Hazardous Fuel Treatment Projects for Community Protection—Shingletown, California

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Hazardous Fuel Treatment Projects for Community Protection—Shingletown, California

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Abstract

This report evaluates multiple aspects of the Shingletown Fire Safe Program: the collaborative process, costs, potential savings, accomplishments, and lessons learned. It provides managers with a guide for developing a similar program and suggests possible strategies to follow when collaborating with a community, which is an essential element for success. The Shingletown fuel treatment program began in 1992 with community involvement in clean-up days targeting neighborhoods and has expanded into a Fire Safe Plan covering over 110,000 acres with multiple projects implemented each year. At the start of the program, extensive time and effort were spent with the community on education, cooperation, and implementation of a fire-safe program for the area. Community support and careful attention to detail during planning have been key to the success of the program, which is still active after 12 years.

1. Introduction

1.1. Project Area Description

The community of Shingletown and the surrounding rural residential areas occupy approximately 27,520 acres along Highway 44, 35 miles east of Redding in Shasta County, northern California (*Fig. 1*). The total population of the area is approximately 8,000 residents occupying 2,800 housing units, in twelve main neighborhoods. The community runs along a ridgeline (approximately 20 miles long) in the southern foothills of the Cascade Mountains at an elevation of 1,500–4,500 ft above sea level. The climate is seasonal and varies with elevation. Summers are hot and dry and winters are cool with moderate rainfall and periodic, heavy snowfall in the higher elevations. Annual precipitation is about 53 inches, most of which falls in the winter and spring months.

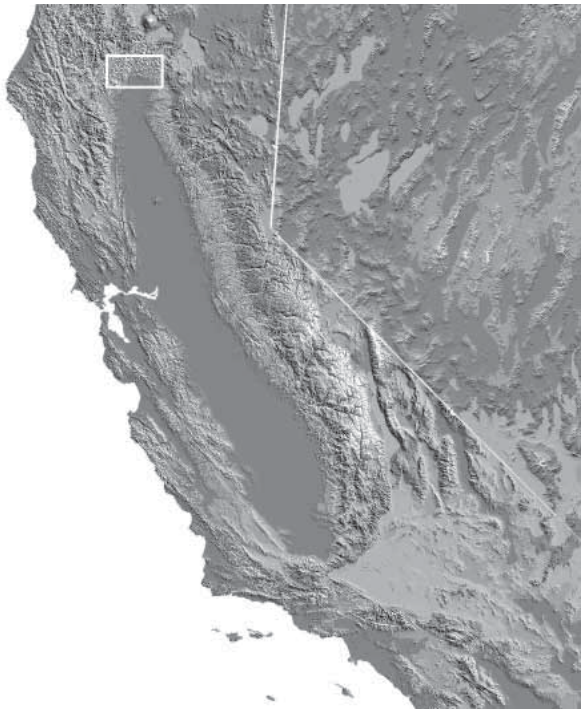

Figure 1—Location of the Shingletown, CA, project.

Vegetation in this area is primarily pine and mixed conifer with an understory of chaparral shrub and

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Figure 2—Vegetation is mixed conifer with understory of brush. Photo shared by WSRCD.

tolerant conifer species (*Fig. 2*). There are large areas of continuous, heavy fire fuels on the forest floor. *Figure 3* is an example of a typical forest stand with tightly spaced trees and crowns. Past logging (followed by natural regeneration) and successful fire-suppression activities for the past 100 years have significantly increased the volume and types of fuels across the landscape, resulting in high to very high fire hazard ratings throughout the area (WSRCD 2003). Within this vegetation, there are dense clusters of homes and businesses. Between 1910 and 2000, there have been 32 recorded wildfires in the area which burned 45,455 acres. The Shingletown ridge has more lightning strikes per acre than anywhere else in Shasta County (WSRCD 2003).

The community of Shingletown has historically consisted of retirees who are active in the community. Volunteerism and participation in community events are high. Most of the residents moved to the area to live in a natural forest environment and are very aware of the fire danger in their community.

