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A Summary of Fuel Treatment Effectiveness in the Herger-Feinstein Quincy Library Group Pilot Project Area

Fire severity differences between treated (left) and untreated (right) areas of the 2002 Cone Fire on the Lassen National Forest.

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by

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Executive Summary

The Herger-Feinstein Quincy Library Group (HFQLG) Forest Recovery Act of 1998 directed the creation of a Pilot Project on national forests in the northern Sierra Nevada mountain range to implement and evaluate how well various hazard fuel reduction and vegetation management activities meet ecologic, economic, and fire management objectives.

This report documents the effectiveness of fuel treatments that interacted with wildfires. All wildfires (20) that interacted with one or more fuel treatments within the HFQLG Forest Recovery Act Pilot Project area from 1999 to 2010 were examined.

These fires, including three complexes with multiple fires, were evaluated to determine the effects of fuel treatments on:

Fire Behavior

Changes in flame lengths and other indicators of severe fire behavior such as spotting compared to non-treated areas.

and

Fire Suppression

Changes in suppression strategy resulting from fuel treatments, including: safer areas for firefighters, anchors for fireline construction, areas from which to initiate burnout operations; or, fuel treatments which modified fire behavior to the extent that the need for suppression action was minimal.

Within this report, fuel treatment effectiveness is compared with untreated areas to determine differences in fire suppression actions, fire severity, and fire effects. All the fires summarized in this analysis started in, or burned into, HFQLG Pilot Project areas. When compared to adjacent untreated areas, completed fuel treatment areas reduced fire behavior and fire severity.

Summary of Key Findings

- Fuel treatments were effective in modifying fire behavior, resulting in a reduction in final fire size and reduced suppression costs.
- Thinning and prescribed fire, used in combination, modified wildfire behavior more effectively than thinning alone and with less tree mortality than lop and scatter and mastication treatments.
- Treated areas had the least vegetation mortality and resulted in retaining a forest after wildfire, maintaining ecological and social benefits of a forest such as wildlife habitat, recreational enjoyment, and numerous other benefits.
- Untreated areas experienced the most severe fire effects and vegetative mortality.
- Treated areas increased fire suppression options and enhanced opportunities for safe, low-severity burnout operations with reduced potential for spotting and torching.
- Smoke volume was reduced significantly when fire reached treated areas.

I Methods

This report summarizes the available literature that describes incidences of wildfire interaction with treatment areas within the HFQLG Pilot Project area. Data for this report were also developed through on-the-ground and aerial reconnaissance, as well as interviews with firefighters, fire managers, fire scientists, and members of the public.

Photo documentation prior to, during, and after the fires was also reviewed. In addition, information was obtained from data and reports prepared and collected by the staffs of the Lassen, Plumas, and Tahoe national forests.

Fuel treatment effectiveness is determined by comparing differences in fire behavior, fire suppression actions, fire severity, and fire effects on treated vs. untreated areas.

II Background

A. Herger-Feinstein Quincy Library Group Forest Recovery Act

The Herger-Feinstein Quincy Library Group (HFQLG) Forest Recovery Act of 1998 directed creation of a Pilot Project on the national forests in the northern Sierra Nevada mountain range to implement and evaluate how well various hazard fuel reduction and vegetation management activities meet ecologic, economic, and fire management objectives.

The Lassen National Forest (LNF) (south of Highway 99), Plumas National Forest (PNF) and the Sierraville Ranger District of the Tahoe National Forest (TNF) are implementing the Forest Recovery Act of 1998 across approximately 1.53 million acres (Fig. 1). This report documents the effect of recent intruding wildfires on fuel treatments within this Pilot Project area.

The Quincy Library Group is a grassroots citizens' organization interested in the collaborative management of national forest lands. The core group represents the local community, environmental representatives, and the timber industry. In 1993, the group developed the "Community Stability Proposal" and eventually lobbied for the successful passage of the Forest Recovery Act in October 1998.

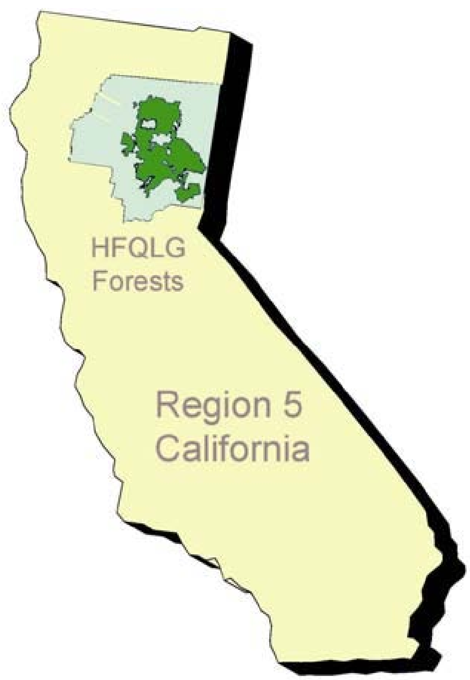

Figure 1 – The Herger-Feinstein Quincy Library Group (HFQLG) national forests.

