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Evaluating the Success of Fuels Treatments On Initial Attack Fires

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INTRODUCTION

The Washington Office of the Forest Service in response to some of the recommendations of the General Accountability Office (GAO) report, *"Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuels Reduction Funds and selecting Projects"* (GAO-07-1168) requested Adaptive Management Services to develop standards for evaluating the effective of hazardous fuels treatment on small fires (< 500 acres). The report from GAO recommends, *"Devote resources to developing a measure of, and subsequently collecting data on, fuel reduction effectiveness…".*

Measuring the success of hazardous fuels treatments in relation to the values protected; whether it is improvements associated with the wildland urban interface or resource values such as habitat, timber or watershed, has always been difficult to quantify. The determination of a successful project is often subject to the interpretation of the individuals assigned to make the determination.

Measuring success can even be more problematic when evaluating small initial attack fires (500 acres or less), as significant resource damage is often not associated with these fires. However, the lack of damage to either improvements or resources may indeed be a function of the fuels treatment with which the fire interacted.

This paper proposes a protocol for evaluating the "*success"* of fuels treatments on smaller initial attack fires. The ability to capture these successes is critical for upward reporting on the progress the agency is making to manage hazardous fuel conditions. Quantifying fuels treatment successes both from the viewpoint of resources protected and monies saved on long-term suppression actions may be critical to justify the continuation of significant hazardous fuels treatment funding. While it is easy to track the current upward trend in fire suppression costs, the agency does not have established methodologies to document cases where suppression costs were reduced due to investing in fuels treatment projects. Without completed fuels treatment projects in place to serve as buffers to values at risk or to modify fire behavior, it is probable that WFSU spending could have exceeded even the 2007 one-billion dollar level.

CAPTURING DATA

One problem associated with quantifying the success of the national fuels treatment program is the lack of a formalized method for collecting data to determine when wildfire suppression has been positively affected by a fuels treatment. Many studies have focused on fuels treatment effectiveness on large fires which received national attention due to high suppression costs or the destruction of personal property. The Angora Fire on the Lake Tahoe Basin Management Unit and the Zaca Fire on the Los Padres National Forest are two primary examples. However capturing data on all fires which interact with fuels treatments currently does not occur.

The system for fire reporting, FSH 5100.29, serves as the national archive of data for all wildland fires for the Forest Service, yet this reporting information does not identify when a fire burns in or adjacent to a hazardous fuels treatment area and if this treatment had an effect on the overall success of the fire suppression effort.

A modification to FSH 5100.29 would allow this data to be captured, archived and used as a reporting tool regarding the level of success of the fuels treatment program. Recommended new reporting fields on the Fire Report would include:

- Did the fire burn in or immediately adjacent to a hazardous fuels treatment?
- Did this treatment improve suppression efficiency?

This data could then be used to identify the total number of fires nationally that are affected by fuels treatments and to quantify the number of fires where a treatment had a positive influence on the outcome of the suppression action.

To provide more information concerning the effectiveness of a treatment, additional data should be collected. This additional data would involve sampling 10% of the fires by region which were identified in the 5100-29 as having been positively effected by a fuels treatment. This sampling, which includes both a quantitative fire severity rating and a qualitative evaluation of the effectiveness of the treatment, will provide a baseline for determining success under a variety of fuel and weather scenarios. The methodology for this data collection is provided as Appendix A.

SAMPLE EVALUATIONS

Two fires in different regions which were contained in the initial attack phase of suppression are presented as models for this proposed reporting system. The completed evaluations are found in Appendices B and C.

Stonington Fire – Hiawatha National Forest, Region 9.

This arson fire started on the afternoon of August 4, 2007, just outside of Rapid River Michigan, on the Hiawatha National Forest. The fire location is shown on Figure 1.