1.2. Project Area and Partners Involved

In 1995, the California Department of Forestry and Fire Protection (CDF), in partnership with California State University, Chico (CSUC), completed the Shingletown Wildfire Defense Plan for the community and surrounding area, covering 40,000 acres. It has since been updated with the Fire Safe Plan for the Shingletown Community (2003), prepared by the Western Shasta Resource Conservation District (WSRCD). This updated plan expanded the planning area to 112,100 acres, of which 5% is federal land, 44% is privately owned timberland, and 51% is other private land (i.e., residential parcels, farms and ranches). Partners in the Wildfire Defense Plan and the Fire Safe Plan include CDF, CSUC, WSRCD, California Department of Fish and Game, California Department of Transportation, Wheelabrator Energy Company, telephone and power utility companies, and landowners and land managers.

2. Goals and Objectives

The initial goals of the project were to reduce costs and losses to the community in the case of a future catastrophic wildfire. Quickly, however, the benefits in terms of improved landscape quality, forest health, and wildlife were recognized, and these benefits became very important to residents' decisions to participate.

In order to achieve the overall goal of reduced damage due to wildfire, the following specific objectives were included in the 2003 Fire Safe Plan for Shingletown Community:

- Define the boundary of the planning area in order to maximize coordination with other groups performing similar work in the area.

Figure 3—Vegetation cover of dense coniferous stand. Photo courtesy of WSRCD.

- Identify assets at risk, including streams, timber, wildlife, and buildings.
- Encourage effective, community-based fire-safe practices around structures.
- Identify, prioritize, and map potential fuel-reduction projects that will minimize the potential for wildfire to burn into the community, provide for human safety, and minimize private-property loss.
- Develop maps of features that are important for fire prevention and control, including soils, fire history, vegetation, land ownership, topography, roads, and the locations of residential areas.
- Foster and maintain multi-agency and landowner roles and responsibilities in the implementation and maintenance of the Shingletown Fire Safe Plan.
- Enter the completed plan on the Western Shasta Resource Conservation District's web site.

3. History

3.1. Impetus for the Project

The leaders of the Shasta-Trinity Ranger Unit of CDF recognized the need to implement fire-safe measures in the community of Shingletown. The community had a high fire risk, excessive fuel loads, higher than average number of lightning strikes, significant increases in development, and high potential losses should a wildfire occur in the area. In 1992, Battalion Chief Ralph Minnich joined Ron Hodgson of CSUC to begin a fuel hazard mitigation program with community cooperation in the Shingletown area. Just after the initial meeting between Minnich and Hodgson, the Fountain Fire of 1992 (*Fig. 4*) burned approximately 64,000 acres in Shasta County, destroying over 600 buildings.

In 1993, Hodgson was awarded a grant from the State of California to work in partnership with CDF to accomplish the following:

- Create a Wildfire Defense Plan.
- Develop and provide educational materials about community fire-safe guidelines.
- Encourage community involvement in developing and implementing a shaded fuelbreak within the Shingletown community.

3.2. Social Theory

3.2.1. Background on Social Theories

When Minnich (CDF) and Hodgson (CSUC) initiated their program in 1992–1993, they wanted to foster collaboration with the community. In order to do this, they focused on implementing social theories that address the way people make use of new ideas (Hodgson, personal communication), including the following concepts:

- Diffusion of innovation
- Principles of adult learning
- Social marketing

The diffusion of innovation theory suggests that adopting innovative ideas takes time—different people respond to innovation differently, and strategic marketing can decrease resistance to change (Surry 1997). The theories involved in the principles of adult learning acknowledge that adults have special needs and requirements as learners compared to children and teens, including the need to direct

Figure 4—Visit to a site burned during the Fountain Fire of 1992.

themselves, to be actively involved in the learning process, to use life experiences and knowledge related to the topic, and to have objectives identified from the beginning (Weinreich 2004). Social marketing makes use of concepts from commercial marketing in the planning and implementation of programs designed to bring about social change. Important concepts include directly linking objectives with actions and the belief that actions occur when the audience believes that the benefits are greater than the costs (Lieb 1991).