The primary purpose of implementing the Pilot Project directed in the Forest Recovery Act is to apply various resource management activities proposed by the Quincy Library Group and evaluate the effectiveness of these activities.

The objectives:

- Promote local economic stability;
- Create healthy, fire-resilient forests that maintain ecological integrity; and
- Construct a strategic network of areas in which fuel volume and stand structure create firebreaks (known as "Defensible Fuel Profile Zones" or "DFPZ" in the Pilot Project).

Within the DFPZs, fuels are modified in amount and form to discourage crown fire development on fires that start in treatment areas, and to enable crown fires to drop to the ground on fires that start outside of treatment areas. Additionally, these treatment areas are places where firefighters can more safely and effectively perform suppression actions and where aerial fire retardant will reach the burning surface fuels without interception in the tree canopy.

Current policy requires that the Lassen, Plumas, and Tahoe national forests take immediate action to suppress wildland fires that start on lands for which these Forests have fire suppression responsibility.

The desired strategy for initial attack on these Forests is “direct attack”. In most cases, this suppression strategy is the safest and most effective tactic, resulting in the least area burned.

Weather, topography, and fuel conditions influence fire behavior and may enable fires to escape initial attack, possibly requiring the use of indirect suppression tactics. Implementing such indirect strategies typically requires more time and resources. In addition, these indirect strategies generally result in a larger fire size.

While the location of the next wildland fire cannot be predicted and weather and topography cannot be altered, land managers can strategically place fuel treatments to influence and affect wildfires.

Numerous documents and Forest Plan amendments were developed to facilitate implementation of the Forest Recovery Act across the Pilot Project area. As of December 2010, approximately 60 percent of the network of treated areas was in place. The Act has been extended twice. It is scheduled to conclude in September 2012.

B. Forest Environment

The USDA Forest Service is implementing the HFQLG Forest Recovery Act across 1.53 million acres on the Plumas National Forest, Lassen National Forest, and the Sierraville Ranger District of the Tahoe National Forest. While each of these national forests has their unique features and history, they all share an environment common to this region of the northern Sierra Nevada mountain range.

The forests have steep, incised canyons on the west side, with ridges that run west to east to the Pacific Crest. Vegetation on the west side consists of dense trees and brush, with areas west of the Pacific Crest receiving the largest amount of rainfall. East of the Pacific Crest, the landscape changes into small valleys or meadows with a surrounding mountain-ridge structure. On the east side, vegetation changes to a more open structure dominated by ponderosa pine, mixed conifer, and brush.

These forests are key watersheds for the California Water Project that supplies clean water for many cities and agricultural lands in California. Each forest is managed for multiple uses, including recreational opportunities; sustainable supplies of wood, water and hydropower; minerals; forage for livestock; habitat for fish and wildlife; and diverse plant communities.

Table 1 – Acreage and counties of the Herger-Feinstein Quincy Library Group Pilot Project area.

National Forest	Acres	Counties
Lassen	1.2 million	Butte, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Tehama
Plumas	1.1 million	Butte, Lassen, Plumas, Sierra, and Yuba
Tahoe (Sierraville Ranger District)	238,000	Plumas, Sierra

C. Fire History

Historically, fire has served as an important ecosystem process on the HFQLG Pilot Project area's national forest lands. Fire, as an ecological force across the Sierra Nevada, is well documented as having been frequent with mixed intensities that are influenced by the vegetation/fuel characteristics, fuel moisture, wind, topography, time of day, and direction of fire spread.

These frequent fires affected the species of plants, their adaptations to fire, and the arrangement of the vegetation. Twentieth-century forest management practices—including the policy of excluding fire by aggressive suppression, combined with changing climatic conditions—have resulted in denser conifer forests of smaller trees, with little or no spacing between tree canopies.

During the last 100 years, within some forests, a shift in tree species has also occurred. Some forests are now dominated by less fire-resilient species adapted to growing in dense, shady conditions. Much of the patterned vegetation mosaic created by frequent, mixed-intensity fire has been eliminated and dead fuels have accumulated in the absence of more frequent fire.

