

# **Wildfire and Poverty**

## **An Overview of the Interactions Among Wildfires, Fire-Related Programs, and Poverty in the Western States**

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## BACKGROUND AND ACKNOWLEDGMENTS

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As we enter the new millennium, the citizens of the West face an increasing number of important challenges. An economic downturn has placed the economy, communities, and workers at risk. The events of September 11 dramatically increased concerns about personal safety and the security of our transportation systems, water resources, energy systems, food supplies, and other issues that were previously taken for granted. These issues have emerged at a time when our environment continues to be a concern. In Oregon, for example, the *Oregon State of the Environment Report*, released in September 2000 by the Oregon Progress Board, identified a number of environmental areas where Oregonians can expect continued problems under current policies and programs including: poor water quality, especially in urban and agricultural areas, inadequate water supplies, loss of wetlands, degraded riparian areas, depleted fish stocks, invasion of exotic species, diminished biodiversity, and waste and toxic releases. Similar problems exist throughout the West. All of these issues contribute to forest health problems which exacerbate the risks of wildfires to humans and the environment.

How can we maintain and enhance our economic security and protect workers and communities while also conserving the environment? The way Western states answer this question may turn out to be one of the most important challenges facing the region for the next number of years. In the spring of 1999, The Center for Watershed and Community Health, an education and research institute affiliated with the Mark O. Hatfield School of Government at Portland State University (PSU CWCH), initiated a project to help decision makers throughout the region better understand the economic issues and facts associated with developing a more environmentally sustainable economy. The PSU CWCH provides accurate, objective, and easy-to-understand information about the potential costs and benefits associated with adopting policies and practices that can resolve pressing economic, social, and environmental problems and lead to a more environmentally efficient and sustainable economy. The PSU CWCH has developed collaborative research partnerships with a number of academic institutions across the West, provided grants to a number of leading economists, and completed its own research, to accomplish this goal. This is one in a series of reports to be produced as a result of this effort. The project is an integral part of PSU CWCH's focus on developing new, more effective and efficient approaches to environmental governance and sustainable development.

The CWCH gratefully acknowledges the financial support of the Ford Foundation for this project. This report was prepared by Ernie Niemi and Kristin Lee of ECONorthwest for The Center for Watershed and Community Health, Mark O. Hatfield School of Government Portland State University. Bob Doppelt, Director of the CWCH, provided editorial advice. The authors are solely responsible for the content.

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# EXECUTIVE SUMMARY AND READER'S GUIDE

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Wildfires and poverty in the West—is there a connection? Yes, a strong one.

## SUMMARY OF MAJOR FINDINGS

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Wildfires and poverty are both common in the West. In 2000, 25,590 fires in eleven western states burned more than 5 million acres. Direct exposure to wildfire occurs primarily where housing adjoins wildlands, in areas commonly called the wildland-urban interface (W-UI). We estimate that 3–5 million of the 10-15 million residents in the W-UI lack adequate resources to protect themselves from wildfire. This population includes those whose incomes fall below the federal poverty line as well as those whose incomes are higher but still insufficient to meet basic economic needs with enough left over to cover the expense of wildfire protection.

Wildfires intensify poverty by having a pervasive, disproportionately negative impact on those households and communities lacking adequate resources to reduce the flammability of nearby wildlands, fire-proof homes and other structures, respond quickly when wildfires occur, and recover from economic losses resulting from fires. The impacts also go in the reverse direction, with poverty increasing the incidence of wildfires, raising the costs of fighting fires, and creating additional risks for firefighters.

The most drastic consequence of the wildfire-poverty connection arises when wildfires kill low-income persons or destroy their homes. Available data do not separate deaths and damage by income-group, but, on average, more than 900 homes have burned each year since 1990 and news reports of fires indicate that low-income persons frequently suffer. Moreover, the economic damage is disproportionately large for poor households. The lower a household's income, the greater its susceptibility to economic loss from wildfires, insofar as it is likely to have a greater share of its financial assets tied up in housing, vehicles, and domestic livestock that can be destroyed by fires. Furthermore, low-income households are less likely to live in areas with high-quality fire-protection services, possess adequate resources for self-protection, or have fire insurance to replace lost possessions.

The direct impacts of wildfires on lives and property, though dramatic, often are outweighed by other, indirect impacts on the economic well-being of poor households and communities. Just the threat of fires reduces the market value of homes and other assets that are at risk, and, all else equal, this reduction in value undoubtedly has a more intense impact on poor

households and communities too poor to afford high-quality, fire-protection services. Fires that disrupt normal commercial activities in a community, e.g., causing evacuation from homes or temporary closure of work places, can have disproportionate adverse impacts on the families of low-income workers, who have the lowest financial reserves to cope with the disruption.

