

September 2007

Safe at Home

Making the Federal Fire Safety Budget Work for Communities

Authors

Amy Mall

Natural Resources Defense Council

Franz Matzner

Natural Resources Defense Council

Contributing Editor

Niel Lawrence

Natural Resources Defense Council



About NRDC

The Natural Resources Defense Council is an international nonprofit environmental organization with more than 1.2 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, and Beijing. Visit us at www.nrdc.org.

Acknowledgments

The authors would like to acknowledge Ronny Coleman and Robert Miller of Emergency Services Consulting inc., Steven Daus of Daus and Associates, Warren Alford of Sierra Forest Legacy, and the Love Creek homeowners who generously volunteered to participate in this effort.

NRDC Director of Communications: Phil Gutis

NRDC Marketing and Operations Director: Alexandra Kennaugh

NRDC Publications Manager: Lisa Goffredi

NRDC Publications Editor: Anthony Clark

Production: Jon Prinsky

Copyright 2007 by the Natural Resources Defense Council.

For additional copies of this report, send \$5.00 plus \$3.95 shipping and handling to NRDC Reports Department, 40 West 20th Street, New York, NY 10011. California residents must add 7.5% sales tax. Please make checks payable to NRDC in U.S. dollars.

This report is printed on paper that is 100 percent post-consumer recycled fiber, processed chlorine free.

Table of Contents

Executive Summary	iv
Who Is Most at Risk?	iv
Firewise Measures Make Homes Fire Safe	v
Federal Fire Protections Fall Short	v
Protecting Life and Property Must Be the Top Priority	v
Chapter 1. Forest Communities at Risk	1
Chapter 2. Preventing Fire Damage: What Works (and What Doesn't)	2
Firewise Methods Prevent the Worst Fire Damage	2
Backcountry Logging Does Not Protect Communities from Fire	3
Chapter 3. The Love Creek Pilot Study	5
Study Finds Many Homes at Risk	5
The Price Tag for Fire Preparedness	6
Love Creek's Lessons	7
Chapter 4. Federal Fire Funds Don't Address Community Safety	8
State, Local, and Volunteer Fire Assistance Programs Are Underfunded	9
The Federal Hazardous Fuels Reduction Program Does Not Prioritize Community Protection	9
Forest Service Management Diverts Funds to Risky Activities	10
Timber and Roadbuilding Increase Fire Risk	11
Chapter 5. Recommendations for Protecting Homes and Communities from Forest Fires	13
Appendix A: The Love Creek Pilot Study: Experts and Methodology	14
Endnotes	15

Executive Summary

Every summer, images of wildfires dominate TV screens and newspaper headlines. Smoke jumpers are deployed, planes dump retardant slurry on the flames, and firefighters dig trenches to halt the fires' advance. Yet despite the effort—and the money—that goes into emergency response, fires destroy hundreds of homes and whole neighborhoods in the American West during wildfire season.

Homes can best be protected by “firewise” measures that improve the fire resistance of structures and modify the surrounding vegetation in order to limit the spread and intensity of these dangerous fires. However, a new NRDC pilot study of a community in California’s Sierra Nevada region found that not a single home there met the minimum standards necessary to maximize the chances of the home surviving a fire. Fortunately, the fixes are relatively easy and affordable. Unfortunately, federal dollars that should be spent on firewise protections are instead diverted to commercial logging and other misguided practices that do not make communities safe, and may even heighten fire risks.

Misdirected federal priorities not only leave woodland homes exposed, but also reinforce a vicious funding circle that makes ever-increasing demands on the federal budget. Failure to get communities firewise means that fewer fires can be allowed to burn, for fear they will escape and reach a town. Increased suppression, however, can increase the intensity and threat of future fires. That, in turn, leads to an ever greater need for suppression funding. Attacking the problem of community safety directly and effectively will help break this cycle and make it possible to reduce suppression, and suppression funding, in the future.

WHO IS MOST AT RISK?

While wildfires occur across the country in forests, grasslands, and chaparral, this paper focuses on forest fires in the American West. Nearly 3.2 million homes in California alone are at very high or extreme risk of wildfire according to the California Department of Forestry and Fire Protection.¹ The West is undergoing an explosion in development, much of it occurring within or near the borders of public, state, and private forestland—in what is known as the Wildland-Urban Interface, or “WUI.” National demographic shifts mean that more and more people are building homes in the WUI. Some experts estimate that nearly 60 percent of all new home construction between 1990 and 2000 was done in WUI areas.² With more and more people moving into these at-risk communities, the need is greater than ever for the government to step up forest fire protections.

FIREWISE MEASURES MAKE HOMES FIRE SAFE

Firewise methods work: U.S. Forest Service research has shown conclusively that firewise methods are the way to protect homes from wildfires. Firewise methods convert high-intensity fires to low-intensity ones around homes, and keep low-intensity fires from igniting structures. When homes are not firewise, even low-intensity fires can set a house ablaze.

FEDERAL FIRE PROTECTIONS FALL SHORT

Although solutions exist to protect homeowners and neighborhoods in the West from forest fires, the federal government is still not doing what it needs to do to make sure these proven methods are implemented on the ground. Instead, federal agencies charged with responding to wildland fire threats continue to invest huge sums of money in logging projects that take place far away from communities, have not been shown to reduce community risk, and may in fact exacerbate fires because commercial logging removes the least flammable materials, often leaving the rest behind, and logging roads greatly increase human-caused fire starts. In fact, only 3 percent of the \$2.7 billion federal fire budget is dedicated to supporting state and local community fire programs that, among other things, promote firewise measures. Funding for these programs has been repeatedly slashed; it is now little more than half of the 2001 level.

PROTECTING LIFE AND PROPERTY MUST BE THE TOP PRIORITY

Firewise improvements are the only proven way to protect homes from fires. The federal government must make spending and policy decisions that support effective firewise improvements, rather than spending funds on activities that may do nothing to save homes or reduce forest fires—and worse, may even increase risks. NRDC research points to the following recommendations for ensuring that all homes and residents are protected:

- Funding must be shifted away from counterproductive programs such as subsidized logging and road-building and channeled into programs that can most increase fire safety, including identification of high-risk communities, public education, community planning, and implementation of firewise practices.
- The Forest Service hazardous fuels reduction program budget—currently used to fund unproven fire prevention techniques—should be directly funding community firewise needs.³ In particular, federal lands in the immediate vicinity of homes, communities, and public infrastructure need to be made firewise.
- State and local governments must receive more federal support to directly help homeowners and community leaders implement firewise practices.

Communities urgently need education, planning, and resources in order to prepare for wildfire events. It is time for Congress to insist that federal fire agencies' budgets clearly reflect the national priority to protect homes.

Make Your Home Firewise

Residents in the West and other fire-prone areas can protect their homes from forest fires with some easy, relatively affordable fixes:

- Install fire-resistant roofing when replacing existing roofs.
- When landscaping, remove the most flammable vegetation from the immediate vicinity of your home by spacing shrubs, pruning tree branches up from the ground and away from structures, removing smaller, more flammable trees, and disposing of dead leaves and needles.⁴
- Make home exteriors fire-resistant and install solid core doors that can withstand high temperatures and delay, or even prevent, exterior ignition.
- Replace easily breakable single-pane windows with double pane windows or tempered glass, or cover single-pane windows with window covers.
- Apply fire-resistant coating to outdoor decks, or enclose the underside of a deck to leave it less vulnerable to flame.
- Make sure the street address is clear from the street and that the driveway is easy to navigate, to ensure that fire crews can locate and access the home in case of fire.