3.2.2. Social Theory Implementation

Minnich and Hodgson implemented these theories while working with the community. They initially met with opinion leaders and directors of community organizations to discuss the program in general terms and explain the threats fire poses and potential mitigation methods. The community leaders learned about the basics of fire behavior and fire effects and how fuel mitigation could change fire behavior. The CDF/CSUC team taught them about the historic role of fire in the mixed conifer forest and what the landscape looked like before logging and fire exclusion. Community leaders were asked to offer advice on likely objections the residents would have, allowing the educational program and recommendations to be altered ahead of time.

Only after the support of the formal and informal community leaders had been gained was the project presented to the community. This helped to ensure that when residents turned to their community leaders for advice on the project, the leaders were well-informed and supportive. Minnich, Hodgson, and community project advocates sponsored numerous social and educational gatherings to promote acceptance for the hazardous fuel reduction and defensible space program. They drew upon a large, strong base of community volunteers who adopted the concept and the program quickly, and took on the task of sharing information with their peers.

When hazardous fuel treatment for defensible space was initially discussed with homeowners, several concerns were raised:

- Cutting and removing the vegetation that was a beloved attribute of the area.
- Loss of screening.
- A perceived loss of visual quality.
- Impacts on wildlife habitat.
- Disposal of cut vegetation.
- Establishing fuel treatment standards.
- Erosion and adverse effects on water quality.

Resource specialists at community gatherings addressed these concerns and distributed written educational material and guidelines. In 1993, the first demonstration project was developed on one lot in the Shasta Forest Village neighborhood. Interest by homeowners spread quickly throughout the neighborhood the first year. The following year other neighborhoods in the Shingletown community began participating. Participants became interested in the project through word of mouth, observation of the work, information sharing and education at social and educational gatherings and meetings of existing organizations, and articles in the local newspaper.

3.3. Shingletown Wildfire Defense Plan (1995) and Fire Safe Plan (2003)

The actual writing of the 1995 Shingletown Wildfire Defense Plan did not occur until several years after initial implementation. The 1995 Plan included action items to reduce the threat of catastrophic wildfire:

- Educational materials were developed and provided to the community. A pamphlet titled “Community Fire Safe–Fuel Reduction Guidelines” was designed that contains illustrations of how to design landscapes around individual homes with fire safety in mind. A video on “Fire Safe Living Space” was developed, and demonstration projects were carried out within the community.

- Funding sources were identified and developed to support cooperative hazard reduction by public and private landowners.

- Recommendations were developed for specific hazardous fuel modification projects (particularly fuelbreak locations and fuelbreak vegetation management guidelines).

- The private sector (local contractors) was encouraged to become interested in applying landscape management techniques to wildland fire defense landscaping.

- A variety of neighborhood-scale landscape designs that demonstrate fire safety and forest health were developed.

In 2001, the Western Shasta Resource Conservation District received a grant from the U.S.D.A. Forest Service to expand the 1995 plan to encompass the entire ridge. The plan, revised in 2003, includes 10 high-priority hazardous fuel reduction projects, 14 high-priority roadside shaded fuelbreaks, and 7 other action items to improve the fire-safe conditions in the Shingletown area. To accomplish the plan, a Technical Advisory Committee was assembled that included representatives of all stakeholder groups. The committee and community were involved in extensive meetings, including field trips to various sites (*Fig. 4*).

Action items that were necessary for development of the 2003 Fire Safe Plan included the following:

- Identify long-term options for the maintenance of fuelbreaks.

- Identify mechanical treatment of excess fuels and possible uses.

- Develop a priority list of recommendations for hazardous fuel treatment.

- Determine potential funding sources.

4. Costs and Potential Savings

4.1. Costs

Hazardous fuel treatment (fire-safe) projects for community protection began in 1993. They have been reassessed and additional treatments and new projects have been added as needed. The projects have been funded through various federal and state grants, with costs shared among multiple agencies and with the participation of landowners and land managers, and supplemented with the sale of removed wood as chips to a nearby biomass power plant. *Table 1* provides a summary of the projects funded, the amount of the grants, how costs were shared and total cost estimates for 1993–2004. Estimates and assumptions were made to determine an approximate cost since detailed records were not available. Determining a complete history of total costs for the project is difficult for several reasons: the lead agency changed from CDF to WSRCD, several personnel changes have occurred within CDF since the program's inception, the sizes of lots treated during community clean-up days varied, there were voluntary contributions of time and/or equipment, and different types of projects were implemented annually. It appears that there has been no centralized location for filing cost figures since the inception of this program.