Fires also can reduce the supply of goods and services derived from the ecosystems of wildlands and important to poor households and communities. When fires reduce the land's inherent ability to control flooding, for example, they increase the hazard for households, often poor, residing in downstream floodplains. Fires can affect the welfare of poor people throughout a city when they alter the vegetation of watersheds and thereby increase the cost of municipal water derived from them. Fires also can curtail the supply of some subsistence foods, native plants, and other resources important to Indian people and other groups.

The connection between wildfires and poverty goes largely unnoticed and unaddressed because it falls between the cracks of institutions that focus on either poverty alleviation or fire management, but not both. Filling in the cracks is essential if the more than \$2 billion of federal funds scheduled to be spent annually on fire-related programs nation-wide are to yield both better economic outcomes for poor households and communities and improved stewardship of wildland resources.

## **SUMMARY OF MAJOR RECOMMENDATIONS**

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Immediate progress toward reducing the connection between wildfire and poverty can be made if federal fire programs follow-through with commitments to address fire risks more cost-effectively. Research indicates the most effective step is to fire-proof housing, other structures, and entire communities by reducing the amount of flammable material between them and adjacent wildlands, and these measures would be especially cost-effective when directed toward poor households and communities. Data identifying relevant targets and site-specific measures have been assembled for only a few locations, however. We recommend that the Forest Service and related agencies place the highest priority on reducing fire risks in these areas, while quickly identifying and extending fire-proofing measures to others throughout the West.

In principle, this recommendation, if carried through, ought to be sufficient to bring about meaningful reductions in the wildfire-poverty connection, as well as long-run, sustainable interactions between the ecosystems of wildlands and the development patterns of communities. In practice, however, much more will be required. Extensive evidence indicates that merely calling for federal fire-management programs to become more effective will yield little unless supported by a well-planned and -implemented strategy to engage groups across the West in encouraging federal officials to adopt and



implement fire policies that equitably address the needs of poor households and communities. For a century, fire-management policy has focused on taking aggressive action to suppress fires, with little concern for cost or long-run consequences, and repeated attempts to redirect it to a new course have found it a hard ship to steer. Redirecting it now toward the interests of poor households and communities will be equally unsuccessful unless these interests capture the attention of the Forest Service, related agencies, and Congress in a sustained and coordinated effort.

Accordingly, we recommend that the Center for Watershed and Community Health implement a major western initiative to address the dual issues of poverty and fire management. Implementing a poverty-related strategy to change fire-management policy should entail these steps:

**Step 1: Initiate outreach and dialogue.** Initial efforts should focus on making key community, civic, and government leaders across the West more aware of the linkages between wildfire and poverty and of the opportunities for making fire-related programs more effective in assisting poor households and communities. These efforts should include broad dissemination of this report, the distribution of follow-up summaries to op-ed pages and other outlets, and meetings with key leaders to discuss the issues unveiled in this report.

**Step 2: Complete detailed case-studies with local communities.** This step should augment the general findings of this report with site-specific details. We propose to complete case studies in 2-4 of the regions where wildfire and poverty are both on the front burner: (1) Pacific Northwest (especially eastern Oregon and Washington); (2) Northern Rockies; (3) Southwest; (4) California (especially the Sierra Nevada). From our work on the report, we are confident it will stimulate innovative conversations and promote the identification of common ground in individual communities among disparate groups, including those with a focus on rural poverty alleviation, rural economic development, and environmental conservation. The case studies should focus on identifying initial ideas for converting the report's findings and recommendations into specific proposals for changing fire-related policies so they have a more positive impact on the welfare of poor households, the economies of poor communities, and the productivity of rural ecosystems.

**Step 3: Symposia on wildfire and community development.** The case studies should lead to 2-4 symposia (one in each area) that bring together experts in fire-management science and western poverty, as well as community representatives from the different case studies, plus others, in an effort to develop concrete proposals for policy changes and related actions pointed toward ensuring that fire-related programs have a more positive impact on poor households, rural communities, and environmental resources. The symposia should be aimed at broadening the involvement of different, interested groups and firmly establish the scientific and policy-based foundation for modifying fire-related programs to address the interests of poor households and communities.