In 1988 the Stockyard fire burned within 2 miles of the Stonington fire in continuous Jack pine stands. The Stockyard Fire consumed a total of 1,100 acres, causing the closure of US Highway 2, the major travel route through the Upper Peninsula of Michigan. This fire led to the implementation of a fuels treatment effort to convert Jack Pine stands to natural grass/oak savannas. The conversion areas now represent a total of 28% of the Stonington peninsula, with the treatments focused on isolating the Wildland Urban Interface (WUI) clustered along the shore of Lake Michigan from the volatile Jack Pine fuels

Figure 1. Stonington Fire, Hiawatha National Forest

At the time of the Stonington Fire, the Upper Penninsula of Michigan was experiencing near-record drought and fire danger. The fire originated in a mature Jack pine stand with significant mortality (Jack pine budworm) and rapidly developed into a high intensity, stand replacing fire. Reported flame lengths in the Jack pine stand were 30' with crowns fully involved. Fire severity in the Jack pine stand is shown in Figure 2.

As the fire moved northwest, it crossed an unimproved dirt road, entering the western limits of a Jack pine type conversion fuels treatment area. The type conversion had been created through a series of biomass removal cuts and subsequent prescribed burns.

Figure 2. Fire Severity in Untreated Jack Pine Stand

As the fire spread through the fuels treatment areas, composed of grasses and regenerated eastern red oak, continuous flame lengths dropped to 6' and fire brand production and the number of spot fires were significantly deceased. Fire severity in the treatment area is shown in Figure 3.

As the fire continued to spread in the treated fuels towards County Road 513 and the interface area to the west, the fire held along an unimproved dirt road without suppression action and also held along County Road 513, where suppression actions were being carried out by two type 6 engines and a Bell 206 helicopter. Two spot fires occurred on the west side of Road 513. These spots originated in a residual stand of red pine located just east of the county road. The spots were rapidly contained by the engines assigned to the road.

The final fire size was 83 acres. A series of dozer lines and roads were used reach final containment on the incident.

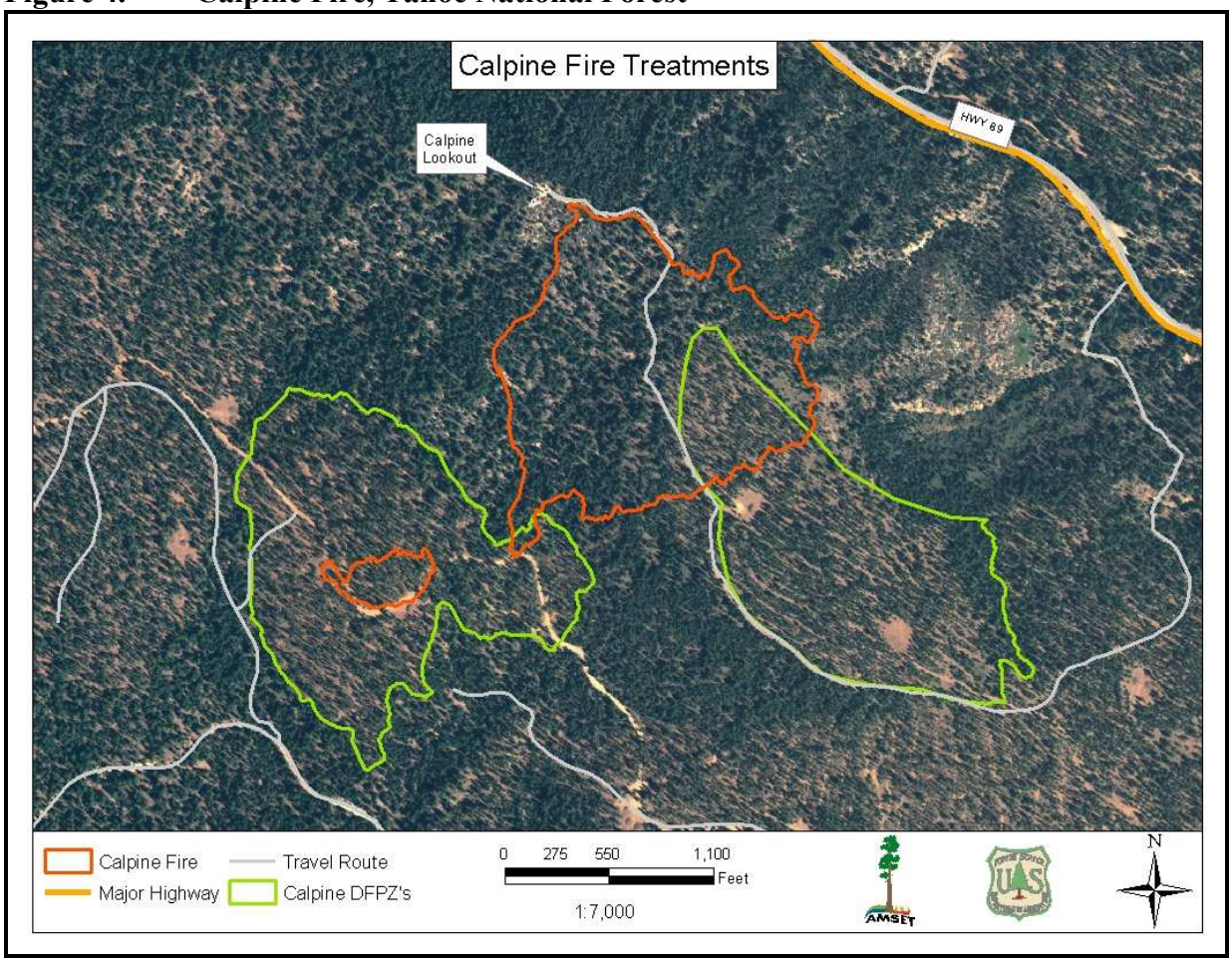
Figure 3. Protected Interface Adjacent to the Oak Savannah Type Conversion. Burned area in foreground.