Fires which once burned with varied severity across the landscape are now, more often, high-intensity fires that burn over large contiguous acreages with severe fire effects.

(For more information regarding fire, fuels, and the effects of fire in the Sierra Nevada, see the *Sierra Nevada Forest Plan Amendment – Final Environmental Impact Statement* [SNFPA-FEIS], volume 2, section 3.5 [pages 238-306].)

III Pre-Treatment Conditions

As with most forests in the West, the forests covered by the Pilot Project produce both surface and canopy fuels faster than decomposition can recycle them. Surface fuels include downed, dead woody biomass and live and dead shrub and herbaceous material (Debano and others, 1998). Canopy fuels are aerial biomass primarily composed of tree branch wood and foliage. These fuels also include arboreal mosses, lichen, and hanging dead material such as needles and dead branches (Scott and Reinhardt, 2001; Reinhardt and others, 2006). In the absence of disturbance by fire, these fuels tend to increase.

Figure 2 – The 1931 photo on left is typical of historic conditions found within the Herger-Feinstein Quincy Library Group Pilot Project area. The photo on right of the same forest shows the current dense conditions that often exist before any treatment.

Fire serves as a major ecological process that shaped plant species and fuel volume on all of the HFQLG Pilot Project forests. However, current fuel conditions have changed from the historic norm. This current condition includes:

- Increased crown density with reduced numbers of large fire-resistant trees,
- A thick understory of small trees with branches closer to the ground that can provide fire a "ladder" into the forest canopy, and
- An increased volume of surface fuels (Fig. 2.).

These current conditions now support high-intensity fires that burn with severe fire effects over extensive acreages. Treatment of the fuelbed is therefore necessary to moderate fire behavior to allow these forests to withstand fires without devastating effects.

IV Post-Treatment Conditions

Fuel treatments within the Pilot Project area are directed by Forest Land Management Plans as amended by the 2004 Sierra Nevada Forest Plan Amendment, as amended by the Herger Feinstein Quincy Library Group Forest Recovery Act.

Fuel treatments within the HFQLG area are categorized by:

- Mechanical thinning (thinning of trees up to 30 inches diameter with mechanized equipment).
- Hand thinning (chainsaw thinning of brush and trees up to 10 inches diameter).
- Hand or machine piling of surface fuel.
- Prescribed fire, which includes pile burning and underburning (which usually follows mechanical treatments).
- Mastication. (Mastication, or mulching, is a mechanical fuel treatment that changes the structure and size of fuels in the stand. Trees and understory vegetation are chopped, ground, or chipped—with the resulting material left on the soil surface.)
- Lop and scatter. (Lop and scatter refers to thinning standing trees and leaving the limbs on the soil surface. This practice was implemented on one project area and is not a current practice in the HFQLG Pilot Project area).

While specific treatment applications vary across the Pilot Project area, they all strive to modify existing fuel conditions to interrupt fire spread and achieve conditions that reduce the size and severity of wildfire.

Post-treatment conditions usually exhibit reduced stand densities that retain the largest fire resilient trees or groups of fire resilient trees. This results in conditions that typically will not support a crown fire, even during high fire weather conditions.

Fuel treatments completed under the HFQLG Pilot Project are designed to moderate fire behavior by decreasing flame lengths and reducing fire spread and severity across the landscape.

Figure 3 – Pre- and post-treatments on Herger-Feinstein Quincy Library Group Pilot Project area lands.

V Fuel Treatment Effectiveness

On the following page, Table 2 summarizes the type of fuel treatment and the treatment effectiveness on fire behavior and suppression activities for each of the 20 wildfires that started in or entered a fuel treatment within the HFQLG Forest Recovery Act Pilot Project area from 1999 through 2010.

The table represents an overall summary of the effectiveness of treatments rather than a treatment-by-treatment or acre-by-acre account.

There is variability in results and the summary represents the majority of the effects. For example, a treatment may have reduced vegetation mortality in the overall treatment area, however, there may be pockets of mortality within the treatment.