**Step 4: Develop educational and political strategies.** From the case-studies and the symposia, the Center for Watershed and Community Health (or a substitute institution), working with collaborators throughout the West, should develop strategies for bringing about changes in fire-related programs so they provide meaningful relaxation in the wildfire-poverty connection in the West. The strategies should specify short- and long-run actions by governmental agencies and nongovernmental organizations, establish benchmarks for measuring progress, and identify individuals and institutions that have accepted responsibility for ensuring that implementation of the strategy has adequate staying power to be effective.

We anticipate that it will take about two years to complete these four steps.

## WHO PREPARED THIS REPORT?

Ernie Niemi and Kristin Lee, of ECONorthwest, prepared this report for The Center for Watershed and Community Health (CWCH), with funding provided by the Ford Foundation. Many people have provided valuable insights and assistance, but we remain solely responsible for the report's contents. The CWCH is affiliated with the Mark O. Hatfield School of Government at Portland State University. The CWCH assists businesses and government in developing new approaches to environmental governance to achieve sustainable development.

We have prepared this report based on our general knowledge of the natural resource industries and the economies of the western states, as well as information derived from government agencies or other sources believed to be reliable. Any statements nonfactual in nature constitute our current opinions, which may change as more information becomes available. As time passes, the results of this report should not be used without accounting for more recent data and relevant assumptions.

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# CHAPTER 1: WILDFIRES AND FIRE-RELATED PROGRAMS

Wildfires in the West are big. They occur in big numbers, scorch big landscapes, and threaten big populations. Ecologists see them as a big, central component of healthy ecosystems, but most Americans see them as a big problem. Consequently, fire-related programs involve big politics, big government, big business, and big amounts of money.

The central purpose of this report is to examine just one slice of the myriad facts and issues associated with wildfires and fire-related programs: their relationship with poverty. How do wildfires influence poverty, how does poverty influence wildfires, and how might alternative programs reduce the mutual risks of wildfires and poverty? These are new questions, however, and there is no backlog of studies and data focused directly on this relationship and from which one can quickly extract answers. Instead, it is necessary to take an indirect approach, piecing together partial answers by assembling descriptions of fires, fire-related programs and poverty, and then overlaying them to see where they reveal relevant overlaps.

We start the process here with an overview of wildfires and fire-related programs. We describe recent wildfires, relate them to natural fire regimes, describe factors influencing fire risks, and summarize fire-related programs. We conclude with reflections on the extent to which the current pattern of fires and the structure of fire-related programs generate potential economic costs and benefits for poor, economically distressed individuals, families, and communities.

Our findings, though preliminary, raise questions about the orientation and efficacy of many fire-related programs. Much of the support for, and focus of these programs rests on perceptions that fires are bad, risks come mostly from forest fires on the national forests, and the risks of forest fires have been made markedly worse by the build-up of fuels to unnaturally high levels. With this foundation, many fire-related programs aim to fight forest fires and reduce the amount of fuel on the national forests.

**Our findings, though preliminary, raise questions about the orientation and efficacy of many fire-related programs.**

The evidence discussed below, however, indicates that fires are not universally bad, but often necessary to sustain ecosystems, and most wildfires occur in non-forested areas. Moreover, increased risks to human lives and the economy stem largely from expanding human encroachment into wildlands, forested and otherwise. From this evidence, programs to reduce fire risks should focus less on manipulating forests and fighting fires, and more on insulating people and communities, while allowing fires to play their natural, ecological role. If fire-related programs are shaped from this premise, then having a better understanding of poor households and communities becomes essential, for they are the most vulnerable populations.

## THE FIRES OF 2000 AND PREVIOUS DECADES

The year 2000 was one of the fiercest wildfire seasons in recent history and serves as an important reference point for contemporary fire policy. Despite unprecedented expenditures on firefighting, wildfires burned more than 8 million acres across the country, the most since the 1950s, and more land than the states of Connecticut, Rhode Island, and Delaware, combined. The fires, the media attention, and the ensuing debates over management policies sparked renewed national interest in the risks of wildfire. By the end of the year, Congress had approved \$2.8 billion in funding for a National Fire Plan aimed at mobilizing resources to combat similar, if not worse, fires in subsequent years.

### 2000 Fire Season Statistics

Wildland fires:	122,827
Acres burned:	8,422,237
Structures burned:	861
Suppression Cost:	\$1.3 billion
Prescribed fires:	4,651
Acres burned:	1,077,314

Source: National Interagency Fire Center (2001b)

Most of the acreage burned in the eleven western states, as shown in Table 1-1. Although there were 25,590 fires in these states, a small percentage of these accounted for the bulk of the acreage burned, with the largest one, in Montana's Bitterroot National Forest, by itself covering nearly 300,000 acres. Table 1-2 describes the ten largest fires of 2000, eight of which were in the western states.