1. Forest Communities at Risk

For years, wildfires have conjured fear in communities across the American West. Smokey Bear taught us all that forest fires are harmful and should be prevented. Yet scientific investigation has concluded that fire is an essential aspect of a forest's life cycle, as natural and necessary as sunshine and rain for most of our forests to flourish.

Fires burn differently all over the West, depending on climate, terrain, elevation, forest conditions, and more. Each specific fire pattern is called a "fire regime," and reflects the unique condition of the forest involved. In some areas, fire's natural pattern is a very low-level burn that does not kill large, mature trees, but only clears out grass, brush, and small trees along the ground. In others, high-intensity blazes that burn entire stands of trees (which regrow naturally following the fire) are the norm. Whatever the fire regime, fire is critical for many forests to exist in their natural state and inevitable in almost all.

Individual forest ecosystems are specifically adapted to their particular fire regime, and many species have evolved with characteristics that protect them from fire, or even take advantage of fire to thrive. The lodgepole pine and the Sargent cypress, for example, have cones that require high heat to melt the substance that keeps the cones closed. Without fire, the cones would never open and release their seeds; new trees would never grow. Fires also help keep insects and diseases in check.

In the early 1900s, the infant U.S. Forest Service campaigned heavily to institute a practice of aggressively fighting and extinguishing forest fires. By 1930, it was apparent that suppressing natural fires led to a build-up of forest material that caused subsequent fires to be larger and more difficult to control.⁵ The agency, however, continued to try to put out every fire by 10 a.m. the day after its discovery. Scientists both inside and outside the U.S. Forest Service now readily acknowledge that in many places this policy of complete fire suppression has led to significant adverse consequences for forest health. Conversely, where fires have been allowed to burn naturally, we see healthy forests and wildlife habitat. The Forest Service itself now states that, "[w]ildland fire, as a critical natural process, must be reintroduced into the ecosystem."⁶

Predictably, fire suppression has been accompanied by more and more Americans building their homes in the woods. This growing population in the WUI escalates fire risk two ways. It increases the probability of man-made fires while exposing ever more residents to both human-caused and natural fires. This sets the stage for tragedy when fires eventually overwhelm suppression capacity. Protecting these homes and communities must be the top priority for federal, state, and local agencies responsible for wildfire management.

2. Preventing Fire Damage: What Works (and What Doesn't)

Fortunately, there is now a strong body of research on how best to protect the homes and communities facing fire risk. Extensive Forest Service research shows that the only effective way to protect a residence from forest fire is to make the house and its immediate surroundings firewise. Simple, practical measures such as converting to fire-resistant roofing and removing all of the most flammable vegetation around a home allow it to survive a wildfire.

FIREWISE METHODS PREVENT THE WORST FIRE DAMAGE

For years, observers noted that some homes survived wildfires while others nearby were destroyed. Fire behavior research began to explore what made the difference and which methods could best protect homes and communities. The Forest Service's Fire Sciences Lab has taken the lead in researching this question, carrying out experiments by building structures in a forest and then lighting fires around them to understand what characteristics contribute to home survivability, visiting communities that have recently experienced a fire in order to assess what actually happens to structures, and developing models to help predict home safety.

A home cannot burn down unless it is ignited. According to the Forest Service's lead expert on the topic of home ignitions, Jack Cohen: "[s]tructure ignition modeling, fire experiments, and WUI fire case studies indicate that the fuel and heat required for home ignitions only involve the structure and its immediate surroundings—the home ignitability context."⁷ Cohen points to a "40-meter zone" of the home and its immediate surroundings that determines home ignitability.⁸ Inside this zone of approximately 130 feet from the exterior walls of a home, critical but simple actions can be taken to address the most common fire threats and make a home firewise (for specific recommendations on how to make a home firewise, see page v).

There are several ways a home could ignite during a forest fire. One of the highest risks is from something called a "firebrand," a small piece of burning wood that has broken off a tree during the fire and is being carried by wind. Because forest fires are fueled by and generate big winds, firebrands can be carried for miles, and can land on a rooftop or be blown into a house vent. This causes houses to ignite and burn down. If a house is firewise, however, and has a fire-resistant roof and proper vent screening, this avenue of destruction is closed off.

A second way that a home can ignite is from fire moving into vegetation that is close to something flammable on or adjacent to the house. To avoid this, trees and other plants immediately surrounding the house can be managed to reduce the risk of fire spread, while the structure itself is constructed or retrofitted with fire-resistant exterior materials, including doors and windows that can withstand high heat. Flammable items near a house, such as stacked firewood and propane tanks, must be relocated, and attached structures such as porches must be treated or constructed to resist ignition.

Firewise vegetation management includes spacing shrubs and trees, pruning tree branches, disposing of dead leaves and needles, and preventing vegetation from regrowing.⁹

Empirical evidence shows that firewise tactics work. According to a Los Angeles Times analysis of more than 2,300 structures destroyed during California's 2003 Cedar Fire, "[f]ire-resistant construction and vigilant removal of flammable vegetation significantly improved the odds of a home's survival."¹⁰ In the 1990 Paint Fire in Santa Barbara, California, 479 homes were completely destroyed, but the chances of a home's survival increased from 19 percent to 70 percent if it had non-wood roofing, and from 15 percent to 90 percent if flammable vegetation had been cleared around the home. If both of these measures were taken, and someone was present to defend the structure, structure survival rates increased from 4 percent to 99 percent.¹¹

Materials explaining how to take all of these steps are available from several sources, most notably from the national Firewise Communities website, which offers brochures, videos, articles, and more.¹² Organizations like the American Red Cross and the Federal Emergency Management Agency, state cooperative extension programs, and local fire departments can also help a homeowner learn about making a home fire safe. In addition, homeowners insurance companies are acknowledging the value of firewise practices.¹³ The National Fire Protection Association (NFPA) has established a building standard for "Protection of Life and Property from Wildfire," with checklists for construction and landscaping, and recommendations for firefighter access and safety.

Not only are these measures critical for the survival of an individual home, but they are equally essential for the survival of a neighborhood. When homes are close together, the ignition of a home can come from neighboring structures or landscaping, rather than a firebrand, adjacent tree, or creeping ground fire. Without proper treatments, a community of hundreds of houses can be destroyed in just a few hours. Similarly, community survival can hinge on firewise treatment of key infrastructure, including access and escape roads, public open spaces, and water supply facilities.

Despite the success of firewise methods, many WUI homes—probably most WUI homes across the West—are still not firewise. Homeowners who live in fire prone areas lack the necessary information and/or resources to implement the full suite of firewise recommendations. Moreover, many homes and much essential community infrastructure stands on federal lands that have not been rendered firewise.

At the same time, federal agencies continue to devote taxpayer dollars to non-essential and even counterproductive measures—primarily backcountry logging—arguing that they will protect communities from wildfires and ignoring the science that shows otherwise.