Calpine Fire – Tahoe National Forest, Region 5

The Calpine Fire on the Sierraville District of the Tahoe National Forest (Figure 4), began on June 23, 2007 as a result of a holdover from pile burning operations the previous winter. The fire was nearly contained at two acres in a roadside Defensible Fuels Profile Zone (DFPZ), before spotting approximately 1/8 mile into an adjacent portion of the DFPZ. Two firefighters attempted to pick-up the spot fire with hand tools but were unable to control it due to lack of available engine support. Based on field observations, the treated fuels are best characterized as standard Fuel Model 9 while untreated fuels best resemble Burgan/Scott, Timber Litter 5, high load conifer litter.

After escaping the containment efforts of the two firefighters, the spot fire spread uphill through the lighter fuels of the DFPZ before becoming involved in the untreated areas upslope, where, in full alignment with the slope and wind, the fire began group torching and short crown runs toward the road leading to Calpine lookout and a second DFPZ

Figure 4. Calpine Fire, Tahoe National Forest



The fire burned into the second DFPZ with significant intensity, as shown in Figure 5. While torching and heavy scorch were observed in the treatment area, crown fire activity was eliminated, resulting in a moderately intense surface fire, as shown in Figure 6. Pushed by the prevailing winds, the fire burned through the second DFPZ and spread over a ridgetop into untreated fuels, where once out of alignment with the slope and wind, suppression actions proved successful in the untreated fuels.

The DPFZs provided several opportunities for firefighters. Reports from initial attack ground crews stated that the original fire had been contained within the DFPZ until the spot fire was discovered. The spot fire could had been easily contained in the treated area had engine support been available at that time. The two firefighters were not able to check the uphill spread of the spot fire given the strong upslope winds affecting the fire area.

The DFPZ also provided usable anchor points from both the upper and lower roads, significantly increasing fireline production rates for ground resources and enhancing the effectiveness of aerial resources when compared against the adjacent untreated fuels.

Figure 5. Fire Severity in Interior Untreated Fuels, Calpine Fire

The slop-over at the ridgetop was reduced in size due to the effects of the DFPZ in reducing fire intensity. Had the fire hit the ridge as an active crown fire, it is expected that the slop-over would had been of greater size, potentially requiring suppression forces to utilize Highway 89 as a control feature. Had the highway been utilized as a strategic control feature, the fire would have increased 5-fold in size and would have lead to a Type 2 Incident Management Team being ordered.