**Table 1-1: Wildfires in Western States, 2000<sup>1</sup>**

	No. of Fires	Acreage Burned
Arizona	2,924	35,820
California	7,283	235,248
Colorado	2,101	126,747
Idaho	1,599	1,361,459
Montana	2,437	949,817
Nevada	1,078	635,715
New Mexico	2,466	519,177
Oregon	2,006	477,741
Utah	1,929	227,827
Washington	1,116	256,781
Wyoming	651	279,583
TOTAL	25,590	5,105,915

Source: Taxpayers for Common Sense (2001) with data from the National Interagency Fire Center and the State of Hawaii.

<sup>1</sup> These are the best available state-by-state data for 2000, and they do not reflect revisions to the final data made at the regional level.

The total amount of money spent fighting fires was record-setting. Federal agencies employed over 30,000 firefighters and support personnel in fighting over 122,000 blazes and incurred costs exceeding \$1.3 billion—more than double the expenditures of the year before and more than has ever been spent on fire suppression in a single year. Federal funds are spent on firefighters, equipment and overhead. Hefty personnel costs reflect time spent transporting crews and compensation for hazardous work and overtime. Contracts for aircraft, bulldozers, and fire engines account for a large portion of the fire-suppression tab.

**Table 1-2: The Ten Largest Wildfires in the United States, 2000<sup>2</sup>**

Fire Name	Location	State	Acres Burned
Valley Complex	Bitterroot National Forest	Montana	292,070
Clear Creek	Salmon-Challis National Forest	Idaho	216,961
Eastern Idaho Complex	BLM-Idaho Falls	Idaho	192,450
SCF Wilderness	Salmon-Challis National Forest	Idaho	182,600
Zitiziana	BLM Tanana Zone	Alaska	164,387
Command 24	BLM Spokane District	Washington	162,500
Diamond	Payette National Forest	Idaho	149,772
Bering Creek	BLM Tanana Zone	Alaska	141,497
Kate's Basin	BIA Wind River	Wyoming	137,600
Eastside Complex	Wallowa-Whitman National Forest	Oregon	93,451

Source: National Interagency Fire Center (2001b)

At times, firefighting resources across the country were stretched thin in the summer of 2000. With large fires burning in many states, new fires were less likely to receive the level of assistance the incident commanders requested. As a result, some fires weren't extinguished as quickly as they would have been and grew, instead, into large blazes. Despite the massive effort, with additional crews from around the world lending support, some fires did not subside until snowfall in October.

Damage from the fires was equally severe, with 861 structures destroyed and 16 lives lost (National Interagency Fire Center, 2001b). Federal agencies have not yet estimated the dollar value of the damage but, as a reference

<sup>2</sup> Note that the data in this table speak only to the amount of acreage burned. As we discuss later in this chapter, knowledge of the natural fire regime for a given area—including the natural severity and frequency of fires—is important context for comparing fires in different areas and in different years.

point, one Forest Service official estimates that \$3.2 billion in damage to homes and other improved property was inflicted by wildfires in the last ten years (Barnard, 2001).

Beneath these aggregate data lie countless details, many of which are at odds with the common perceptions that influence the design and focus of fire-related programs. These disconnects between facts and perceptions provide insights into how fires and fire-related policies have impacted poverty in the past and can be modified to have different impacts in the future. Among the most important are perceptions about the cause of fires and their concentration on forest lands and the national forests.

## CAUSES OF WILDFIRES

**85 percent of the fires during 2000 were caused by human activities, but lightning-ignited fires resulted in 57 percent of the burned acres.**

It is easy for a casual observer to conclude that humans are the cause of most forest fires and, hence, that most fire risks can and should be avoided by preventing fires and suppressing those that are ignited. This perception is easily drawn from Smokey Bear's mantra, "Only you can prevent forest fires."

It is true that humans ignite most of the large fires on wildlands. The National Interagency Fire Center (NIFC) reports that 85 percent of the fires reported to the agency during 2000 were caused by human activities, such as campfires, smoking, incendiary devices, and equipment. Lightning caused the other 15 percent.

Human-ignited fires did not, however, burn most of the land. Instead, lightning-ignited fires resulted in 57 percent of the burned acres.

