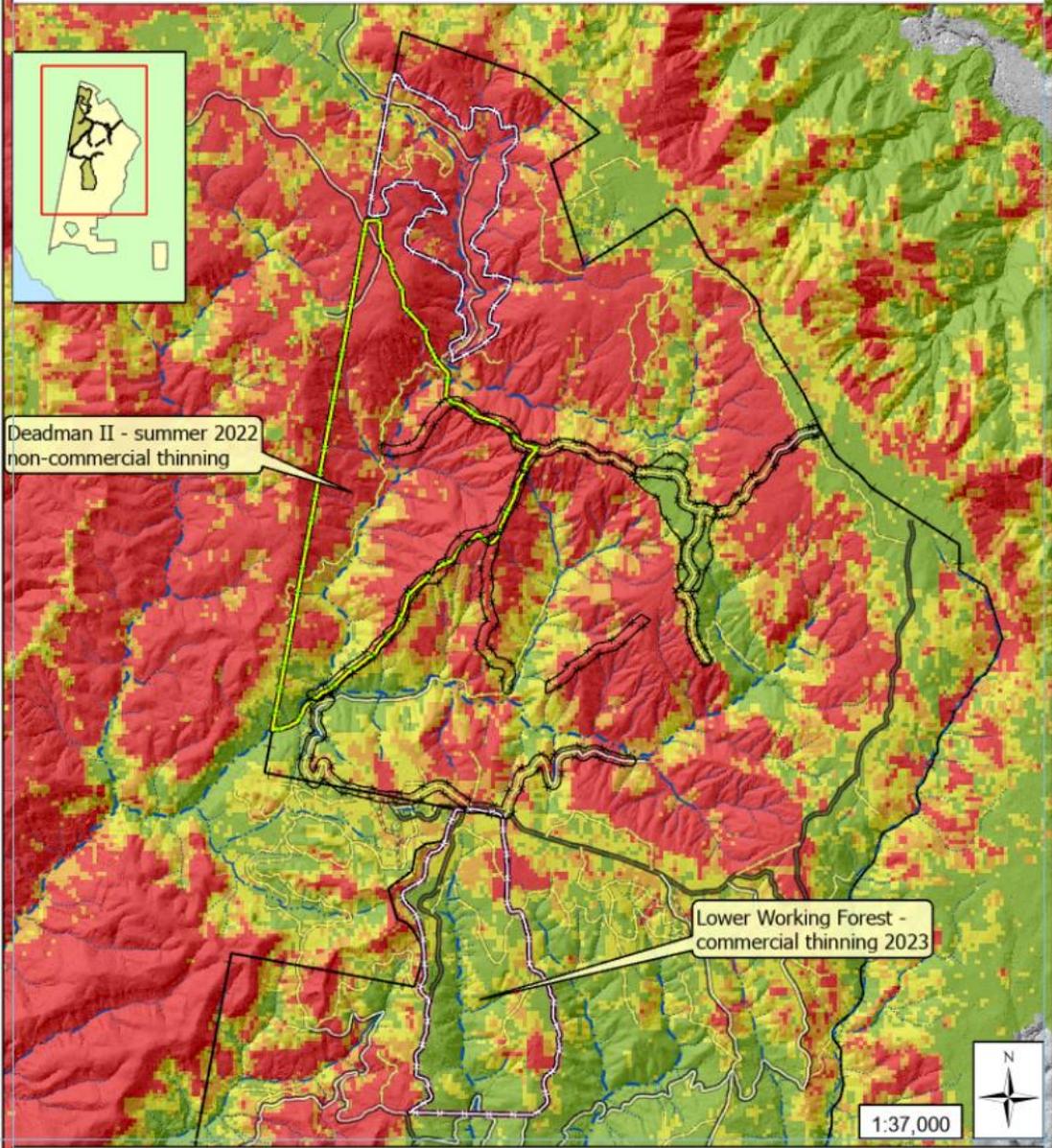Pre-Treatment Data Collection on Post-Fire Effects Includes:

- % crown scorch
- % crown torch
- % live canopy remaining
- Scorch height (ft)
- Torch height (ft)
- Max bole char (ft)
- Total height (ft)
- Sprouting on branches and/or bole
- % Sprouting on branches and bole based on the estimated percentage of canopy that existed pre-fire
- # of sq. ft of sprouts at base: Estimate # of sq. ft of sprouts (1 = 1 sq. ft of sprouts)
- Proportion of cambium burned
- Area of fungus on the bark

Projected Draft Budget for Post-Fire Defect Study on Approximately 200 Redwood Trees

Year 1	Duties	Hours	$/hr Rate	Total Cost
Forester	Pre-and post-treatment Data collection & Data processing	40	125	5000
Field technician	Pre-and post-treatment Data collection & Data processing	100	90	9000
Tree Faller	Fall and Buck	40	200	8000
Log Grader	Inspect defect and grade redwood	40	200	8000
		Total Cost		~$ 30,000
Year 2+?				
Forester	Post-treatment Data collection, Data processing & Report Summary	40	125	5000
Field technician	Post-treatment Data collection, Data processing & Report Summary	40	90	3600
Tree Faller	Fall and Buck	40	200	8000
Log Grader	Inspect defect and grade redwood	40	200	8000
		Total Cost		~$ 24,600

San Vicente Redwoods - 2020 CZU Lightning Complex Fire
Redwood Defect and Merchantability Study
Santa Cruz County, San Vicente Rancho, T9S & T10S, R3W MDBM, Davenport 7.5' Quad

Deadman II - summer 2022
non-commercial thinning

Lower Working Forest -
commercial thinning 2023

1:37,000

N

Fire Severity
- Low
- Low-Medium
- Medium-High
- High

Working Forest
- Working Forest
- Fuelbreak
- Restoration Reserve
- San Vicente Redwoods

Road System
- Arterial
- Principal
- Secondary
- Jeep
- Legacy

Watercourses
- Class I
- Class II
- Class III