The bracketed figures in *Table 1* are estimates based on several assumptions: CDF Shasta-Trinity Unit annual contributions (where none are noted) were $15,000; an average cost per green ton was $60; and California Department of Corrections (CDC) inmate crews' contribution to fuelbreak work (where none are noted) was estimated at $442 per acre. Based on this information and a 10% factor for error, approximately $800,000 has been spent on this program (including shared costs) from 1993–2004.

4.2. Potential Savings and Effectiveness of Treatment

This on-going program is intended to produce an incremental reduction in the chances of severe fire in and around the community of Shingletown. The objectives of the fuel treatment program over the long term are to lower fire-suppression costs and post-fire restoration costs, reduce smoke, reduce wildfire-related property damage, and decrease lost socioeconomic and ecological forest benefits.

***Table 1**—Funding history (1993–2004) for the Shingletown Fire Safe Program*

Year	Grant (agency)	Amount of grant	Shared costs (contributed)[1]	Total cost estimate	Project description
1993	California Forestry Incentive Program (CDF)	$15,000	CDF overtime salary, equip., fuel, crew work: $2,300 Energy biomass sold: $3,200	$30,000	Developed community-based fuel hazard management program including educational material and handouts and developed and wrote the Wildfire Defense Plan. Removed 90 green tons of fuel from one neighborhood.
	Stewardship Grant	$9,000	CDF Volunteers in Prevention		
1994–1997	Hazard Mitigation	$4,200	Donations from participants: $7,239	$81,950 or average cost $65/green ton	Removed 1,266 green tons of fuel during community clean-up days from 12 neighborhoods, averaging 165 participants per year (over 5 years).
	Stewardship Grant (CFIP, CDF)	$11,000	Energy biomass sold: $31,427		
	Vegetation Management Program (CDF)	$5,000	CDF Shasta-Trinity Unit: $23,082		
1998	N/A	N/A	Donations from participants: $1,870; unknown hours Energy biomass sold: $6,333 CDF labor, equip., fuel: $7,442	$15,650 or average cost $54/green ton	Removed 290 green tons of fuel (133 participants) during community clean-up days.
1998	Hazard Mitigation (FEMA)	$19,542	CDC inmate crew labor, 11,350 hours: work valued at $119,637	$121,590 or $1,335/acre	Constructed 2.5-mile (300-ft-wide, 91-acre) shaded fuelbreak. Removed 692 green tons of fuel; piled and burned approx. 230 tons.
1999	Forest Stewardship Program (CDF)	$14,996	Donations from participants: $2,845 Energy biomass sold: $9,653 CDF labor, equip., fuel, etc.: $7,959 CDC inmate crew labor, 8,585 hours: $56,704	$92,160	Removed 370 green tons of fuel (182 participants) during community clean-up days. Constructed 0.75-mile (300-ft-wide, 27-acre) shaded fuelbreak (fuels piled and burned).
2000	N/A	N/A	Donations from participants: $4,405 plus 291 hours Energy biomass sold: $13,315 CDF 426 labor, equip., fuel: $12,886 actual cost	$30,730 or $54.60/green ton	Removed 563 green tons of fuel (221 participants) during community clean-up days.
2000	N/A	N/A	CDC inmate crew labor: 4,580 hours	Work valued at $18,420 or $420/acre	Constructed 1.2-mile (300-ft-wide, 44-acre) shaded fuelbreak (fuels piled and burned).
2001	Western Wildland Urban Interface (USFS)	$35,060	Donations from participants: unknown CDF labor, equip., fuel: $14,500 Variety of other sources: $12,500	$66,560	Maintenance of 1-mile fuelbreak (36 acres, positively affecting 4,000 residents). Removed 264 green tons of fuel after community clean-up days.
2001–2002	Forest Service Community (USFS) Two-year Grant (Wildland Urban Interface)	$46,500	Donations from participants: $3,238 (2002) CDC inmate crew labor 1,688 hours [est. $6,788 work value] Variety of other sources: unknown [est. $30,000]	Unable to locate actual cost [est. $86,500]	Expanded 1995 Shingletown Fire Plan to encompass the entire ridge area. CDF printed and distributed color brochure "Are You Prepared? Wildland Fire Evacuation Plan for Shingletown Ridge." Fuelbreak maintenance 0.25 miles (10 acres; fuels piled and burned). Removed 270 green tons of fuel (255 participants) during community clean-up days.
2003	Unable to locate info	Unable to locate info	Unable to locate info	Unable to locate actual costs [est. $18,400]	Removed 216 dry tons (283 green tons) of fuel during community clean-up days.
2003–2004	Resource Advisory Committee funds (USFS)	$83,692	Variety of sources (majority were contributed costs from commercial timber landowner): $392,440	$476,132	Maintained 4 miles of existing fuelbreak, constructed new 0.5-mile shaded fuelbreak with landowner (1,080 green tons). Five-year plan to construct 19-mile fuelbreak with commercial timber landowner.
2004	Community Protection (USFS)	$16,100	Donations from participants: unknown Energy biomass sold: $4,960 CDF salary, equip, fuel, etc.: $21,950	$42,853	Removed approx. 240 tons of fuel during community clean-up days.

