



Forest Health Protection

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Special Project Report

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To: District Ranger, Almanor Ranger District, Lassen National Forest

Subject: Storrie Fire – Survivability of Fire-Injured Trees (NE-SPR-05-03)

Thank you for allowing Forest Health Protection (FHP) to implement and continue monitoring fire-injured trees in the 2000 Storrie Fire. We greatly appreciated the cooperation of District personnel in setting up the study. Our current District contact for the project is Robin Bryant. Enclosed please find a copy of the original study plan, a map of the tree locations and a summary of data collected from 2001 to 2004.

As part of this project, 200 trees are being monitored through 2006 or longer if funds are available. Individual study trees have a numbered metal tag at the base that corresponds with an orange painted number at breast height (please note that some of the orange paint may have faded to white). Please continue to notify us if there is a need to remove study trees that have died. Verification of full crown fade and the tree number are required prior to tree removal.

One item of interest on the Storrie Fire is the number of white fir and red fir that are still green despite suffering extensive cambial injury during the fire. Many of these green crowned trees have developed extensive stem decay and a few have failed. Based on observations from the 1999 Bucks Fire, Plumas National Forest, where many green-crowned true fir (similar to trees on the Storrie Fire) failed in 2004, an increase in the number of failing, green-crowned, red and white fir may be expected for 2005. Please refer to the following web address for more information regarding these potentially hazardous trees.

(http://www.fs.fed.us/r5/spf/publications/Hazard_Tree_Alert.pdf)

Data for all FHP fire-injured tree survivability studies are currently being analyzed. A presentation at the National Silvicultural Workshop (June 2005, Lake Tahoe) is planned followed by a publication in the conference proceedings. Please contact us if you have any questions or concerns.

/s/ Danny Cluck

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/s/ Sheri Smith

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Summary of data for the 2000 Storrie Fire

Table 1. Total number of trees and mortality by year.

Species	# of trees evaluated in 2001 (all live)	2002 Mortality	2003 Mortality	2004 Mortality	Total Mortality
Red fir	99	20	10	1	31
White fir	101	17	9	8	35
TOTAL	200	37	19	9	66

Table 2. Number of trees and % survival by percent remaining live crown.

Live Crown (%)	# of red fir	% survival	# of white fir	% survival
1-20%	5	0%	16	13%
21-34%	14	36%	12	33%
35-49%	29	62%	18	72%
50-65%	12	67%	11	100%
>=70%	39	82%	44	86%

Table 3. Number of trees and % survival by cambium scorch rating.

Cambium Scorch Rating	Red Fir	% survival	White Fir	% survival
0	7	71%	8	88%
1	21	86%	29	76%
2	24	75%	28	61%
3	29	59%	22	77%
4	16	31%	14	36%

- Rating of 0-4 is based on a cambium sample taken in each of four equally spaced directions near ground level. A rating of 0 is equal to no fire damage for any sample and 4 is dead cambium at each sample location.

Table 4. Number of trees and % survival by diameter breast height.

DBH (inches)	Red Fir	% survival	White Fir	% survival
10-20	71	66%	75	68%
20-30	18	56%	23	65%
30+	8	75%	3	66%

Table 5. Number and size of trees with Ambrosia beetle boring dust on $\geq 1/3$ bole circumference

Species	DBH Range (inches)	# with boring dust on $\geq 1/3$ of bole	% survival
Red fir	15.9 – 35.3	26	52%
White fir	15.2 – 33.4	22	50%

- No trees under 15" dbh had boring dust on more than 25 % of bole circumference regardless of assessed cambium injury.

ADMINISTRATIVE STUDY PLAN
SURVIVABILITY OF FIRE-INJURED TREES
STORRIE FIRE

ALMANOR RANGER DISTRICT, LASSEN NATIONAL FOREST

Background and Need

Most large fires in California over the last decade have occurred in the pine type. These fires have allowed FHP to monitor the survivability of fire-injured ponderosa and Jeffrey pine providing valuable documentation regarding survival criteria for these species (Barkley, Crystal; and Divide fire monitoring projects). Survival criteria are typically applied on a per tree basis, so they need to incorporate variables that are easy to interpret, quick to apply, and provide a relatively high degree of accuracy. Due to the infrequency of fires in other forest types, such as the mixed conifer and true fir types, we are currently lacking monitoring studies and survivability data for other conifer species such as white and red fir. The Storrie fire, which occurred during the 2000 fire season, provided an opportunity to obtain documentation to improve upon and/or modify the current survivability criteria for true fir. A concurrent study, monitoring true fir and sugar pine, was also initiated in 2001 within the Bucks fire on the Plumas National Forest.