BACKCOUNTRY LOGGING DOES NOT PROTECT COMMUNITIES FROM FIRE

Cutting down trees away from communities—in what is called the "backcountry"—is not a proven method to reduce fire risk to homes and neighborhoods. Forest Service expert Jack Cohen states categorically that backcountry logging "does not effectively change home ignitability."¹⁴ In 2005, fire scientists found that "fuels treatments have been suggested as a means to limit the size and intensity of wildfires but few experiments are available to analyze the effectiveness of different treatments."¹⁵ An Interior Department publication noted in 2002 that "scant information exists, however, on the efficacy of fuel treatments for mitigating wildfire severity."¹⁶ As recently as 2006, a scientific report concluded that "[r]emoving dead trees and other fuels can effectively reduce the risk of fire damage at a local scale, e.g., in the immediate vicinity of a home or community. However, the effectiveness of harvest in reducing fire risk over larger areas, e.g., a forest landscape, is less clear."¹⁷ A comprehensive survey of the relevant scientific literature also found that backcountry logging was unsubstantiated as a fire reduction technique, stating that "the proposal that commercial logging can reduce the incidence of canopy fire appears completely untested in the scientific literature."¹⁸

In fact, forest thinning as actually performed under real world conditions can exacerbate fire risks. A recent study of national forests in the Sierra Nevada found that, after a forest fire, “mechanically thinned,” or logged, areas experienced significantly higher fire-induced tree mortality during the fire than adjacent unlogged areas. The logged areas “burned at high severity,” while unlogged areas “burned predominantly at low and moderate severity.”¹⁹ Similarly, the Forest Service’s own retrospective study of how fuel reduction efforts affected subsequent fire intensity in Colorado’s Hayman Fire found that “each of the different types of fuel modification...had instances of success as well as failure in terms of altering fire spread of severity.”²⁰ Thus a panel of prominent fire ecologists and forest scientists reported to President Bush that “[a]lthough a few empirically based studies have shown a systematic reduction in fire intensity subsequent to some actual thinning, others have documented increase in fire intensity and severity.”²¹

Firewise Measures Protect Against Fire Risks from Bark Beetle Outbreaks

Many western forests, including some in California, are currently experiencing a high level of bark beetle infestation, leading to a proliferation of weak and dying trees. There have been calls to cut down many of these trees in order to stop the spread of the beetle outbreak and to reduce the fire risk from the increased number of dead trees. Scientists have reached consensus on several important points: (1) cutting down the dead or dying trees will not stop the spread of beetles if they are already present in an area;²² (2) the high levels of bark beetle infestation will not necessarily increase fire risk;²³ and (3) cutting down dead or dying trees far away from communities may not help protect those communities from fire risk.²⁴ Concerns about fire threats from bark beetle outbreaks and the many dead trees they leave are best addressed by protecting communities and infrastructure through proven firewise methods that increase a community’s chances of surviving a forest fire.

According to the Forest Service, “Timber harvesting ‘opens’ a forest (Countryman 1955), which allows more sunlight to penetrate to the forest floor causing the fine fuels, needles, and small sticks to dry faster and to stay dry longer. In addition, wind is able to penetrate into an open forest, which can sometimes cause fires to spread faster and become larger.”²⁵ Often, logging operations leave behind limbs, twigs, needles, and small saplings. These woody materials do not have any commercial value and are difficult to remove from the forest, so they get left behind. However, they are also the most flammable materials. A 2000 Forest Service report found that “timber harvest can sometimes elevate fire hazard by increasing dead-ground fuel, removing larger fire-resistant trees, and leaving an understory of ladder fuels.”²⁶ Moreover, federal agencies cannot pre-determine where a fire will start, or how it will travel once it starts, making it impossible to locate logging projects with any confidence in areas where fire will actually occur in the foreseeable future.

The risks and uncertainty associated with remote thinning operations make them a poor use of federal funds intended to protect communities. Evidence that backcountry logging can actually increase fire risk only magnifies the concern over the fact that so much federal money is being spent on activities with such uncertain outcomes.

3. The Love Creek Pilot Study

In the spring of 2006, NRDC engaged expert consultants to conduct an assessment of a typical WUI community in the central Sierra Nevada region of California. The Love Creek community is a neighborhood of approximately 50 homes in the town of Avery, located in Calaveras County. The homes are nestled within the steep slopes of a mixed conifer forest in a climate that is naturally home to periodic forest fires and can burn with high intensity. Most recently, in 2001, the Darby Fire burned more than 3,000 acres in the area.

The Love Creek community shares one boundary with the Stanislaus National Forest and another with private timberland owned by Sierra Pacific Industries. These federal and private lands are neighbors to many of the Love Creek homes.

We picked Love Creek as a manageably sized discrete study area, with residents interested in how to protect their homes from wildfire and willing to participate in our project. We asked our experts to assess two key indicators: how well prepared for fire the community is; and what it would cost, homesite-by-homesite, to make it firewise. A relevant question beyond the scope of our study is: how many homes in the U.S. are within the WUI and at significant risk of destruction by wildfire?

STUDY FINDS MANY HOMES AT RISK

Even though most of the homes surveyed met the minimum state-mandated clearance guidelines around homes, not one home in the NRDC pilot assessment complied with all of the basic standards necessary to ensure survival from a forest fire. Every home assessed failed multiple safety measures. The good news, however, is that these homes can survive a forest fire with easy and relatively affordable retrofit fixes.

NRDC brought in two experts to assess fire risk in the Love Creek community. Emergency Consulting Services, inc. (ESCi), led by former California State Fire Marshal Ronny Coleman, examined the ability of individual homes to survive a wildfire, the extent of mitigation practices needed in this typical community, and the cost of such mitigation, all based upon nationally recognized and established professional standards. Daus and Associates, led by California Registered Professional Forester Dr. Steven Daus, reviewed the vegetation surrounding each home and the mitigation practices needed to maximize the home's chances of surviving a fire. (For more information on the experts used in the pilot study, see Appendix A.)

Working in close cooperation with the Love Creek Homeowners Association, NRDC and these experts provided each homeowner with an explanation of the project and its purpose. Twenty-four homeowners volunteered to participate in the assessment; to protect their privacy, their individual information is not disclosed. The project team spent several days in the Love Creek community, going from home to home to meet with homeowners and assess their property structures as well as surrounding vegetation.

The team studied properties covering between 1 and 40 acres. The dates of construction of the homes range from 1940 to 2001, with many built in the 1950s and 1960s and several in the 1980s. Because of the range of property size, age, and style, Love Creek provided a good sample of homes that might be found in a typical WUI community.

The experts found that all Love Creek homes they evaluated lack one or more basic fire protections and therefore are at increased risk of catastrophic loss in an ensuing wildfire. According to Chief Coleman, “Communities up and down California are similar to Love Creek—responsible homeowners want to do the right thing, but often lack necessary expert guidance, and sometimes also lack the financial ability to make needed improvements in their homes.”

The good news is that with easy and relatively affordable improvements these homes can survive a forest fire. The most significant areas found to need mitigation were the following:

Adjacent vegetation in many instances was not managed in a way that would prevent a wildfire from reaching structures with rapid spread rates and moderate-to-high intensities. Ground fuels, such as pine needles, cones, branches, logs, roots, shrubs, peat, and other flammable materials, were generally present within the assessed area, permitting fire to approach the structures closely. Ladder fuels that could carry ground fire into the crowns were generally present and the trees were too tightly packed, allowing the swift progress of a crown fire that would be almost impossible to fight.