With a final fire size of 40 acres, the District was able to manage the incident in a Type III configuration, eliminating the cost of team mobilization and reducing the duration of the overall incident. The ability to manage the fire at the local level and reduce the duration of the incident led to significantly lower overall suppression costs.

Figure 6. Upper DFPZ Fire Severity, Calpine Fire

DEFINING SUCCESS

Evaluating the success of fuels treatments on initial attack fires can take a variety of forms. Subjective qualities such as increased fireline production rates, anchor points, increased efficiency of aircraft and improved firefighter safety can all be used to qualitatively identify success. There are also physical features which can be measured to indicate success. These features include reduced fire severity, lower scorch height, less crown consumption, less exposed soil, and less consumption of larger downed-woody material. These last features relate best to the concept of resource protection, while qualitative measurements may be most appropriate for describing firefighter efficiency and areas protected.

The suggested approach for measuring success of fuels treatments against smaller fires should be a combination of both of these methods. The National Park Service's Burn Severity Coding Matrix has been modified to produce a system for rating the quantitative elements of the fuels treatment effectiveness. This proposed protocol allows for a rapid assessment of burn severity between treated and untreated areas in all fuel types (forests, shrublands, and grasslands). A reduction in the severity in treated areas versus untreated areas can be used to validate the relative success of the fuels treatment. The greater the deviation between the

scores of the untreated and treated burn areas, the greater the level of *"success"* that could be claimed from the treatment.

A checklist has been developed to capture qualitative data concerning the fire suppression activties and the associated fuels treatment. These tools are included as Appendix A.

The key to both the checklist and the Burn Severity Matrix is the rapidity with which an evaluation can be completed. Minimizing time requirements and the depth of analysis required will increase the probability that local units will accomplish this work. Conversations with personnel from three forests indicate that requiring the establishment of monitoring plots and multiple site visits will reduce the level of compliance for data gathering.

Examples of the use of the reporting process for the Stonington and Calpine fires are included as Appendices B and C.

RECOMMENDATIONS

1. Establish a system through FSH 5100.29 that will capture information concerning the influences of fuels treatments on a fire. Reporting is the first step of documenting the influence of fuel treatments on the fire suppression work load.
2. Require a rapid evaluation of both qualitative and quantitative aspects of a fuels treatment effect on both resources and suppression operations. A sampling of 10% of all fires by region will provide an overview of the impacts of fuels treatments on fire suppression without overburdening local units.
3. Adopt the proposed standardized method to evaluate the effectiveness of fuels treatments on initial attack fires (500 acres or less) in order to eliminate bias that currently exists with anecdotal reporting. These protocols could be applied to large fires should a detailed examination of the incident not be appropriate.
4. Provide a standardized data recording method to support upward reporting of the success of the hazardous fuels treatment program within the agency.

Appendix A

Reporting Worksheets and Guidance

Fuels Treatment Evaluation Checklist

Fire Name: _____
Fire Number: _____
Fire Date: _____

Treatment

1. Did the fire burn in, or immediately adjacent to a hazardous fuels treatment area? ☐ Yes ☐ No

2. Age of the treatment: ☐ 0-1 Year ☐ 1-5 Years ☐ 5 -10 years ☐ more than 10 years

3. The type of treatment that effected this fire (check all that apply):
   - ☐ Pre-commercial thinning
   - ☐ Commercial thinning
   - ☐ Commercial harvest
   - ☐ Biomass removal
   - ☐ Mastication without follow-up treatment
   - ☐ Mastication with follow-up treatment
   - ☐ Fuelbreak
   - ☐ Defensible Fuel Profile Zone
   - ☐ Disking
   - ☐ Understory burning
   - ☐ Prescribed fire
   - ☐ Hand piling