Table 2 – Fuel Treatment and Effectiveness on Fire Behavior and Suppression Activities on the 20 Wildfires that Interacted with Fuel Treatments within the Herger-Feinstein Quincy Library Group Pilot Project Lands, 1999 to 2010

Fire name and size	*Wildfire behavior outside treatment area*	*Type of fuel treatment*	*Wildfire behavior inside treatment area*	*Role treatment area played in suppression of wildfire*
Dow Fire 80 acres LNF-1999	Surface flame lengths 2-8ft. Individual tree torching. Rapid rates-of-spread. Spotting ¼ to ½ mile.	Mechanical thin, biomass removal, hand thin/pile, pile burn, underburn.	The treatments reduced flame lengths, fire intensity, and vegetation mortality.	The fire spotted over the Defensible Fuel Profile Zone (DFPZ) and therefore did not provide a safe work area for firefighters.
Treasure Fire 282 acres TNF-2001	Surface flame lengths 4-10ft. Individual and group torching. Crown fire and rapid rates-of-spread. Spotting ¼ to ½ mile.	Hand thin/ pile, pile burn.	The treatments reduced flame lengths and fire intensity, reduced the rate-of-spread, and reduced vegetation mortality.	Open stands lowered fire intensity, allowing suppression crews safe access and direct attack. This resulted in smaller final fire size and reduced suppression costs.
Stream Fire 3526 acres PNF-2001	Surface flame lengths 4-12ft. Individual and group torching. Rapid rates-of-spread. Spotting ¼ to ¾ mile.	Mechanical thin, biomass removal, hand thin/pile, pile burn, underburn.	The treatments reduced flame lengths, fire intensity, and vegetation mortality.	Open stands lowered fire intensity, allowing suppression crews safe access and direct attack. This resulted in smaller final fire size and reduced suppression costs.
Cone Fire 2000 acres LNF-2002	Surface flame lengths 2-8ft. Individual and group torching. Crown fire. Rapid rates-of-spread. Spotting up to 1¼ mile.	Mechanical thin, biomass removal, lop and scatter, underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced or stopped the rate-of-spread, and reduced vegetation mortality.	The fire entering fuel treatments resulted in an abrupt change in fire behavior. Some treatment units stopped the advancing wildfire with little to no suppression effort. This resulted in smaller final fire size and reduced suppression costs.
Boulder Complex 2920 acres PNF-2006	Surface flame lengths 4-12ft. Individual and group torching. Rapid rates-of-spread. Spotting ¼ to ¾ mile.	Mechanical thin, biomass removal, hand thin/pile, pile burn, underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	Fuel treatments allowed suppression crews to conduct burnout operations safely and effectively. The reduced rate-of-spread in previously underburned areas allowed suppression crews to focus on higher-priority areas.

Fire name and size	*Wildfire behavior outside treatment area*	*Type of fuel treatment*	*Wildfire behavior inside treatment area*	*Role treatment area played in suppression of wildfire*
Antelope Complex 23,420 acres PNF-2007	Surface flame lengths 4-10ft. Individual and group torching. Crown fire. Rapid rates-of-spread. Spotting up to 1¼ mile.	Mechanical thin, biomass removal, hand thin/pile, pile burn, underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	Fuel treatments allowed suppression crews to conduct burnout operations safely and effectively. Spot fires were easily detected and contained. Treated areas reduced fire behavior, providing for safe egress of fire crews during extreme fire behavior. Treatments resulted in smaller final fire size with reduced suppression costs.
Davis Fire 30 acres PNF-2007	Surface flame lengths 2-8ft. Individual and group torching. Crown fire. Rapid rates-of-spread.	Mechanical thin and mastication.	The treatments reduced flame lengths and rate-of-spread.	Fuel treatments allowed limited firefighting resources to be effective. Masticated fuels produced low flame lengths and rate-of-spread. However, due to fuel density, fire intensity and residence time was quite high.
Calpine Fire 40 acres TNF-2007	Surface flame lengths 4-8ft. Individual and group torching. Crown fire. Rapid rates-of-spread. Spotting up to ¼ mile.	Mechanical thin, biomass removal, hand thin/pile, pile burn.	The treatments reduced flame lengths, fire intensity, rate-of-spread, and vegetation mortality.	Fuel treatments allowed limited suppression resources to be effective. Treated areas provided anchor points, increased production rates, and allowed effective application of aerial retardant.
Moonlight Fire 64,997 acres PNF- 2007	Surface flame lengths 4-12+ft. Individual and group torching. Crown Fire. Rapid rates-of-spread. Long range spotting up to 2 miles.	Mechanical thin, biomass removal, mastication and underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	In the earlier stages of the fire, dry conditions, steep topography, large areas of heavy fuel loadings, and frontal winds contributed to intense, plume-dominated fire behavior with long-range spotting. The fire spotted over treatment areas that were being used in suppression efforts. Due to very extreme fire behavior outside of the treatment unit igniting untreated fuels on the other side of treatments, these treated areas became unusable for suppression resources. However, many of the fuel treatments were effective in slowing fire progression. These treatments aided firefighters in controlling fire growth in those sections of the fire. According to firefighters utilizing these treatments in suppression efforts, the fire dropped from an intense fire, with group torching and short crown runs, to a surface fire. This fire transition allowed direct attack using bulldozers in some of these treatment areas.