Eave enclosures were missing from every home assessed. When wildfires approach a home, the temperatures along exterior walls increase. Open joints and eaves collect heat and are often the first structural elements to ignite.

Fire resistant exterior siding and solid core doors are important for a home to withstand higher temperatures during a fire and delay or even prevent exterior ignition. Constructing or retrofitting with fire-resistant exterior materials and doors that can withstand high heat is essential. Almost all of the homes assessed in Love Creek need additional exterior siding (19) and/or new exterior doors (21) to meet the minimum standards necessary to ensure they will survive a forest fire.

Windows are also a critical component in a home’s ability to meet firewise standards. Single-pane windows can break quickly in a fire due to the heat, giving flames direct access to the interior of a home. Almost all of the homes assessed in Love Creek have single-pane windows. Replacing these windows would bring homeowners other benefits in addition to fire protection, including energy efficiency. At a minimum, homeowners should have window covers available to install before they evacuate their homes when a fire threatens.

Fire-resistant roofs and proper vent screening help prevent ignition during a forest fire. One of the highest fire risks is a firebrand, a small piece of burning wood that breaks off a tree during a fire and is carried by the wind. Firebrands can travel for miles and may land on a rooftop or be blown into a vent, causing a house to ignite and burn down. Three of the homes assessed need roof improvements—either replacement of roof shingles, clearing away of tree needles, and/or application of a fire-resistant coating.

Outdoor decks are another area of high risk. According to ESCi, unenclosed decks allow fire and heat to accumulate underneath the deck and ignite structural components of a house. Four of the homes assessed in Love Creek are in need of deck work—either enclosing the exposed underside of a deck or applying a fire-resistant coating.

Easy access to homes in case of forest fire is critical. Several homes needed things as simple as proper signage for their address (8), or driveway improvements (6).

Mitigating risks in common areas is also necessary to make each individual home and property safe, such as removing flammable brush and dense trees along the roads through the community. Although the NRDC assessment focused only on privately owned homes and property, community-wide needs must also be incorporated in any community wildfire protection plan.

THE PRICE TAG FOR FIRE PREPAREDNESS

The average projected cost to make a Love Creek home firewise was \$2,510 per home, ranging from \$1,135 to \$3,730 per home. These estimates include improvements necessary to get a house, driveway, and other accessories to minimum standards for wildfire survivability and were based on local area costs. When translated into monthly payments on a five-

or 10-year home improvement loan or as part of a mortgage for a home purchase at prevailing interest rates, this becomes an affordable cost for many homeowners.

This amount does not include the equally important firewise task of reducing risk on the property surrounding each home. According to Forester Daus: “Many of the homesites evaluated need extensive work to remove the most flammable materials from the land. If coupled with a firewise structure, however, this effort will save houses and could also save lives.” Critical forestry work includes removing all understory brush and other small diameter materials immediately adjacent to the house, thinning ladder fuels that can allow a ground fire to escalate to a crown fire, and increasing crown spacing between the tops of trees.

The average cost to conduct the recommended vegetation management was \$4,575 per parcel, or \$558 per acre. The estimated costs ranged from \$500 for a 6.9 acre parcel to \$26,000 for a 40 acre parcel, based on the total estimated cost of the work minus any expected income from timber removed that has commercial value.

To minimize soil impact while eliminating the smallest materials (up to 6 inches in diameter), the best approach is to remove them with handheld chainsaws and feed them into a chipping machine that blows the chips back out onto the ground. According to Daus and Associates, a typical local crew can treat one to two acres per day with this method, and costs are generally around \$1,200 to \$1,400 per acre. A less expensive method is to masticate the materials with larger equipment that can accomplish two to three acres per day, depending on the equipment used, steepness of the terrain, rockiness, height of stubs left behind, and size of wood left on the ground. The costs of this method can range from \$400 to \$900 per acre, depending on the same factors.²⁷

It is important to note that these costs have risen approximately 60 percent since the field work in Love Creek was originally conducted in 2006. Machine work that had cost roughly \$800 per acre would now cost \$1,200 to \$1,500 per acre. This increase in expenses can be attributed to 1) upwardly spiraling costs of fuels and lubricants, and 2) the lack of commercial markets for products resulting from the small material removed during these operations.²⁸ Forest Service research discussed above identifies the critical zone for vegetative treatment as the first 40 meters from the structure, roughly one acre with the house included.

The NRDC pilot project did not examine the financial resources of homeowners who participated in the assessment. It is likely that many of the homeowners do not have the financial resources to fund completely the improvements necessary to make their own homesites safe from forest fire. And homeowners who are able to afford these costs still need technical assistance to learn how to bring their homes and property to a firewise standard. Similarly, civic leaders and contractors need information and training if the large number of at-risk communities is to be treated in a reasonable timeframe. Public investment in making these homes and towns firewise pays off by reducing the losses due to forest fires and by making firefighting easier and less urgent. Structure upgrades are typically a one-time expense. And once the initial thinning of vegetation around the home is done, maintenance of these safer conditions is much easier and more affordable.

LOVE CREEK'S LESSONS

Love Creek is a typical community in a mixed conifer forest prone to wildfires. It has a range of homes and properties that are similar to other communities found across the West. The results of the pilot study indicate that a large percentage of homes in high-risk communities similar to Love Creek will likely require some degree of retrofitting and preventative vegetation management to become firewise. The associated costs will vary from place to place, but community-wide education and planning initiatives are critical in keeping homes in the WUI safe from the risk of forest fire. In many places, financial incentives for homeowners may also be necessary. State and local agencies that have a presence in the community and prioritize firewise methods are in the best position to plan and deploy assistance. A federal budget shift to make these activities the highest funding priority would have a number of positive effects:

- An increase in community, home, and firefighter safety;
- Creation of a considerable number of skilled jobs in the fields of home improvement and forestry, substantially contributing to local economies;
- A track record of federal involvement in projects created by consensus and cooperation that enjoy broad support; and
- Reduced pressure on federal agencies to suppress fires regardless of cost.

NRDC's recommendations for how the federal government can help vulnerable communities become firewise are on page 13.

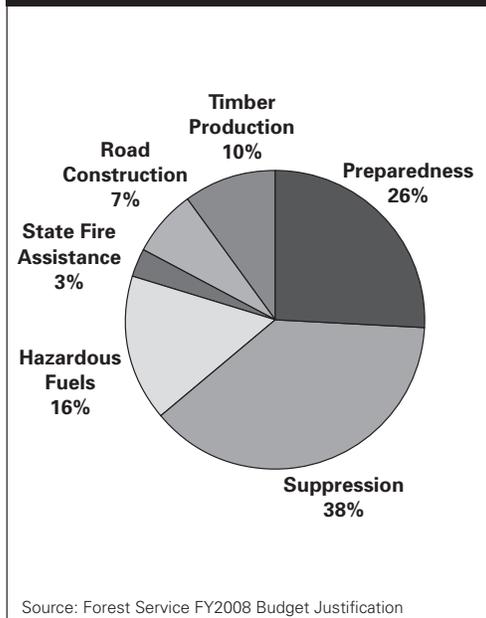
4. Federal Fire Funds Don't Address Community Safety

Only 3 percent, or \$85 million, of the \$2.6 billion federal fire budget is dedicated to supporting state and local community fire programs that fund, among other essentials, firewise measures. Funding for these programs has been repeatedly slashed until it is now little more than half of the 2001 level. Spending on dubious backcountry commercial logging and other misguided management is rising, as is investment in fire suppression, while federal assistance that actually reaches homesites and community infrastructure continues to decline.