This difference between the number of fires and acreage burned points toward potentially important distinctions between human-caused and natural fires. Much, perhaps most, of the risk from fire is a natural part of the environment. We discuss this risk further, in this chapter and the appendix, when we describe natural fire regimes. Preventing and suppressing these fires inherently involves fighting Mother Nature and, hence, yields environmental consequences that lie outside the natural tendencies of ecosystems. It also has economic consequences associated with fighting nature. These can be positive, as when such efforts prevent natural fires from burning human-built infrastructure, or negative, insofar as fighting nature alters the ability of the ecosystem to provide ecological goods and services. We discuss these issues further in the appendix.

By contrast, human-caused fires may have unnatural consequences, but maybe not. In some settings, such fires may have devastating environmental consequences, but in others, human-caused ignition may lead to outcomes that are a close approximation of what would have occurred naturally.

In short, if one is concerned about the environmental and economic consequences of wildfires, then all fires are not equal. If natural environmental processes and their economic implications are important, then some fires must be seen as beneficial, and others as harmful. Or, more accurately, every fire may have both positive and negative impacts.

This conclusion contradicts the common perception that wildfires are bad, and has important implications for understanding the relationship between wildfires and poverty. With the common view, fires are bad for everyone, including the poor. The new view, though, is that a fire can have both positive and negative economic impacts on a given group or can have positive impacts on one group and negative impacts on another. Sorting through this mix to determine the gross and net impacts on poor individuals, families, and communities requires examining the different ways in which positive and negative impacts can materialize, a task to which we turn in Chapter 3.

## **FOREST (AND NON-FOREST) FIRES**

A common perception is that all wildfires are forest fires. Not so. A wide variety of landscapes burned in the 2000 fire season, some in conifer and broadleaf forests and others in non-forested or sparsely-forested landscapes dominated by sagebrush, grasslands, juniper, chaparral, etc. Unfortunately, federal agencies do not track how much of the burned land was forested and how much had other types of vegetation (National Interagency Fire Center, 2001a).

**Federal agencies do not track how much of the burned land was forested, but two studies indicate that a significant portion, and perhaps the majority of the burned landscape is non-forested.**

Two studies by experts in the analysis of spatial data at the Pacific Biodiversity Institute have attempted to fill the void. One study examined the location of wildfires during 2000 through August, and concluded that non-forested lands comprised a significant portion of the land burned (Morrison et al., 2000). A follow-up study found that deserts, grasslands, and shrublands accounted for most of the acreage burned in the largest fires of 2001 (Morrison et al., 2001). Although future studies undoubtedly will clarify the extent to which fires have burned forests and non-forested areas, these two studies indicate that a significant portion, and perhaps the majority of the burned landscape was non-forested.

This outcome should not be surprising, insofar as non-forested landscapes dominate much of the West. The data in Table 1-3 show that, as a percentage of total acreage, forested landscapes—including non-timberlands such as pinyon-juniper and chaparral, which are considered "forest"—range from 14 percent in Nevada to 51 percent in Washington.



**Table 1-3: Percent of Total Land Area that is Forested, by State**

<b>State</b>	<b>Percent Forest Land</b>
Arizona	27%
California	39%
Colorado	32%
Idaho	41%
Montana	25%
New Mexico	20%
Nevada	14%
Oregon	48%
Utah	30%
Washington	51%
Wyoming	18%
<b>Total, 11 Western States</b>	<b>30 %</b>

Source: ECONorthwest with data from Smith and Vissage (2001)

## **OWNERSHIP OF BURNED ACREAGE**

Another common perception is that wildfires occur largely on the nation's national forests. This perception seems to arise from several sources, including: the widespread publicity campaign surrounding the Forest Service's Smokey Bear, extended media coverage of large fires on national forests, and the national institutional structure, which gives the Forest Service a lead role in coordinating fire policy and communicating with the public about wildfires.

**The acreage burned on the national forests was less than ten percent of the nationwide total in both 1997 and 1998.**

Source: Morrison et al. (2001)

In reality, though, fires on national forests are often only a small part of the overall picture. Of the 8.4 million acres burned in 2000, 2.1 million were on the national forests. A similar pattern appears in preliminary data for 2001. The recent analysis, cited above, of the spatial distribution of wildfires through mid-summer of 2001 and in previous years concludes that most fires occur on lands with other ownership (Morrison et al., 2001). Through August 27, 2001, less than 15 percent of the acres burned nationwide during the 2001 fire season were on the national forests, with "the vast majority of fires" occurring on tribal, private, and state lands as well as on lands administered by other federal agencies, such as the National Park Service and the U.S. Bureau of Land Management. The study also finds that the acreage burned on the national forests was less than ten percent of the nationwide total in both 1997 and 1998.