Fire name and size	*Wildfire behavior outside treatment area*	*Type of fuel treatment*	*Wildfire behavior inside treatment area*	*Role treatment area played in suppression of wildfire*
Franks Fire 2.1 acres PNF- 2007	N/A (100% of fire was within treatment area.)	Mechanical thin, biomass removal, mastication.	The treatments resulted in low flame lengths and slow rate-of-spread.	The reduced flame length and rate-of-spread allowed initial attack fire fighting resources to work close to the flame front and create a direct line and contain the fire at 2.1 acres.
Irish Fire 1.2 acres PNF- 2007	N/A (100% of fire was within treatment area.)	Mechanical thin, biomass removal, mastication.	The treatments resulted in low flame lengths and slow rate-of-spread.	The reduced flame length and rate-of-spread allowed initial attack firefighting resources to work close to the flame front and create a direct line and contain the fire at 1.2 acres.
Peterson Complex 8,000 acres LNF-2008	Surface flame lengths 4-12ft. Individual and group torching. Rapid rates-of-spread. Spotting ½ to 1 mile.	Mechanical thin, biomass removal, pile, pile burn, underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	Change in fire behavior allowed the suppression crews to focus their attention on the head of the fire and not be concerned about the flanks of the fire that were burning in the treated areas. This resulted in smaller final fire size with reduced suppression costs.
Rich Fire 6,112 acres PNF-2008	Surface flame lengths 4-12ft. Individual and group torching. Rapid rates-of-spread.	Mechanical thin, biomass removal, pile, pile burn, underburn.	The treatments reduced flame lengths, fire intensity, rate-of-spread, vegetation mortality, and smoke production.	Fuel treatments allowed effective application of aerial retardant. Reduced rate-of-spread allowed suppression crews to focus on higher priority areas that were threatening watersheds and communities. This resulted in smaller final fire size with reduced suppression costs.
Butte Fire 49 acres LNF-2009	Surface flame lengths 4-6ft. Individual and group torching. Rapid rates-of-spread.	Mechanical thin and underburn.	It is estimated that while over 30 smoking embers were located within the treated unit, having minimal surface fuels, the spot fires were quickly extinguished.	The fire entering fuel treatments resulted in an abrupt change in fire behavior. The treated unit provided ground resources with a safe opportunity to halt the forward progress of the fire. Spot fires within the treated unit had little hope of gaining momentum and were quickly suppressed. Air Attack was able to identify a 5' x 5' spot fire over ¼ mile to the southeast burning within the treated unit. Fuel treatments resulted in smaller final fire size and reduced suppression costs.

Fire name and size	*Wildfire behavior outside treatment area*	*Type of fuel treatment*	*Wildfire behavior inside treatment area*	*Role treatment area played in suppression of wildfire*
Silver Fire 45 acres PNF-2009	Surface flame lengths 4-6ft. Individual and group torching. Rapid rates-of-spread.	Hand thin, pile, pile burn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	This treatment caused fire to drop to the ground and allowed firefighters the ability to stop the head of the running fire. Firefighters were also able to use this treatment to stop the progression of the fire to the east toward the community of Meadow Valley.
Milford Grade Fire 226 acres PNF-2009	Surface flame lengths 4-6ft. Individual and group torching. Rapid rates-of-spread.	Mechanical thin, pile, pile burn and underburn.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread, and reduced vegetation mortality.	The treatment areas provided a safe anchor point for crews to initiate line construction. The low surface fuel loading allowed for increased line production rates due to low fire line intensities and flame lengths—allowing for direct attack suppression tactics. In addition, the DFPZ demonstrated the ability to reduce overall fire severity.
Brown Fire 1833 acres LNF-2009	Surface flame lengths 4-6ft. Individual and group torching. Rapid rates-of-spread.	Hand thin, pile, mastication.	The treatments reduced flame lengths and fire intensity, significantly reduced the rate-of-spread.	The treatment areas provided a safe anchor point and allowed crews to complete back firing operations and halt the forward progress of the fire.
Sugarloaf Fire 9354 acres LNF-2009	Surface flame lengths 8-10 ft. Individual and group torching and crown fire runs. Rapid rates-of-spread.	Mechanical and hand thin, biomass removal, hand pile/pile burn.	Fire burned with high intensity in thinned area with heavy surface fuel. Fire burned with low intensity in areas with light surface fuel.	In places where the Sugarloaf Fire impacted the DFPZ at high intensity, the fire carried through the treatment at high intensity due to the high surface fuel loading. In areas with light surface fuel loading, the fire burned as a low intensity surface fire and helped suppression resources halt the spread of the fire.
Friend-Darnell Fire 3879 acres PNF-2008	Surface flame lengths 4-12ft. Individual and group torching.	Hand thin/pile, pile burn, underburn.	Flame lengths less than 2 feet, low fire intensity, direct attack possible.	The treatment area allowed suppression forces to go direct and halt fire spread. The DFPZ was the last line of defense for adjacent communities.
Ponderosa Fire 6 acres PNF-2009	Surface flame lengths were 4-10 ft and moderate rate-of-spread.	Hand thin/pile, pile burn and underburn.	Flame lengths less than 1 foot, very low fire intensity.	The treated area provided a safe anchor point and allowed for direct attack on both the flank and head of the fire. Full containment was possible in one operational period.