[1]Contributed costs include donations; CDF staff salary, equipment, and fuel use; CDC inmate crew hours; private landowner/manager implementation costs; products sold from project (biomass); and other partners' costs.
Abbreviations: *CFIP* California Forest Improvement Project, *FEMA* Federal Emergency Management Agency, *CDC* California Department of Corrections (supervised by CDF staff), *USFS* U.S.D.A. Forest Service

There have been no wildfires since the inception of the program to test the effectiveness of the treatments.

To estimate potential savings from the Shingletown program, the resources needed to contain a fire and the potential fire behavior would need to be analyzed using a spatially explicit fire-behavior model, such as FARSITE. Insufficient information was available to predict wildfire behavior changes due to the fuel treatments adequately. The locations, sizes and fuel conditions of all of the treatment sites would be needed to conduct a fire behavior assessment to evaluate potential benefits. Even then, the actual benefit would be impossible to predict exactly because by nature the location and spread of fire are unpredictable, and depend on the ignition source, location and weather.

The number of homes that could burn and the loss of timber production are hypothetical and depend on the actual location of the fire. If we assume that, without treatment, all homes would be lost, then a potential loss of $353 million might occur (assuming an average home value of $126,000). Fire treatments are expected to reduce the likelihood of loss of some homes, but without spatial fire-behavior analysis, it is not possible to quantify the amount of risk reduction.

5. Accomplishments

5.1 Organizational Collaboration

One of the reasons for the success of the Shingletown Ridge project was the extensive cooperation among organizations. In the first few years of the project, CSUC worked closely with CDF, organizing neighborhood work, arranging media coverage, assisting with actual labor, conducting community and block education programs and carrying out project planning and management. Later CDF handled most of the project, until the leadership role was taken over by WSRCD.

Throughout the project there has been close collaboration with California Department of Fish and Game, California Department of Transportation, Wheelabrator Energy Company, telephone and power utility companies and land managers.

5.2. Participatory Process

Another critical reason for the success of this project was the fact that Hodgson and Minnich made use of social theories. They paid careful attention to applying innovation diffusion, social marketing, and adult education theories to the project design and implementation. Throughout the project, all decisions made and actions taken were consistent with these theories.

Initial interaction with the community occurred through existing organizations. Such groups are often well organized and able to provide useful information about the community. They include individuals who are activists, opinion makers, initiators, and leaders and who know others in the community with these personalities and skills. With support from such individuals in Shingletown, the project became a community project immediately, allowing for meaningful involvement.

Hodgson and Minnich marketed the program to address homeowner needs: to protect family and friends, avoid damage to property, preserve the aesthetics of the wildland setting, and avoid disruption of the family and neighborhood. They provided resource specialists who were able to address the concerns of the residents and video presentations to provide additional information at meetings. Written material was provided to the residents and demonstration projects were established. Feedback from the homeowners was encouraged, including possible ways to improve the program.