Suppression

4. The treatment (check all that apply):
   - ☐ Provided an anchor point for suppression
   - ☐ Increased fireline production rates
   - ☐ Reduced surface fire intensity
   - ☐ Slowed rates of spread
   - ☐ Served a part of the final control line
   - ☐ Allowed for firing operations
   - ☐ Reduced spotting or firebrand production
   - ☐ Improved ingress or egress into the fire area

5. The treatment improved the effectiveness of air operations: (check all that apply):
   - ☐ Fixed wing
   - ☐ Rotor wing
   - ☐ Improved canopy penetration
   - ☐ Reduced required coverage levels

6. The treatment protected private property or government improvements:
   ☐ Yes ☐ No

7. If yes to #6, how many structures:
   ☐ Less than 5 ☐ 5 to 25 ☐ 26 to 100 ☐ more than 100

Safety

8. The treatment area allowed for direct attack on the fire:
   ☐ Yes ☐ No

9. The treatment served as either an escape route or safety zone:
   ☐ Yes ☐ No

10. The treatment provided protection to public improvements (check all that apply):
    - ☐ Roads
    - ☐ Schools
    - ☐ Structures
    - ☐ Powerlines
    - ☐ Other utility infrastructure
    - ☐ Other

Incident Management

11. The effects of the fuels treatment reduced the final fire size:
    ☐ Yes ☐ No

12. Incident management level of this fire:
    ☐ Type 4 ☐ Type 3 ☐ Type 2 ☐ Type 1

13. Expected incident management level of the fire had the treatment not been in place:
    ☐ Type 4 ☐ Type 3 ☐ Type 2 ☐ Type 1

14. The effects of the treatment on the fire reduced the duration of the incident:
    ☐ Yes ☐ No

15. The expenditure of WFSU funds decreased as a direct result of the treatment:
    ☐ Yes ☐ No

COMPLETE THE *BURN SEVERITY MATRIX* FOR TREATED AND UNTREATED BURN AREAS OF THE FIRE.

Sample Size: The sample is not intended to be statistically significant.

For fires over 5 acres complete 10 transects of 45 meters for both treated and untreated burn areas. For fires less than 5 acres, complete 5 transects of 45 meters for both treated and untreated burn areas.

Brush and Grassland Plot Burn Severity Data Sheet

Plot ID: _____ Date: _____

Fire Name: _____ Recorder(s): _____

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Observations are from a 1 meter square area along the 45 meter transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions

Shrubland and Grassland Plot Burn Severity Detailed Descriptions

	Shrublands		Grasslands	
	Substrate	Vegetation	Substrate	Vegetation
Unburned (5)	not burned	not burned	not burned	not burned
Scorched (4)	Litter partially blackened, duff nearly unchanged; wood/leaf structure unchanged	Foliage scorched and attached to supporting twigs	Litter partially blackened, duff nearly unchanged leaf structure unchanged	Foliage scorched
Lightly Burned (3)	Litter charred top partially consumed, some leaf structure undamaged; surface is predominately black; some gray ash may be present immediately post burn; charring may extend slightly into the soil surface where litter is sparse, otherwise soil is not altered	Foliage and smaller twigs partially to completely consumed; branches mostly intact; less than 60% of the shrub canopy is commonly consumed	Litter is charred to partially consumed, but some plant parts are still discernable; charring may extend slightly into the soil surface, but soil is not visibly altered. Surface appears black (this soon become inconspicuous); burn may be spotty to uniform based on the continuity of the grass	Grasses with approximately two inches of stubble; foliage and smaller twigs of associated species partially to completely consumed; some plant parts may still be standing; bases of plants are not deeply burned and are still recognizable
Moderately Burned (2)	Leaf litter consumed leaving course, light colored ash, duff deeply charred, but underlying mineral soil is not visibly altered, woody debris is mostly consumed; logs are deeply charred, burned-out stump holes are common	Foliage twigs and small stems consumed; some branches (>.25 to .50 in) still present; 40 to 80% of the canopy is commonly consumed	Leaf litter consumed, leaving coarse, light gray ash immediately after the burn; ash soon disappears leaving bare mineral soil; charring may extend slightly into the soil surface	Unburned grass stubble usually less than 2 inches tall; for other species, foliage completely consumed, plant bases are burned to ground level and obscured in ash immediately after burning; burns tend to be uniform
Heavily Burned (1)	Leaf letter completely consumed, leaving a fluffy white ash; all organic material is consumed in mineral soil to a depth of 0.5 to 1.0 inches, this is underlain by a layer of black organic material; structure of the surface mineral soil may be altered	All plan parts are consumed leaving only stubs greater than 0.5 inches in diameter	Leaf letter completely consumed, leaving a fluffy white ash; this soon disappears leaving bare mineral soil; charring extends up to 0.5 inches into the soil. This condition is usually limited to heavy fuel loads on mesic sites, burned under dry conditions with low wind speeds	No unburned grasses above the root crown; for other species all plant parts are consumed, leaving some or no major stems or trunks, any left are deeply charred, this severity class is uncommon due to short burnout time of grasses
Not Applicable (0)	Inorganic preburn	Inorganic preburn	Inorganic preburn	Inorganic preburn