The perception that wildfires occur largely on the nation’s national forests, and especially in forested areas of the national forests, can have major implications if it leads to fire-related programs aimed primarily at preventing and suppressing fires in these areas. Indeed, much of the discussion about fire policy over the past year has occurred in the context of decisions by the Clinton Administration to ban most new road construction, logging, and similar activities on nearly 60 million acres of unroaded areas on the national forests. Many opponents to the ban argue that it will interfere with the Forest Service’s ability to fight fires in those areas. Other indications are that any adverse impacts on timber workers and local economies from reductions in logging on the national forests will be offset by increased, fire-related expenditures on thinning and other activities that require similar skills (Niemi and Fifield, 2001).

Even when fires do occur on lands administered by the Forest Service, they do not necessarily burn forests, let alone commercially valuable forests. The data in Table 1-4 show the percentage of National Forest Land that the agency classifies as suitable for timber production. This percentage ranges from less than one percent in New Mexico to 84 percent in Oregon. Overall, less than two-thirds of National Forest land in the western states is suitable for timber production.

**Table 1-4: Percent of National Forest Land Suitable for Timber Production, by State**

<b>State</b>	<b>Percent of National Forest Land Suitable for Timber Production</b>
Arizona	32%
California	60%
Colorado	68%
Idaho	75%
Montana	80%
New Mexico	0.3%
Nevada	2%
Oregon	84%
Utah	58%
Washington	75%
Wyoming	51%
<b>Total, 11 Western States</b>	<b>62%</b>

Source: ECONorthwest with data from Smith and Vissage (2001).

## NATURAL FIRE REGIMES

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Wildfire in the West is a natural phenomenon, as natural as rain and snow and wind. It both arises from the environment, by occurring more frequently in drier areas, for example, and exerts a dominant influence on the environment. The varied climates, topography, and ecology of the western states support a spectrum of fire types, patterns, and personalities. Because of this variation, wildfire eludes easy definition, description, and one-size-fits-all action. Often policymakers, citizens, and other concerned parties advocate specific recommendations that may not reflect the underlying complexity of fire. In turn, adopted solutions may not achieve the intended results. Therefore, we present a short overview of fire ecology in the West.<sup>3</sup>

Scientists describe the natural fire cycles in terms of regimes that reflect the severity and frequency of fires. The severity of a fire reflects the extent to which it consumes existing vegetation and affects ecological parameters, such as the biological make-up and chemical behavior of soils. Stand-replacement fires are the most severe, killing essentially all the existing vegetation and setting the stage for complete regeneration of new plants. They can occur in all types of vegetation, from grasslands to tall forests. Less severe fires have a mixed impact on the vegetation, burning some areas and plants heavily, while adjacent ones are affected little or not at all. Stand-replacement and mixed fires can occur as ground fires, which travel along the surface of the land, or as crown fires, which travel through the tops of trees and tall brush.

Fire frequencies vary widely across the West. Where conditions are regularly hot and dry, fires may occur quite frequently; whereas long periods of time may elapse between the blazes in damp and cooler climates. The combination of severity and frequency reflects climatic conditions, as well as the accumulation and flammability of fuels, i.e., burnable organic material. In some settings, climatic conditions amenable to fires, with lightning, low humidity, and high winds occur every year or every few years, and fires would naturally burn across the landscape as soon as enough fuel to support a fire had accumulated. Elsewhere, the appropriate combination of climatic conditions needed to support wildfires might occur decades or even centuries apart, allowing the accumulation of brush and trees capable of fueling great conflagrations, such as the Tillamook Burns early in the 20<sup>th</sup> Century (Pyne, 1997).

Figure 1-1 shows the wide variation of natural fire regimes across the landscape. Areas with high-frequency, low-severity fires are dispersed throughout the West. The most frequent stand-replacement fires in the West historically occurred in areas, such as lands in eastern Montana and