Over the last decade, the combined national fire budget tripled, from \$1 billion annually prior to FY1997 to \$3 billion by FY2005, with the Forest Service receiving more than 70 percent of the funds.²⁹ An analysis of how the Forest Service and the Bureau of Land Management (BLM), the two agencies responsible for implementing the National Fire Plan, deploy their newfound wealth reveals that the agencies' on-the-ground practices fall far short of their stated policy goals, and the dictates of current science. An analysis of Forest Service spending reveals continued misplaced priorities and investment in costly, potentially counterproductive measures.

The federal fire budget consists of three main categories—preparedness, suppression, and hazardous fuels reduction—with a fourth related category, state fire assistance, providing funding for activities on non-federal lands. The Bush administration's 2008 budget request for these categories was \$837 million,³⁰ \$1.2 billion, \$494 million, and \$85 million, respectively.³¹ But much of this spending pays for activities of questionable value, some of which can actually heighten forest fire risk. For instance, the Forest Service requested \$318 million for timber production and \$227 million for road construction,³² activities which the agency claims in part support fire response goals, but both of which are associated with increased fires.

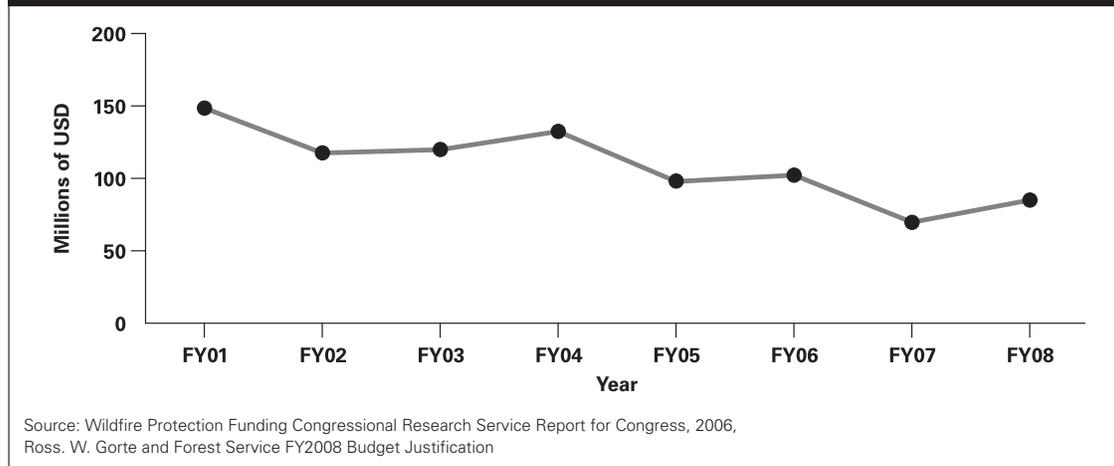
Figure 1: National Fire Management Related Funding



STATE, LOCAL, AND VOLUNTEER FIRE ASSISTANCE PROGRAMS ARE UNDERFUNDED

The state, local, and volunteer fire assistance programs of the Forest Service and the BLM currently provide important funding for genuine firewise activities. These programs fund community fire departments that have the most interaction with homeowners, as well as “hazardous fuels treatments, fire prevention and education campaigns, personnel training, equipment, personnel availability, and community planning.”³³ Unfortunately, funding for these programs has been repeatedly slashed, year after year, until it is less than 60 percent of the 2001 level—all while more and more homes are being built in the WUI. The majority of these programs were first funded in 2001 for a total of \$148.5 million and have steadily declined to the FY08 budget request of \$85 million.³⁴

Figure 2: State and Community Fire Assistance Funding FY01–FY08 (In Millions)



Without significant additional funding to support state and local efforts to identify high-risk communities, educate the public, provide technical assistance, and support individual and community mitigation efforts, catastrophic fire events will continue to threaten life and property. Despite massive federal funds being devoted to agencies with wildfire responsibilities, homes continue to be lost. More than 240 homes were destroyed by forest fire in 2005 alone.³⁵ Federal activity must begin to reflect the best science and the best practices available to fulfill the national priority of protecting homes and communities from wildfire risk.

THE FEDERAL HAZARDOUS FUELS REDUCTION PROGRAM DOES NOT PRIORITIZE COMMUNITY PROTECTION

The stated goal of the federal hazardous fuels reduction program is to reduce the risk of “unplanned and unwanted wild-land fires.”³⁶ Much of the program, however, is currently used to fund fire management techniques that are not proven to keep communities safe. This money should instead be directed toward firewise programs—the only way we know for certain to prevent wildfire damage to homes and communities, and thereby make suppression, and suppression funding, less urgent.

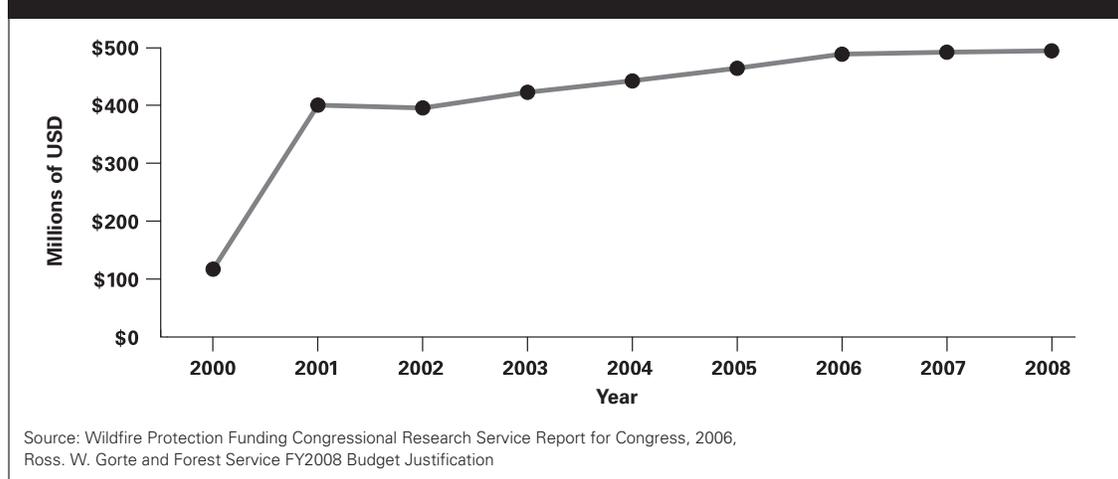
The Forest Service asserts that decades of fire suppression have significantly altered historical fire regimes by allowing unnatural quantities of woody fuels—small trees, undergrowth, overly dense stands—to build up in large swaths of our national forests. According to the Forest Service this buildup will cause these forests, when they do burn, to burn hotter and more uncontrollably than in the past. In some forests, particularly dry ecosystems characterized by naturally frequent fire, this may be the case.³⁷ But the degree to which most individual forests’ fire regimes have been altered remains both

debatable and highly variable, affected by forest type, microclimates, elevation, and many other factors—including past management action such as logging, grazing, and road-building.³⁸ Whatever the historic or altered fire regime may be, the responsible course of action is to give top priority to methods proven to protect communities.