Forest Plot Burn Severity Data Sheet

Plot ID: _____ Date: _____

Fire Name: _____ Recorder(s): _____

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Observations are from a 1 meter square area along the 45 meter transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions

Forest Plot Burn Severity Detailed Definitions

	Unburned (5)	Scorched (4)	Lightly Burned (3)	Moderately Burned (2)	Heavily Burned (1)	Not Applicable (0)
Substrate	Not burned	Litter partially blackened; duff nearly unchanged; wood/leaf structures unchanged	Litter charred to partially consumed; upper duff layer may be charred, but the duff layer is not altered over the entire depth; surface appears black; woody debris is partially burned; logs are scorched or blackened but not charred; rotten wood is scorched to partially burned	Litter mostly to entirely consumed, leaving coarse light colored ash; duff deeply charred, but underlying mineral soil is not deeply altered; woody debris is mostly consumed; logs are deeply charred, burned out stump holes are common	Litter and duff completely consumed, leaving fine white ash; mineral soil visibly altered, often reddish; sound logs are completely charred, and rotten logs consumed. This code generally applies to less 10% of natural or slash burned areas	Inorganic preburn
Vegetation	Not burned	Foliage scorched and attached to supporting tress	Foliage to smaller twigs partially to completely consumed; branches mostly intact	Foliage twigs and small stems consumed; some branches still present	All plant parts consumed, leaving some or no major stems or trunks; any left are deeply charred	None present preburn

Appendix B

Stonington Fire Fuels Treatment Effectiveness Worksheets

Fuels Treatment Evaluation Checklist

Fire Name: Stonington
Fire Number: 0910-02-014
Fire Date: August 7, 2007

Treatment

16. Did the fire burn in, or immediately adjacent to a hazardous fuels treatment area? ☒ Yes ☐ No

17. Age of the treatment: ☐ 0-1 Year ☒ 1-5 Years ☐ 5 -10 years ☐ more than 10 years

18. The type of treatment that effected this fire (check all that apply):
    - ☐ Pre-commercial thinning
    - ☐ Commercial thinning
    - ☐ Commercial harvest
    - ☒ Biomass removal
    - ☐ Mastication without follow-up treatment
    - ☐ Mastication with follow-up treatment
    - ☐ Fuelbreak
    - ☐ Defensible Fuel Profile Zone
    - ☐ Disking
    - ☐ Understory burning
    - ☒ Prescribed fire
    - ☐ Hand piling

Suppression

19. The treatment (check all that apply):
    - ☒ Provided an anchor point for suppression
    - ☒ Increased fireline production rates
    - ☒ Reduced surface fire intensity
    - ☒ Slowed rates of spread
    - ☐ Served a part of the final control line
    - ☐ Allowed for firing operations
    - ☒ Reduced spotting or firebrand production area
    - ☒ Improved ingress or egress into the fire