Post-fire Survivability

Historically, fire-salvage marking guidelines used throughout California were based on a 1961 paper by Willis Wagener (1961) with some modification by Weatherspoon (1987) and Cluck and Smith (2001). The three criteria that are most important for evaluating fire-damaged trees are 1) remaining green foliage, 2) remaining % of live crown and 3) amount of cambium damage. Damage to roots is also an important factor in determining survivability however it is difficult to paper by Willis Wagener (1961) with some modification by Weatherspoon (1987) and Cluck and Smith (2001). The three criteria that are most important for evaluating fire-damaged trees are 1) remaining green foliage, 2) remaining % of live crown and 3) amount of cambium damage. Damage to roots is also an important factor in determining survivability however it is difficult to assess for long-term monitoring studies.

Wagener (1961) indicates that with true firs, foliage scorch can occur on up to 65% of the crown before survival is compromised assuming cambium damage is not severe and that twigs and buds survive within at least 45 % of the pre-fire live crown. His survival criteria for cambium damage is < 25% of the bole circumference on individual trees for both red fir and white fir. Weatherspoon (1987) suggests that conifers can survive up to 40% cambium damage when crown scorch is light or absent.

Monitoring Plan

A total of 200 trees (100 WF, 100 RF) were selected to incorporate a wide range of fire related injuries. The selected trees were numbered using orange paint at breast height and a metal numbered tag near ground level. A stem map was created to illustrate tree locations within the study area. The selected trees will be protected for the duration of this study from management activities that could influence the results. Trees that die during the study will be monitored for snag longevity and will require additional protection. Initially each tree was photographed to document initial condition. Subsequent photos will be taken as necessary to document changes.

Objective: To evaluate, document and monitor the survivability of conifers that sustained fire injuries during the 2000 Storrie fire.

Specific Goals:

1. To obtain information to modify or enhance existing fire-salvage marking guidelines
2. To improve the efficiency and accuracy of applying individual tree marking guidelines.

Time frame: The study was implemented during the summer of 2001 and will continue for a minimum of four years or longer as necessary and appropriate. Individual trees will be monitored annually.

Procedure: The following data were collected for each tree:

- a) Species
- b) DBH
- c) Tree height
- d) Percent live crown (percentage of pre-fire crown remaining)
- e) Live crown (post-fire live crown ratio)
- f) Insect or pathogen activity, including an estimate of percent bole circumference with frass or boring dust
- e) Cambium injury - Determined by four equally spaced cambium samples taken near ground level (recorded as live or dead) resulting in a 0-4 dead cambium rating for each tree (samples taken with a gas powered drill fitted with a 1" hole saw bit)

The following data will be collected for each study tree that dies:

- a) Actual post-fire cambium damage recorded as a percent of the circumference of the bole (determined by basal bark removal)
- b) Insect attack and disease infection
- c) How long the tree stands as a snag

Data Steward: FHP will initiate data management and be responsible for data collection. District personnel are encouraged to become involved as much as they desire.

Reports: FHP will write annual monitoring reports and distribute as appropriate.

Literature Cited

Cluck, D.R. and S.L. Smith. 2001. Crystal fire marking guidelines for fire injured trees- Administrative Study Monitoring Report. Report NE01 – 8. USDA Forest Service, Pacific Southwest Region, San Francisco, CA. 8p.

Weatherspoon, C. P. 1988. Evaluating fire damage to trees. In: Proceedings of the 9th Annual Forest Vegetation Management Conference, November 4-5, 1987, Redding, CA. p. 106-110.

Wagener, W. W. 1961. Guidelines for estimating the survival of fire-damaged trees in California. USDA-FS, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. Misc. Paper No. 60, 11 p.

Location

Storrie Fire, Almanor Ranger District, Lassen National Forest