According to a recent comprehensive review conducted by a panel of eminent forest ecologists, “[t]he characteristic fire regime, especially the extent and severity of fire and how often it recurs, varies over a surprisingly large spectrum. Fires recur in western forests from once a decade or less...to a cycle of 250-400 years.”³⁹ Particularly in low-frequency forest regimes, such as high-elevation lodgepole pine forests, it is unlikely that past suppression activities have notably altered historic patterns.⁴⁰ Most importantly, the short and long term efficacy of fuels reduction away from developed areas in mitigating fire risk remains unsubstantiated. In a letter to President Bush, 12 of the nation’s top forest ecologists wrote: “The most debated response to alleviating destructive fires in the future—mechanically thinning trees—has had limited study, and that has been conducted primarily in dry forest types. Thinning of overstory trees, like building new roads, can often exacerbate the situation and damage forest health.”⁴¹

A significant amount of the hazardous fuels reduction program budget is still devoted to projects that are not grounded in the best available science, may never help protect a home, and could indeed increase fire risk to communities. Despite this, Congress more than tripled funding for the program between 2000 and 2001, from \$117 to \$400 million, and since 2002 has increased spending an additional 24 percent to \$494 million.⁴² While these funds could be put to good use making communities safer and increasing the number of firewise homes, instead the agencies are using many of these funds in ways that are contrary to the best available science and research.

Figure 3: Hazardous Fuels Reduction Funding 2000–2008



Forest Service Mismanagement Diverts Funds to Risky Activities

Reports on Forest Service accountability shortfalls and management failures are legion, including investigations by the Government Accountability Office (GAO), the U.S. Department of Agriculture (USDA) Inspector General, and many nonprofit organizations, documenting lack of transparency, missing funds, poor data quality, and more.⁴³

Across the West, the Forest Service is using hazardous fuels reduction funds to log large, fire-resistant trees that are tens of miles from the nearest community. This pattern is problematic for two reasons: first, these projects might actually increase fire risk to communities; second, the Forest Service is using funds that could otherwise be dedicated to proven methods to make homes and communities firewise.

In California’s Sierra Nevada, for example, thousands of acres are being logged that are far from the nearest home. The 2006 Empire Project in the Plumas National Forest includes more than 1,200 acres of so-called group selection clearcuts—a patchwork quilt of clearcuts, generally two acres in size, across the landscape. It also includes more than 6,600

Government Agencies Find Federal Fire Support Lacking

Regarding hazardous fuels, the Government Accountability Office found in 2002 that “the federal effort still lacks clearly defined and effective leadership,”⁴⁴ and proceeded to document the lack of “(1) Consistent criteria to identify and prioritize wildland-urban interface communities... (2) clearly defined and outcome-oriented goals and objectives...”⁴⁵ The GAO went on to conclude that,

*As a result, (1) high-risk communities have not been identified and prioritized, (2) multiple strategies have been developed with different goals and objectives, (3) quantifiable indicators of performance have not been developed to measure progress in reducing risks, and (4) annual plans and reports that have been developed do not describe what will be accomplished with the appropriated funds. Therefore, it is not possible to determine if the \$796 million appropriated for hazardous fuels reduction in fiscal years 2001 and 2002 is targeted to the communities and other areas at highest risk of severe wildland fires.*⁴⁶

In 2004, the GAO concluded similarly: “Without a systematic approach to assessing risk to ecosystems at the landscape level, the agencies cannot effectively target their fuel reduction activities to protect areas that face the greatest losses...”⁴⁷

Confirming these findings, the 2006 U.S. Department of Agriculture Office of Inspector General audit of the Healthy Forests Initiative found that the Forest Service “...lacks a consistent analytical process for assessing the level of risk that communities face from wildland fire and determining if a hazardous fuels project is cost beneficial.”⁴⁸ Nor does the Forest Service “have the ability to ensure that the most important projects are funded first.”⁴⁹ This means “The FS cannot clearly identify the level of risk to communities from wildfire. It cannot demonstrate to stakeholders its accomplishments in reducing those risks...”⁵⁰

The Office of Inspector General found a profound lack of data tracking and a shortfall in performance measures. Moreover, since the Forest Service’s funding levels are based on its ability to meet target goals of acreage treated and not its ability to reduce risk, the Forest Service’s prime incentive is to treat as many acres as possible with little regard to the effect of these treatments.⁵¹

acres of “fuel breaks” up to a half-mile wide, and another 2,370 acres with large tree logging.⁵² The 2007 Kings River Project would entail more than 13,800 acres of logging in the Sierra National Forest, including thousands of old, large trees, with more logging planned on 130,000 acres over 30 years.⁵³

The performance records of the Forest Service and the Bureau of Land Management (BLM) reflect this sloppiness in the hazardous fuels reduction program. In FY 2006, the agencies treated, through various approaches, almost 4 million acres of land.⁵⁴ There is no clear evidence as to how much of this money was actually spent in the immediate vicinity of homes and communities. While the agencies do report a certain number of acres treated in the WUI, they use an extremely broad, imprecise definition of the WUI, and a large portion of the acres are not identified in any specific way at all. There is no way to be confident that federal agencies are meeting the stated purpose of this program: prioritizing at-risk communities and pursuing fuels reduction in a manner that most effectively reduces threats to public safety.

TIMBER AND ROADBUILDING INCREASE FIRE RISK

The Forest Service continues to spend hundreds of millions of dollars on commercial timber sales and related roadbuilding activities throughout our National Forests. Although the Forest Service has promoted these massive logging projects as contributing to the reduction of fire risk,⁵⁵ little evidence supports such claims.

Not only can logging actually increase fire risk (see the discussion on page 4), but the road building on which back-country timber projects depend also exacerbates fire risk. Forest Service studies have found that the number of large fires is dramatically higher in areas that have roads,⁵⁶ and that human-caused wildland fire is nearly five times more likely to occur on lands with roads.⁵⁷ According to a 15-year study by independent scientists, large wildfires are more likely to occur and to burn to greater extents in areas with roads.⁵⁸

Road building can increase fire risk in several ways. Roads open up the forest to let in sunlight and wind, both of which dry out the forest interior and increase flammability.⁵⁹ Roads, and the vehicles that travel on them, bring diseases and pests into forests, which damage trees and can make them more flammable.⁶⁰ Perhaps most importantly, roads provide access for

more people and machinery to enter the forest, which leads to more human-caused forest fires. Or, as fire scholar Stephen Pyne has summarized, "Almost any map that segregates anthropogenic from lightning caused fires reveals the same geography: people-caused fires follow people."⁶¹ Illustrating this point, from 2001 to 2005, 84 percent of wildfires were human caused.⁶²

Financially, road building also exacts a considerable toll. The Forest Service continues to emphasize road building at the expense of repairing the vast network of existing roads already crisscrossing the National Forest System. Currently, the agency's road maintenance backlog stands at a staggering \$10 billion and counting,⁶³ yet the administration's deferred maintenance budget request for FY 2008 is only \$9 million, \$3 million less than the previous year.⁶⁴ At this rate it would take a thousand years to repair just the existing decayed roads. Once again, this budget picture reinforces the Forest Service's pattern of directing funds to activities with either no demonstrable contribution to community fire protection or with known deleterious effects.