20. The treatment improved the effectiveness of air operations: (check all that apply):
    - ☐ Fixed wing
    - ☒ Rotor wing
    - ☒ Improved canopy penetration
    - ☐ Reduced required coverage levels

21. The treatment protected private property or government improvements:
    ☒ Yes ☐ No

22. If yes to #6, how many:
    ☐ Less than 5 ☒ 5 to 25 ☐ 26 to 100 ☐ more than 100

Safety

23. The treatment area allowed for direct attack on the fire:
    ☒ Yes ☐ No

24. The treatment served as either an escape route or safety zone:
    ☐ Yes ☒ No

25. The treatment provided protection to public improvements (check all that apply):
    - ☒ Roads
    - ☐ Schools
    - ☒ Structures
    - ☐ Powerlines
    - ☐ Other utility infrastructure
    - ☐ Other

Incident Management

26. The effects of the fuels treatment reduced the final fire size:
    ☒ Yes ☐ No

27. Incident management level of this fire:
    ☐ Type 4 ☒ Type 3 ☐ Type 2 ☐ Type 1

28. Expected incident management level of the fire had the treatment not been in place:
    ☐ Type 4 ☒ Type 3 ☐ Type 2 ☐ Type 1

29. The effects of the treatment on the fire reduced the duration of the incident:
    ☒ Yes ☐ No

30. The expenditure of WFSU funds decreased as a direct result of the treatment:
    ☒ Yes ☐ No

COMPLETE THE *BURN SEVERITY MATRIX* FOR TREATED AND UNTREATED BURN AREAS OF THE FIRE.

Sample Size: The sample is not intended to be statistically significant.

For fires over 5 acres complete 10 transects of 45 meters for both treated and untreated burn areas. For fires less than 5 acres, complete 5 transects of 45 meters for both treated and untreated burn areas.

Brush and Grassland Plot Burn Severity Data Sheet

Plot ID: 0910-02-014 Date: October 2, 2007

Fire Name: Stonington Recorder(s): Kerr

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Each observation is from 1 meter square area along the transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation	4	4	4	5	4	4	5	5	3	4
Substrate	4	4	4	5	4	4	5	5	4	4

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation	4	3	3	3	5	5	5	4	4	4
Substrate	4	4	4	4	5	5	5	4	4	4

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation	5	5	4	4	4	4	3	4	4	4
Substrate	5	5	4	4	4	4	4	4	4	4

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions

Forest Plot Burn Severity Data Sheet

Plot ID: 0910-02-014 Date: October 2, 2007

Fire Name: Stonington Recorder(s): Kerr

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Each observation is from 1 meter square area along the transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation	2	2	3	3	3	2	2	2	2	2
Substrate	2	2	2	3	2	2	2	2	2	2

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation	3	3	3	2	3	2	3	3	2	2
Substrate	3	3	2	2	2	3	2	2	2	2

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation	3	3	3	3	3	2	2	2	2	2
Substrate	3	3	2	3	3	2	2	2	2	2

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions

Appendix C

Calpine Fire Fuels Treatment Effectiveness Worksheets

Fuels Treatment Evaluation Checklist

Fire Name: Calpine
Fire Number: 0517-056-025
Fire Date: June 23, 2007

Treatment

31. Did the fire burn in, or immediately adjacent to a hazardous fuels treatment area? ☒ Yes ☐ No

32. Age of the treatment: ☐ 0-1 Year ☒ 1-5 Years ☐ 5 -10 years ☐ more than 10 years

33. The type of treatment that effected this fire (check all that apply):
    - ☒ Pre-commercial thinning
    - ☐ Commercial thinning
    - ☐ Commercial harvest
    - ☐ Biomass removal
    - ☐ Mastication without follow-up treatment
    - ☐ Mastication with follow-up treatment
    - ☐ Fuelbreak
    - ☒ Defensible Fuel Profile Zone
    - ☐ Disking
    - ☐ Understory burning
    - ☐ Prescribed fire
    - ☒ Hand piling