5.3. Cooperative Involvement from Community Residents (The Shingletown Fire-Safe Community Project)

Annual community participation included (and continues to include) residents cutting fuels on their properties, and hauling the large slash material to the road (*Fig. 5*) where it is picked up, chipped (*Fig. 6*) and sold to a biomass power plant. Residents donate approximately $10 per pile to

Figure 5—Slash pile for pick up during annual community fire-safe program.

Figure 6—Fuels being chipped and hauled to co-generation plant. Photo shared by WSRCD.

participate in the program. The active participation of some community residents engages neighbors in the program. Because of initial concerns about retaining trees for screening (i.e., maintaining the natural vegetative state), the actual removal of vegetation by most landowners was conservative. The annual clean-up allows the homeowners to reassess their lots each year and complete additional work to meet the fire safe/defensible space goal.

5.4. Utilization

The area around Shingletown is ideally situated for using cleared vegetation as biomass for energy. The topography is relatively flat which allows access for heavy equipment. Highway 44 bisects the area and provides easy access to Wheelabrator Energy Company's biomass plant, approximately 20 miles from the Shingletown area. Because of this, the majority of fuels generated by the fuel reduction and fuelbreak construction are hauled to centralized locations, chipped, and sold to the nearby biomass power plant. The money generated from these sales helps offset the cost of the project. *Table 1* shows the amount of money generated (i.e., energy biomass sold) and the green tons generated during the projects. For economic and/or environmental protection reasons, other options for treating fuels include piling and burning, and masticating.

5.5. Building Community Relationships and Leadership Roles

While working on the Shingletown Fire-Safe Project, CDF and CSUC personnel and community residents worked together, creating a community bond and shared goals.

Ralph Minnich, former CDF Battalion Chief for the area, provided strong leadership and commitment and helped to ensure the success of the program. Residents took leadership roles starting with the initial design and continuing through implementation. Several of the original key participants in the community are still actively involved with the program 12 years later. The relationships that were built during the Shingletown Fire-Safe Project aided in the collaboration and development of the 2003 Fire Safe Plan.

5.6. Combining Fuelbreaks with Forest Treatments

Commercial timber landowners and managers cooperated in the hazardous fuel reduction/defensible space project. Fuelbreaks were designed to coincide with forest treatment of these lands. After stands were thinned of sawlogs of non-commercial standards, the understory vegetation was removed (*Fig. 7*). This work continues today, as fire crews and contractors are beginning to re-enter the shaded fuelbreaks for maintenance.

6. Lessons Learned

6.1. Changing Leadership Roles and Lead Agency

CDF and CSUC worked closely together to organize the volunteer Fire-Safe Community Program and actively led this program for several years

Figure 7—Pile burning after removal of small trees and brush. Photo courtesy of R. Minnich.

before most of the responsibility was turned over to CDF. Eventually the leadership for the program switched to WSRCD and the Fire Safe Council. With development of the Fire Safe Plan, the Shingletown program has grown to include many more projects and a much larger area. WSRCD is now responsible for the entire program, including taking the lead in applying for grants. Rapid expansion of the program is causing concern given WSRCD's limited staffing. Maintaining a strong base of leadership will be a key to the program's continued success.

6.2. Long-term Financing of Projects

The program is dependent on outside funding to implement new projects, and to maintain and continue existing projects. Grants are becoming far more competitive. Many years of work and money spent could be lost if the projects are not maintained over time. The lack of long-term funding threatens program continuity.

6.3. Collaboration

Several agency representatives provided the following advice on the collaboration process:

- Initial contact with the community is one of the most important steps in collaboration.

- It is essential to gain support from well-respected individuals in the community so that they become strong advocates for the project and program.

- Developing a bond and shared goals is important to creating an inclusive feeling between the community and agency representatives.

- Convincing residents that there is a problem is key, along with including the community in the solution.

- Rather than forcing people to do something, bring them along and have them feel ownership by being involved.

- Demonstration projects that show how treatments look, and ensuring that the treatments are visually pleasing, is critical.

- Encourage the community to take a leadership role and become more independent from government assistance with community programs. This will help with the transition during times of personnel changes and agency funding cuts. One motto was "this is a local project supported by government, not a government project supported by locals."