5. Recommendations for Protecting Homes and Communities from Forest Fires

Protecting lives and homes must be the top priority for fire protection. To maximize firewise conditions in vulnerable WUI communities, federal agencies should take the following actions to prioritize measures that are proven to protect homes from wildfires:

- **Shift funding away from counterproductive projects** such as subsidized logging and roadbuilding that can increase fire risk, and toward programs that can most increase fire safety, such as identification of high-risk communities, public education, community planning, and implementation of firewise practices.
- **Dedicate funds in the hazardous fuels reduction program currently used for unproven fire protection techniques to direct community firewise needs.** In particular, federal lands in the immediate vicinity of homes, communities, and public infrastructure must be made firewise.
- **Increase funding to state and local governments so that they have enough resources to help homeowners and community leaders** implement firewise practices to ensure survivability of their homes and critical community infrastructure.
- **Embrace the Office of Inspector General's recommendations to improve Forest Service data quality and control measures** in order to ensure tangible on-the-ground results.

NRDC's pilot project indicates that communities desperately need education, planning, and mitigation resources in order to prepare them to survive wildfire events. It is time for Congress to ensure that federal agency budgets clearly reflect the national priority to protect these homes.

Appendix A:

The Love Creek Pilot Study: Experts and Methodology

NRDC engaged Emergency Consulting Services inc. (ESCi) to assess the ability of individual homes in the Love Creek community to survive a wildfire, the extent of mitigation practices needed in this kind of typical community, and the cost of such mitigation, all based upon nationally recognized and established professional standards. The ESCi team was led by Senior Vice President Ronny Coleman, former California State Fire Marshal and former fire chief for the cities of Fullerton and San Clemente, California. Chief Coleman currently serves as President Emeritus of the Fire Education & Training Network and as a technical consultant to the International Code Council (ICC). He retired as Chief Deputy Director of the California Department of Forestry and Fire Protection and also served as the president of the International Association of Fire Chiefs.

ESCi based its assessment on National Fire Protection Association (NFPA) Standard 1144, Protection of Life and Property from Wildfire, a document that “has been officially adopted by state and local governments and adapted for use by numerous jurisdictions involved in planning Firewise Communities.”⁶⁵

To assess the vegetation surrounding each home and the mitigation practices needed to achieve survivability of the home during a forest fire, NRDC engaged Daus and Associates, led by Steven Daus, Ph.D. Dr. Daus is a California Registered Professional Forester with over 25 years of experience developing and implementing land and resource management plans in compliance with appropriate laws and regulations. He is familiar with state, federal, and international environmental laws and regulations, and has worked with local fire safe councils in California as well as the National Forest System.

The vegetation assessment reflects the provisions of the California state fire code and State Fire Marshal’s regulations, as well as generally accepted practices for forestry and vegetation management. Based on these guidelines the assessment considered three different management zones: an immediate home ignition zone from zero to 30 feet from the structure, a middle zone from 31-235 feet from the structure, and an outer zone of a five-acre area space surrounding each home, starting at 235 feet away from the structure. The California code does not provide a single standard for every property, so the prescriptions are specific to each individual site and its conditions. Forester Daus reviewed the vegetation surrounding each home and identified specific mitigation measures needed in each of the three zones to maximize the home’s chances of surviving a fire.

Endnotes

1. California Department of Forestry and Fire Protection, "The Changing California: Forest and Range Assessment," Chapter 3, Subchapter: Wildfire Risks to Assets (October 2003), p. 6. Available at http://frap.cdf.ca.gov/assessment2003/Chapter3_Quality/wildfirerisk1.pdf.
2. Bronson J.W. "Government Has New Plan for Fire Season." *Albuquerque Tribune*. (January 31, 2007). Available at <http://www.abqtrib.com/news/2007/jan/31/government-has-new-plan-fire-season>.
3. See United States Department of Agriculture. "Fiscal Year 2007 President's Budget: Budget Justification." US Forest Service. pp. 9-16. Available at <http://www.fs.fed.us/aboutus/budget>. Hazardous fuels are vegetation, such as grasses, brush, and trees, that have accumulated and increase the likelihood of large wildland fires. The Forest Service "hazardous fuels reduction program" is intended "to reduce the undesired effects of large, destructive wildfires by reducing the volume of hazardous fuels on forests, woodlands, shrublands, and grasslands." Hazardous fuels are reduced through a variety of treatments including prescribed fires, manual or mechanical removal, and the application of herbicides.
4. Barkley, Y C., C. Schnepf and J. Cohen. "Protecting and Landscaping Homes in the Wildland/Urban Interface." University of Idaho Extension; Idaho Forest, Wildlife and Range Experiment Station. Station Bulletin No. 67. (January, 2005).
5. Benedict, M. A., Supervisor of the Sierra National Forest. "Twenty-one Years of Fire Protection in the National Forests of California" *Journal of Forestry*, 28 (1930):707-710.
6. USDA. "Fire Management: Wildland Fire Policy." US Forest Service. Available at <http://www.fs.fed.us/fire/management/policy.html>. (June 18, 2007).
7. Cohen, J. D. "Preventing Disaster: Home Ignitability in the Wildland-Urban Interface." *Journal of Forestry*. 98 (2000):15-21.
8. *Ibid.*
9. Barkley, Y. C., et al. (January, 2005).
10. Chong, J. and D. Smith. "Some Homes Had Shields to Ward Off Wildfires." *Los Angeles Times*. (April 1, 2004).
11. Martin, R. E. "The 1993 Southern California Fires." IFFN No. 10 (January 1994):21-22. Available at http://www.fire.uni-freiburg.de/iffn/country/us/us_5.htm.
12. www.firewise.org.
13. "Wildfire Spots Spook Insurance Companies," Associated Press, May 20, 2007.
14. Cohen, J. D. "Reducing the Wildland Fire Threat to Homes: Where and How Much?" USDA Forest Service. General Technical Report PSW-GTR-173. (1999).
15. Stephens, S.L. and J.J. Moghaddas. "Experimental fuel treatment impacts on forest structure, potential fire behavior, and predicted tree mortality in a mixed conifer forest." *Forest Ecology and Management*. 215 (2005):21-36.
16. U.S. Dept. of Interior. "People, Land & Water." 8:10 (May/June, 2002):17.
17. Romme, W.H., et al. "Recent Forest Insect Outbreaks and Fire Risk in Colorado Forests: a Brief Synthesis of Relevant Research." Colorado Forest Restoration Institute. (2006).
18. Carey, H. and M. Schumann. "Modifying Wildfire Behavior-The Effectiveness of Fuel Treatments." The Forest Trust. p. 16. Available at www.theforestrust.org/images/swcenter/pdf/WorkingPaper2.pdf.
19. Hanson, C. T. and D. C. Odion. "Fire Severity in Mechanically Thinned Versus Unthinned Forests of the Sierra Nevada, California." *Proceedings of the 3rd International Fire Ecology and Management Congress*. (November 13-17, 2006), San Diego, CA.
20. Finney, et al. "Fire Behavior, Fuel Treatments, and Fire Suppression on the Hayman Fire." *Interim Hayman Fire Case Study Analysis* R. Graham, tech ed. US Forest Service Rocky Mountain Research Station. (2003). p. 82. Available at http://www.fs.fed.us/rm/pubs/rmrs_gtr114.html.
21. Christensen, N., et al. Letter to President Bush of 9/9/2002. Available at http://docs.nrdc.org/land/lan_07062801g.pdf.
22. Black, S.H. "Logging to Control Insects: The Science and Myths Behind Managing Forest Insect Pests." The Xerces Society for Invertebrate Conservation. (2005).
23. Romme, W.H., et al. (2006).
24. Black, S.H. (2005). See discussion pp. 1-11.
25. USDA. "Final Environmental Impact Statement for the Roadless Area Conservation Rule," US Forest Service, Vol. 1 (2000) p. 3-110. Available at roadless.fs.fed.us/documents/feis.
26. *Ibid.* "Forest Service Fuel Management and Fire Suppression Specialist's Report." Ladder fuels are any flammable vegetation that act as a "ladder" for a fire to climb from the lower levels of a forest to taller trees and the canopies, or crowns, of trees.
27. Daus and Associates report to NRDC.
28. Within the "working circle" of Love Creek (an area of operation and marketing usually defined by the costs of transporting the raw material) there are three sawmills and one co-generation plant, but only one of these sawmills accepts small diameter pine and white fir -- the type of material that would be generated from fuel reduction operations. This mill is far enough away from Love Creek that current transportation costs, when combined with the other cost of removing the materials, exceed the price paid by the mill. There is also little professional expertise in the area for the type of forestry work required for working close to homes, which includes some specialized equipment, coordination with agencies and landowners, and the specific care needed around elements of WUI infrastructure such as fencing, cables, and other objects.
29. Gorte, R. "Forest Fire/Wildfire Protection." Congressional Research Service Report for Congress. (January, 2006). p. 16.
30. USDA. "Fiscal Year 2008 President's Budget: Budget Justification." US Forest Service. pp. 5-6. The figure combines Forest Service and DOI preparedness with the new Forest Service appropriations line item Wildland Firefighters. This new category is described as supporting both suppression and preparedness activities, but for consistency across budgets and for comparative purposes, has been included here in preparedness.
31. *Ibid.* State fire assistance includes categories funded through the Forest Service's State and Private Forestry programs so as to capture the full funding being provided to states.
32. *Ibid.*
33. USDA. "FY2007: Budget Justification." pp. 9-40.