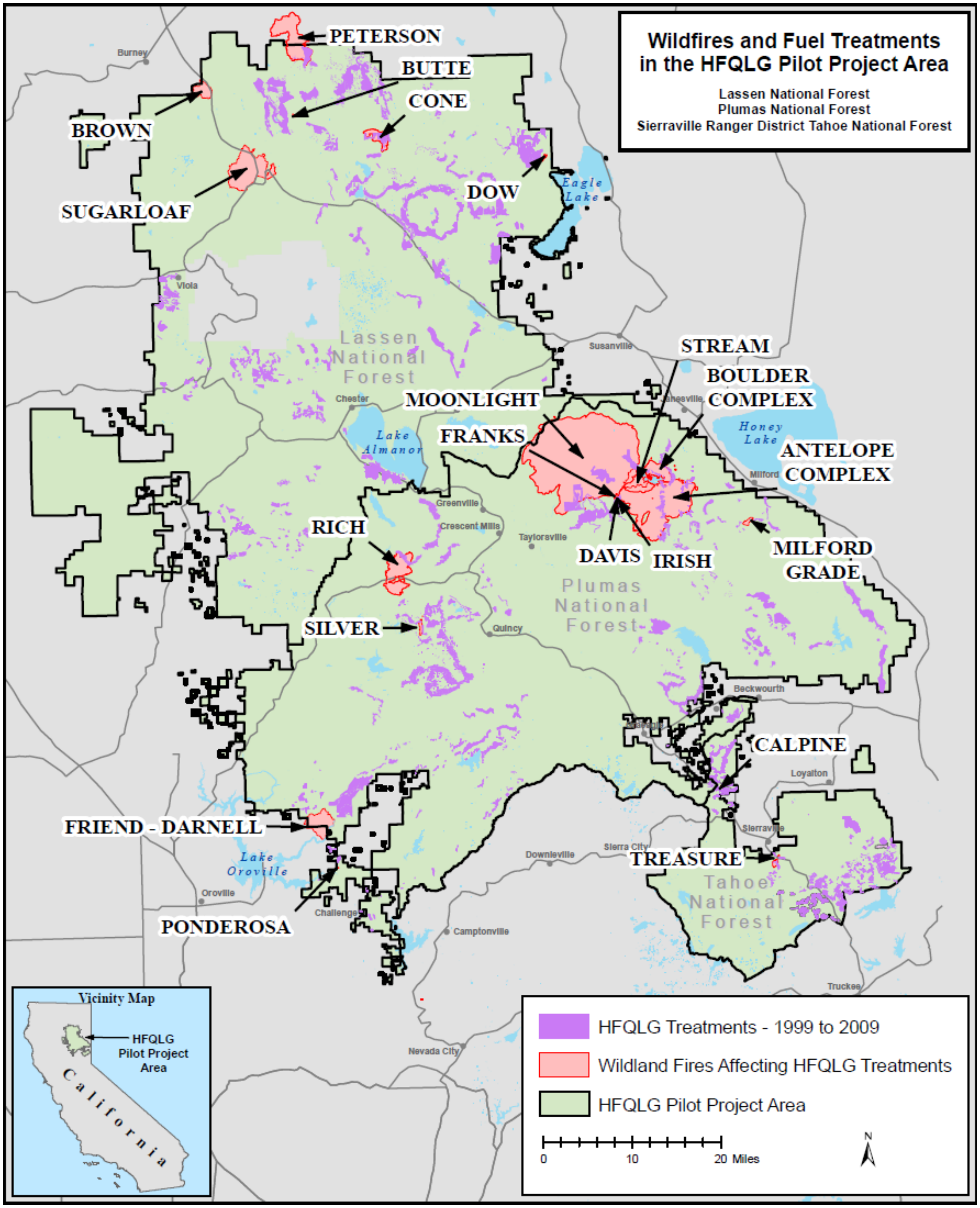

Figure 4 – Wildfires and fuel treatments in the Herger-Feinstein Quincy Library Group Pilot Project area.