Suppression

34. The treatment (check all that apply):
    - ☒ Provided an anchor point for suppression
    - ☒ Increased fireline production rates
    - ☒ Reduced surface fire intensity
    - ☒ Slowed rates of spread
    - ☐ Served a part of the final control line
    - ☐ Allowed for firing operations
    - ☒ Reduced spotting or firebrand production area
    - ☒ Improved ingress or egress into the fire

35. The treatment improved the effectiveness of air operations: (check all that apply):
    - ☒ Fixed wing
    - ☒ Rotor wing
    - ☒ Improved canopy penetration
    - ☐ Reduced required coverage levels

36. The treatment protected private property or government improvements:
    ☒ Yes ☐ No

37. If yes to #6, how many structures:
    ☒ Less than 5 ☐ 5 to 25 ☐ 26 to 100 ☐ more than 100

Safety

38. The treatment area allowed for direct attack on the fire:
    ☒ Yes ☐ No

39. The treatment served as either an escape route or safety zone:
    ☐ Yes ☒ No

40. The treatment provided protection to public improvements (check all that apply):
    - ☒ Roads
    - ☐ Schools
    - ☒ Structures
    - ☐ Powerlines
    - ☐ Other utility infrastructure
    - ☐ Other

Incident Management

41. The effects of the fuels treatment reduced the final fire size:
    ☒ Yes ☐ No

42. Incident management level of this fire:
    ☐ Type 4 ☒ Type 3 ☐ Type 2 ☐ Type 1

43. Expected incident management level of the fire had the treatment not been in place:
    ☐ Type 4 ☐ Type 3 ☒ Type 2 ☐ Type 1

44. The effects of the treatment on the fire reduce the overall duration of the incident:
    ☒ Yes ☐ No

45. The expenditure of WFSU funds decreased as a direct result of the treatment:
    ☒ Yes ☐ No

COMPLETE THE *BURN SEVERITY MATRIX* FOR TREATED AND UNTREATED BURN AREAS OF THE FIRE.

Sample Size: The sample is not intended to be statistically significant.

For fires over 5 acres complete 10 transects of 45 meters for both treated and untreated burn areas. For fires less than 5 acres, complete 5 transects of 45 meters for both treated and untreated burn areas.

Forest Plot Burn Severity Data Sheet

Plot ID: 0517-056-025 Date: October 2, 2007

Fire Name: Calpine Recorder(s): Kerr

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Each observation is from 1 meter square area along the transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation	4	4	4	4	4	4	4	4	3	4
Substrate	4	4	4	3	4	4	4	4	3	4

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation	4	4	3	4	4	4	4	4	4	4
Substrate	4	4	4	4	4	4	4	4	4	4

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation	4	3	3	4	4	4	4	4	4	4
Substrate	4	3	4	4	4	4	3	4	4	4

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions

Forest Plot Burn Severity Data Sheet

Plot ID: 0517-056-025 Date: October 2, 2007

Fire Name: Calpine Recorder(s): Kerr

Treatment Area: (Circle one): Untreated Treated

Refer to the coding matrix for all transects. Each observation is from 1 meter square area along the transect.

Transect 1	1	5	10	15	20	25	30	35	40	45
Vegetation	2	2	3	2	3	2	2	3	3	2
Substrate	2	2	2	3	2	2	2	3	3	2

Transect 2	1	5	10	15	20	25	30	35	40	45
Vegetation	3	3	3	2	2	2	3	3	2	2
Substrate	3	3	2	2	2	3	2	2	2	2

Transect 3	1	5	10	15	20	25	30	35	40	45
Vegetation	3	3	2	2	3	2	2	2	2	2
Substrate	3	3	2	3	3	2	2	2	2	2

Transect 4	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Transect 5	1	5	10	15	20	25	30	35	40	45
Vegetation										
Substrate										

Coding Matrix:

5 Unburned 4 Scorched 3 Lightly Burned 2 Moderately Burned 1 Heavily Burned 0 Not Applicable

Note: See reverse for detailed definitions