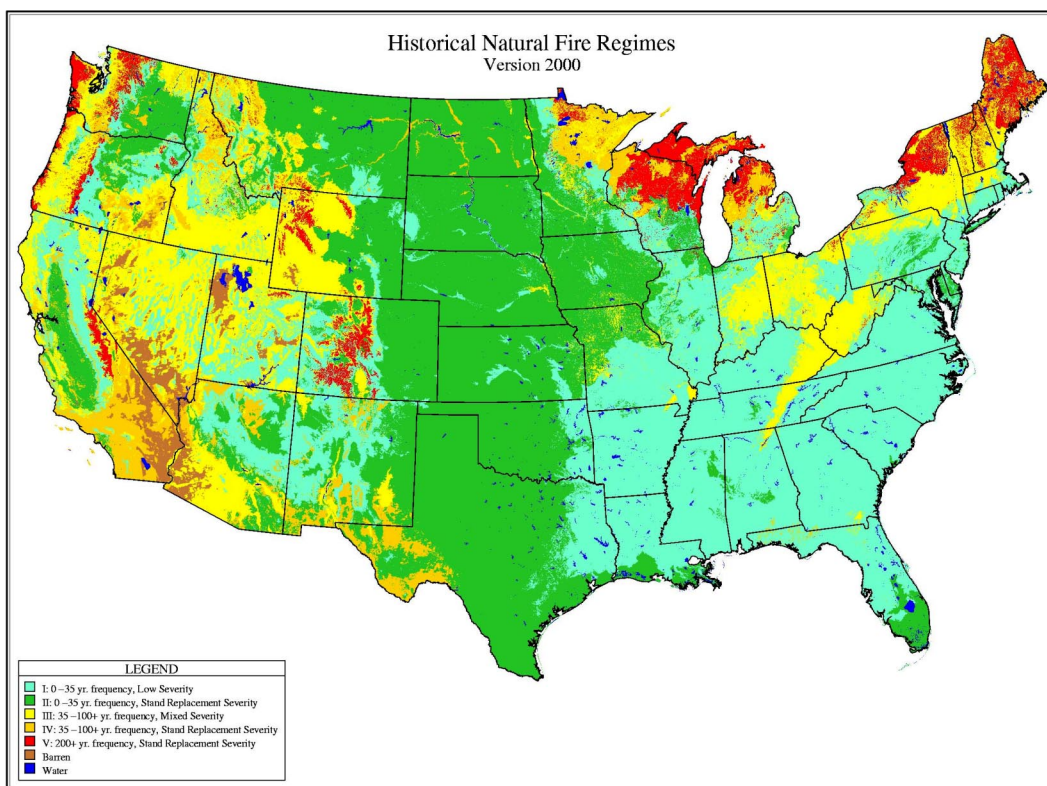
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<sup>3</sup> This discussion is no more than a brief overview. For a more detailed discussion, see Brown and Smith (2000) and Smith (2000).

Washington, typified by grasslands and shrublands. Other, non-forested areas, such as the Great Basin of Utah, burned less severely, less frequently, or both. For forested areas, stand-replacement fires occurred most frequently in the mountains of the Southwest, parts of the Rockies in Montana, and other areas. Low-frequency, stand-replacement fires were typical of coastal Oregon and Washington, the high Sierra Nevada, and parts of the Rockies.

The spatial variation in fire regimes has important ecological, economic, and policy implications. Practically all western ecosystems evolved in conjunction with fire, yet each has its own fire regime and ecological response to fire. The native vegetation evolved in response to the fire regime and, in turn, influenced the frequency and severity of fires. Areas that developed in response to fires occurring frequently (every 1-35 years) may sport grasses and shrubs, with trees unable to become established. Or, if trees do become established, they tend to have thick, fire-resistant bark that can survive low-intensity fires. Areas where fires have been less frequent tend to show the growth of more trees as well as vegetation of all sorts that is not tolerant of fire. Generally, the longer the period of time between fire episodes, the more intense the fire when it eventually occurs. In some places, however, fires routinely burned with high intensity.

**Figure 1-1: Historical Natural Fire Regimes**



Source: Hardy and Bunnell (2001)

As we discuss in subsequent sections of this report, this interaction among fire ecosystems has important implications for individuals, families, and

communities. It determines the underlying, natural risk of death and damage for those who live in a specific area. It also determines the mix and amounts of ecological goods and services that each ecosystem can provide local residents and visitors. Moreover, the underlying, natural interaction between ecosystems and fire exerts great influence on the ecological and economic consequences of human efforts to manage fire or modify the ecosystem. We discuss some of these consequences in the next section.

## **FIRE TRENDS AND OUTLOOK**

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The fire season of 2000 was attention-getting in many ways. It began dramatically when a prescribed burn intended to reduce fire risk instead spread to residential areas of Los Alamos, New Mexico. Then, fires burned far more acres than were burned in recent years, and consumed unprecedented amounts of money for fire suppression. Furthermore, all this occurred amid highly partisan struggles between President Clinton and Congress, and within the context of disputes over the president's policies for managing the national forests, establishing new national monuments, and restricting traditional industrial activity on federal lands. The fires of 2000 also came about after a decade of rapid economic and population growth which left far more people exposed to fires at the urban-wild interface, and the general public became far more aware of the extent to which past forest-management policies have increased the risk of severe, stand-replacement forest fires.