VI Conclusion

All Treatment Areas Experienced a Documented Reduction in Fire Behavior and Fire Severity

Fuel treatments completed under the Herger-Feinstein Quincy Library Group (HFQLG) Pilot Project were designed to moderate fire behavior by decreasing flame lengths and reducing fire spread and severity across the landscape.

The effectiveness of this strategic network of fuel treatments (Defensible Fuel Profile Zones [DFPZ]) that stretch across the Lassen and Plumas national forests and Sierraville Ranger District on the Tahoe National Forest as part of the Herger-Feinstein Quincy Library Group Act depends on:

- The type and intensity of the treatment,
- Vegetation type,
- Topography within and adjacent to treatments,
- Weather conditions during the fire, and
- The availability of firefighting resources.

The 20 fires summarized in this report burned in HFQLG Pilot Project fuel treatment areas in which the vertical and horizontal continuity of live and dead fuels had been previously modified. Almost all treatments experienced a documented reduction in fire behavior and fire severity.

Key Findings

This "Key Findings" section (A. through D.) details this report's pertinent findings—all related to the effectiveness of the various fuel modifications identified in this analysis.

A. Type of Fuel Treatment

- Thinning and surface fuel treatments reduced fire severity.
- Thinning and prescribed fire treatments, used in combination, modified wildfire behavior more effectively than solely thinning.
- Lopping and scattering—when implemented without any other treatment types—and mastication modified fire behavior. However, due to the resultant high volume of surface fuels and long burn time, mortality in these areas was high.
- Trees less than 80 feet from the boundary between treated and untreated areas were likely to suffer high mortality due to radiant heat from high-intensity wildfire in untreated areas.

B. Fire Behavior and Severity

- Treated areas reduced fire behavior and fire severity.
- Treated areas had the least vegetation mortality and resulted in retaining a forest after wildfire, maintaining ecological and social benefits of a forest such as wildlife habitat, recreational enjoyment, and numerous other benefits.
- Smoke volume was reduced significantly when fire reached treated areas.

- In severe fire areas, fuel treatments increased needle retention in standing trees compared to untreated areas. Residual needle cast later provided ground cover to protect soil.

C. Fire Suppression

- Treated areas increased fire suppression options by allowing direct suppression by hand crews and dozers.
- Where surface and ladder fuels were sufficiently modified, little suppression action was required and no unacceptable fire effects occurred.
- Areas of fuel treatment enhanced opportunities for safe, low-severity burnout operations and reduced the potential for spotting and torching.
- Strategically placed fuel treatments slowed fire and allowed suppression forces to focus on high-priority areas located closer to communities and high-value watersheds.
- Strategically placed fuel treatments slowed fire at ridge tops and allowed suppression forces to establish safe anchor points and engage in direct suppression actions.
- When a fire cut off other escape routes, firefighters used a DFPZ for a safe escape route under adverse weather conditions.

D. Design of Fuel Treatment Areas

- Design of fuel treatment areas is important. To be effective, treatments must be large enough (considering fuel type, stand conditions, expected weather and topography) to modify fire behavior and increase fire suppression capability.
- Width specifications must be sufficient to consider the effects of mid- to long-range spotting outside of treated areas.
- DFPZs have been shown to be adequate to slow low- to moderate- and even high-intensity wildfires, allowing fire suppression resources an opportunity to stop wildfires.
- Large, unbroken blocks of untreated fuels can allow fire to build momentum and increase fire intensity, including long-range spotting over DFPZs. This situation can overwhelm suppression forces. Although the treatment may modify fire behavior, suppression personnel may not be able to take advantage of the treatment.

Significant documentation is available on fuel treatment effectiveness in which wildfire tested those treatments within the HFQLG Pilot Project area. Treating stands by thinning and reducing surface fuels increased fire suppression options, modified fire behavior, and reduced final fire size and suppression costs. Treated areas also experienced the least vegetation mortality—resulting in improved ecological conditions—and retained forests after wildfire.

VII Acknowledgements

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VIII Bibliography

Bauer, R., Dillingham, C., Duncan, P. 2009. Silver fire fuel treatment effectiveness report, USDA Forest Service, R-5, Plumas National Forest.