34. Congressional Research Service, *Wildfire Protection Funding*, p. 6, FY 2008 Budget Justification
35. USDA. "FY2007: Budget Justification." pp. 4-2.
36. USDA. "FY 2007: Budget Justification." pp. 9-16.
37. See U.S. Government Interagency Healthy Forests Overview, available at http://www.forestsandrangelands.gov/Healthy_Forests/overview.shtml and "Healthy Forests: An Initiative for Wildfire Prevention and Stronger Communities" (August 22, 2002). Available at http://www.fs.fed.us/projects/documents/HealthyForests_Pres_Policy%20A6_v2.pdf.
38. See Noss, R. et al, "Managing Fire-prone Forests in the Western United States," The Ecological Society of America, 2006, pp. 481-483; Schoennagel, T., et al, "The Interaction of Fire, Fuels, and Climate Across Rocky Mountain Forests," *BioScience* (July 2004), Vol. 54 No. 7, pp. 662, 674; Rhodes, J., "Watershed Impacts of Forest Treatments to Reduce Fuels and Modify Fire Behavior," Pacific Rivers Council, February 2007, pp.34-35; USDA Forest Service, *Roadless Area Conservation Final Environmental Impact Statement*, Volume 1, (November 2000), pp. 3-115-3-116; and Eastman, Jill C., et al, "Roadless Areas and Forest Fires in the Western United States" (May 29, 2002): American Geographical Union Spring Meeting.
39. Noss R. F., et al. "Managing Fire-prone Forests in the Western United States." *Frontiers in Ecology and the Environment*. 4:9 (2006):482.
40. See Carey and Schuman; Noss, et al. (2006); Romme, et al. (2006).
41. Christensen, N., et al. (September 9, 2002).
42. Gorte, R. "Wildfire Protection Funding." Congressional Research Service (2006). p. 3.
43. See USDA. "Audit Report Implementation of the Healthy Forest Initiative." Office of Inspector General. (2006); USDA "Audit Report Forest Service Large Fire Suppression Costs." OIG (2006); GAO. "Severe Wildland Fire Leadership and Accountability Needed." (2002); GAO. "Forest Service Lack of Financial and Performance Accountability Has Resulted in Inefficiency and Waste." (1998); Taxpayers for Common Sense. "Lost in the Forest: How the Forest Service's Misdirection, Mismanagement, and Mischief Squanders Your Tax Dollar." (2002); O'Toole, R. "Reforming the Fire Service." The Thoreau Institute. (2002).
44. GAO. "Severe Wildland Fires: Leadership and Accountability Needed to Reduce Risks to Communities and Resources." (January, 2002). p. 3. Available at www.gao.gov/cgi-bin/getrpt?GAO-02-259.
45. *Ibid.*
46. *Ibid.* P. 4
47. GAO. "Wildland Fires: Forest Service and BLM Need Better Information and a Systematic Approach for Assessing the Risks of Environmental Effects." (June, 2004). p. 12. Available at www.gao.gov/new.items/d04705.pdf.
48. USDA. "Implementation of the Health Forests Initiative, Audit Report No. 08601-6-AT." Office of Inspector General, p. i.
49. *Ibid.*
50. *Ibid.*
51. *Ibid.* pp. 8, 12, 13.
52. USDA. "Empire Project Final Supplemental Environmental Impact Statement" US Forest Service. (March, 2007). Available at http://www.fs.fed.us/r5/plumas/projects_and_plans/empire_project.
53. <http://www.fs.fed.us/r5/sierra/projects/environassess/kingsriver/index.shtml>.
54. U.S. Department of the Interior and U.S. Department of Agriculture, "Healthy Forests Report" (May 2007), p. 4. Available at http://www.forestsandrangelands.gov/reports/documents/healthyforests/2007/healthy_forests_report_05142007.pdf.
55. See USDA. "FY 2007: Budget Justification." pp. 8-51.
56. USDA., "Roadless Area Conservation Final Environmental Impact Statement." US Forest Service. Vol. 1. (November, 2000). pp. 3-115.
57. *Ibid.* pp. 3-116.
58. Eastman, J. C., et al. "Roadless Areas and Forest Fires in the Western United States." American Geographical Union Spring Meeting. (May 29, 2002).
59. See supra, USDA. "Final Environmental Impact Statement for the Roadless Area Conservation Rule," US Forest Service, Vol. 1 (2000) p. 3-110. Available at <http://roadless.fs.fed.us/documents/feis>.
60. Ercelawn, Ayesha. *End of the Road: The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research*. (New York: Natural Resources Defense Council, 1999).
61. Pyne, S. J. *Tending Fire: Coping with America's Wildland Fires*, Island Press, 2004, p. 208.
62. National Interagency Fire Center. "Fire Information – Wildland Fire Statistics: Lighting vs. Human Caused Fires." Available at http://www.nifc.gov/fire_info/lightning_human_fires.html.
63. Taxpayers for Common Sense. "Road Wrecked: Why the Forest Service \$10 billion road maintenance Backlog is Bad for Taxpayers." (March, 2004). p. 1. Available at www.ourforests.org/fact/tcs040104.pdf.
64. USDA. "FY2008: Budget Justification."
65. National Fire Protection Association, "Wildland Codes and Standards." For more information, see www.nfpa.org.