- Provide recognition and reward residents for their hard work.

Landowners and land managers interviewed provided additional advice:

- Agencies need leaders who have good relationships within the community.

- The agency representatives should care about the program personally and professionally and have the wherewithal to share knowledge, provide direction, and know how to acquire resources to make things happen.

- An agency should try to maintain consistency with personnel.

Do not assume the process is linear (pre-planning, planning, implementation, monitoring). The public wants to see results quickly and expects follow-through with planning efforts. It is necessary to educate the public that the forest is dynamic and treatment must respond to changes in the forest.

Collaboration requires an upfront investment of time and effort. It took many contacts over several years to generate support for this program. Collaboration and social theories have been around for a long time and are good resources. Learn to make use of what has been successful in the past and adapt it to the present problems.

6.4. Other Key Points

Other key points for managers include the following:

- When expanding the program, ensure all stakeholders are included. Develop a core team with broad-based representation to develop a plan. With good involvement and support for the plan, implementation will be smoother.

- Grant funding is inconsistent. Look at the big picture and do not worry about the order in which projects get funded. Look for all sources of funding and take advantage of every opportunity.

- Portable or permanent biomass power plants, if available, should be utilized to the greatest extent possible to help off-set costs.

6.5. Effectiveness of Treatment

Perspectives differ on how effective this program has been in terms of preventing a future catastrophic wildfire. Because of concerns described earlier in this document, most residents were initially conservative with the amount of hazardous fuels removed around their structures. Some residents chose not to participate in the volunteer program, and there are vacant lots where no hazardous fuel treatment has been completed. Due to these conditions, the community has a mosaic pattern of treated areas. It is believed that approximately 40–50% of residents have participated (Minnich, personal communication). The ability of the residents to reassess their lots annually, CDF personnel's willingness to inspect the lots for fire safety, and the neighborhood volunteers working with their peers allow for adaptive management, increasing the potential for its effectiveness over time.

One person interviewed commented on the ineffectiveness of the 300-ft-wide shaded fuelbreaks. He felt shaded fuelbreaks provided a false sense of security to the community. Effectiveness of fuelbreaks is a subject of debate within and outside of the fire management community. Fuelbreak construction and the behavior of the approaching wildland fire contribute to the effectiveness of a fuelbreak. Fuelbreaks are not designed to stop fires but to allow suppression forces a higher probability of successfully attacking a wildfire (Agee et al. 2000). Though there are no absolute standards for width, a minimum of 300 feet is typically specified for primary fuelbreaks (Green 1977).

From the start, however, the landscape-level approach to the Shingletown Ridge project was designed to accommodate concerns about both the patchiness of the treatment and the effectiveness of fuel breaks. It was understood that mitigation would be an incremental and adaptive effort. Even after several years, it would be unlikely that all properties would be treated. As long as untreated lots were scattered throughout the mostly treated community, suppression resources could be aimed at any ignitions on these lots and fires there would pose much less danger to neighboring land. The fuel break treatment was intended to compartmentalize the ridge, breaking apart the existing continuous, heavy fuels in high-risk areas in order to interrupt crown fires.

6.6. Cost–Benefit Analysis

Presently there is no consistent, inter-agency cost–benefit analysis for fuel-treatment projects. Evaluating the net benefits of fuel treatments involves estimating the effect of treatments on reducing the likelihood of extreme wildfire events by reducing wildfire intensity, severity, and scale, as well as the effects the treatments and wildfires have on forest-management costs and, of course, on the forest itself (Kline 2004). It is difficult to quantify economically the costs of natural- and cultural-resource losses from a wildfire.

Fuel treatments undoubtedly can be used to alter forest structure and modify wildfire behavior and severity. To date there has been little scientific quantification of whether fuel treatments make economic sense (Kline 2004). Examples of ecological forest benefits and losses that must be considered include timber and nontimber products, range and forage, fresh water, flood protection, terrestrial and aquatic habitats, wildlife, recreation, scenery, and carbon sequestration. Community benefits include increased property values resulting from improvements in landscape aesthetics, better access to watchable wildlife and birds, and increased usability of the property (see *Fig. 8* of post-treatment landscape and contrast with *Figs. 2* and 3). The Bureau of Land Management reported on a study showing that fuel hazard treatment can increase property values by as much as 10–30% (Stone and Tyler 2002). Potential community losses include property damage (e.g., homes, power lines, access ways) and lost revenue (e.g., wages, lost recreation revenue).