Beckman, S. 2001. Assessment of the effects of multiple fuel treatments on fire spread and timber stand damage, Stream Fire, Plumas National Forest, Fire Behavior Analyst Report, California CIIMT 5.

Dailey, S., Fites, J., Reiner, A., Mori, S. 2008. Fire behavior and effects in fuel treatments and protected habitat on the Moonlight fire, AMSET Fire Behavior Assessment Team Report, USDA Forest Service, Pacific Southwest Research Station, 40 pp.

Debano, L.F., Neary, D.G., Folliott, P.F. 1998. Fire's effect on ecosystems. John Wiley and Sons, New York, NY, USA.

Dillingham, C. 2009. Davis fire fuel treatment effectiveness report, USDA Forest Service, R-5, Plumas National Forest.

Dillingham, C. 2009. Irish fire fuel treatment effectiveness report, USDA Forest Service, R-5, Plumas National Forest.

Dillingham, C. 2009. Franks fire fuel treatment effectiveness report, USDA Forest Service, R-5, Plumas National Forest.

Dillingham, C., Burks, R., Troedson, B., Haug, R., Suihkonen, T. 2010. Treasure fire fuel treatment effectiveness report, USDA Forest Service, R-5, Tahoe National Forest.

Dillingham, C., Mayer D. 2010. Brown wildfire, Hat Creek complex and Jawbone DFPZ fuel treatment effectiveness report, USDA Forest Service, R-5, Lassen National Forest. 6 pp.

Dillingham, C., Mayer D. 2010. Sugarloaf wildfire, Hat Creek complex and Station DFPZ fuel treatment effectiveness report, USDA Forest Service, R-5, Lassen National Forest. 8 pp.

Estes, J., Vermillion, J., Dillingham, C. 2010. Ponderosa wildfire and the effectiveness of the Slapjack DFPZ, USDA Forest Service, R-5, Plumas National Forest.

Estes, J., Vermillion, J., Dillingham, C., Cherry, D. 2010. Friend-Darnell wildfire and the effectiveness of the Brush Creek DFPZ, USDA Forest Service, R-5, Plumas National Forest.

Fites, J., Campbell, M., Reiner, A., Decker, T. 2007. Fire behavior and effects relating to suppression, fuel treatments, and protected areas on the Antelope Complex fire, AMSET Fire Behavior Assessment Team Report, USDA Forest Service, Pacific Southwest Research Station, 31 pp.

Holcomb, John F. 2008. Rich wildfire fuel treatment effectiveness, USDA Forest Service, Plumas National Forest.

Hood, L. 1999. A defensible fuel profile zone (DFPZ) gets put to the test (Dow Fire), USDA Forest Service, Lassen National Forest.

Kerr, D. 2007. Evaluating the success of fuels treatments on initial attack fires, Adaptive Management Services Enterprise Team, USDA Forest Service, 28 pp.

Lamb, J., Dillingham, C. 2009. Milford Grade fire fuel treatment effectiveness report, USDA Forest Service, R-5, Plumas National Forest

Maleki, S. 2007. Tested by fire: the Cone fire and the lessons of an accidental experiment. Science Perspectives, Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA.

Merriam, K. 2008. Pittville fuel treatment effectiveness report Peterson Fire complex, USDA Forest Service, Lassen National Forest, 24 pp.

Moghaddas, J., Abrams, S., Duncan, P. 2006. Boulder complex fire behavior, suppression action, and severity, USDA Forest Service, Mt. Hough RD, Plumas National Forest, 5 pp.

Reinhardt, E.D., Scott, J.H., Gray, K.L., Keane, R.E. 2006. Estimating canopy fuel characteristics in five conifer stands in the western United States using tree and stand measurements. Canadian Journal of Forest Research 36, 2803-2814.

Ritchie, M., Oliver, B., Skinner, C., Farris, K., Zack, S., Nakamura, G. 2003. Effects of altering stand structure on wildfire severity and effects in the Black Mountain Experimental Forest, Cascade Range, California, Joint Fire Science RFP 2003-2 Task 3, Project number 03-2-3-20, 9 pp.

Scott, J.H., Reinhardt, E.D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. USDA Forest Service Rocky Mountain Research Station, Research Paper RMRS-RP-29, Fort Collins, CO.

Skinner, C., Richie, M. 2007. The Cone fire: A chance reckoning for fuel treatments. In: Fire Science Brief, Issue 4, January 2008, www.firescience.gov, 5 pp.

Wintch, Michael. 2009. Butte wildfire fuel treatment effectiveness, USDA Forest Service, Lassen National Forest.