As mentioned previously, we were unable to perform a detailed benefit analysis in terms of potentially reduced fire severity, increased fire-suppression effectiveness, and reduction in number of homes that might be lost in a wildfire. This was due to a lack of readily available records on the location, extent and condition of areas treated for fuel hazard reduction. While detailed tracking of treatments and the condition of the land is an additional expense, it may be critical for providing key information on potential effectiveness.

7. Conclusion

The Shingletown Wildfire Defense Program started in 1995, expanded in 2003, and is still active and effective today. A carefully thought-out plan based on innovation diffusion theory, social marketing, and adult education principles was the basis for the project's success. No detail of planning was left out, from choosing the community leaders to be targeted, to the choice of message and the medium through which it was disseminated, to the incentives chosen. The strategies and tactics were well-grounded in established social theories, the detailed plans were carefully carried out and the plans allowed for monitoring and adapting as necessary. Innovative leadership and close collaboration with the community made the project a success.

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Figure 8—Post-treatment landscape. Fuels in this area were chipped and then the land was lightly burned. Photo courtesy of R. Minnich.

References

Agee, James K.; Benii Bahro; Mark A. Finney; Philip N. Omi; David B. Sapsis; Carl N. Skinner; Jan W. van Wagtendonk; C. Phillip Weatherspoon. 2000. **The use of fuelbreaks in landscape fire management.** Forest Ecology and Management 127:55-66.

California Department of Forestry and Fire Protection and University of California, Chico. 1995. **Shingletown wildfire defense plan.** Redding, CA: California Department of Forestry and Fire Protection.

Green, Lesle R. 1977. **Fuelbreaks and other fuel modification for wildland fire control.** Agric. Handb. 499. Washington, DC: U.S. Department of Agriculture, Forest Service. 79 p.

Hodgson, Ron, PhD. Retired professor, California State University, Chico. [Telephone conversation with Marian Kadota]. 13 October 2004.

Kline, Jeffrey D. 2004. **Issues in evaluating the costs and benefits of fuel treatments to reduce wildfire in the nation's forests.** Res. Pap. PNW-RN-542. Corvallis, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.46 p.

Lieb, Stephen. 1991. **Principles of adult learning**. In: Vision; 1991 Fall. Accessed via World Wide Web at http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/adults-2.htm on November 1, 2004.

Minnich, Ralph. Deputy Chief, California Department of Forestry and Fire Protection at Redding. [Telephone conversations with Marian Kadota]. 13 October 2004 and 20 December 2004.

Stone, Eric and Tammy Tyner. 2002. **A process and economics report on forest restoration and wildfire mitigation in southwest Colorado**. Report to the Four Corners Sustainable Forests Partnership. Quoted in BLM Snapshots 2003. Bureau of Land Management,

Surry, Daniel, W. 1997. **Diffusion theory and instructional technology.** In: Annual Conference of the Association for Educational Communications and Technology; 1997 February 12-15; Albuquerque, NM. Accessed via World Wide Web at http://www.gsu.edu/~wwwitr/docs/diffusion/ on November 1, 2004.

U.S. Department of Agriculture, Forest Service. 1998. **Fireline Handbook.** Forest Service Handb. 5109.32a (National Wildfire Coordinating Group Handbook 3 (PMS 410-1)). Boise, ID.

Western Shasta Resource Conservation District. 2003. **Fire safe plan for the Shingletown community.** Anderson, CA. 77 p. Accessed via World Wide Web at http://wim.shastacollege.edu/catalog.aspx?ws=3&act=Fuels%20Management%20Plan&format=Document on November 1, 2004.

Weinreich, Nedra Kline. 2004. **What is social marketing?** Accessed via World Wide Web at http://www.social-marketing.com/Whatis.html on November 1, 2004.

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