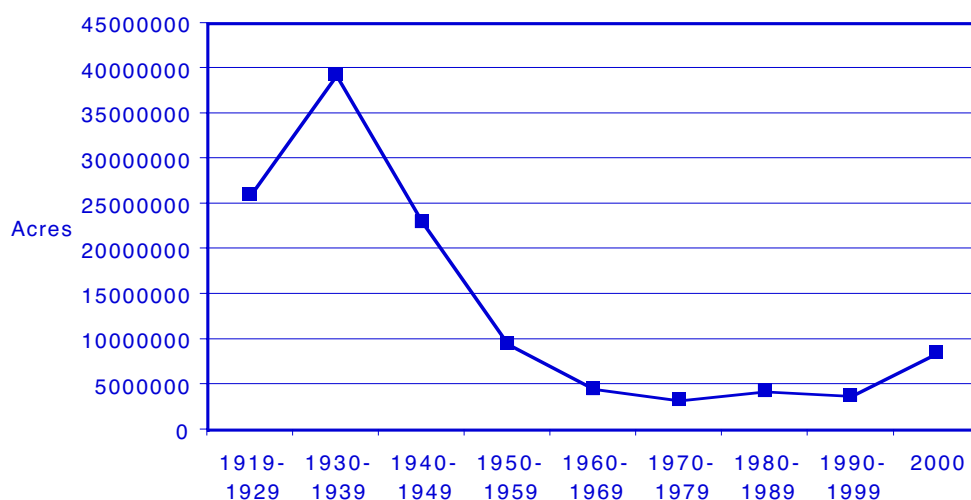
Against this backdrop, we attempt to sort through the numbers and put them into a broader perspective.

## **HISTORICAL TRENDS**

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In terms of the overall number of fires and acres burned, the fire season in 2000 was remarkable compared to recent years, but not when viewed with a longer perspective. As shown in Figure 1-2, records compiled by federal agencies indicate that, on average, upwards of 20 million acres burned each year through the 1940s. Acreage burned declined sharply in the 1950s, however, and the average remained below 5 million acres per year throughout the past four decades. This pattern raises the question: Was the experience of 2000 a fluke or a warning of far more and far more severe fires to come?

**Figure 1-2: Annual Acreage Burned, by Decade, 1919-2000**



Source: ECONorthwest with data from National Interagency Fire Center (2001b)

The evidence indicates that the fires of 2000 were both. This conclusion is reflected in a summary of the year's fires, in which Michael Dombeck, then Chief of the Forest Service, said the cause was a "combination of hot, dry weather; prolonged drought; bad luck; and excessive fuels buildups that accelerated fire spread" (Dombeck, 2001).

**The severity of the 2000 fires was due to the intersection of these factors:**

- **Hot, dry weather.**
- **Several years of drought.**
- **Build-up of fuel from decades of fire suppression and other land-management activities.**

The fire season began unusually early and ended late, due in no small part to the prevailing weather. In many places the tail end of the La Nina weather phenomenon contributed to a drying trend, with a below-normal snowpack and low spring precipitation levels setting the stage for a dry summer. The summer brought hotter and drier than normal temperatures. Severe to extreme drought conditions persisted across the West, leaving forests and rangelands parched and highly flammable.

All potential sources of fire—human or natural—had a much higher likelihood of bursting into flame than under normal conditions. The Southwest's summer monsoon season, which usually signals an end to the wildfires, came weak and late. Many fires eluded suppression until snow began falling in October, and the country's firefighting resources were stretched to their limits.

These factors—dry weather, drought, and inadequate suppression resources—may be unique to 2000, although some suspect that changes in global and regional climates may signal continuing and increasingly dry conditions with the risk of more severe wildfires in the future (Torn et al., 1998). Fire statistics for the first part of the 2001 fire season, however, indicate that the acreage burned may fall back below the previous year's level (Morrison et al., 2001).

## **BUILD-UP OF FUELS**

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Other factors, most notably the build-up of fuels, in both forested and non-forested areas, portend increases in the severity of fires and, perhaps, in the number of fires. The increase in fuels stems largely from past efforts to prevent and suppress fires. The fire-suppression activities of the federal firefighting crews since the early 1900s have, for the most part, been successful in keeping fire from burning millions of additional acres every year.

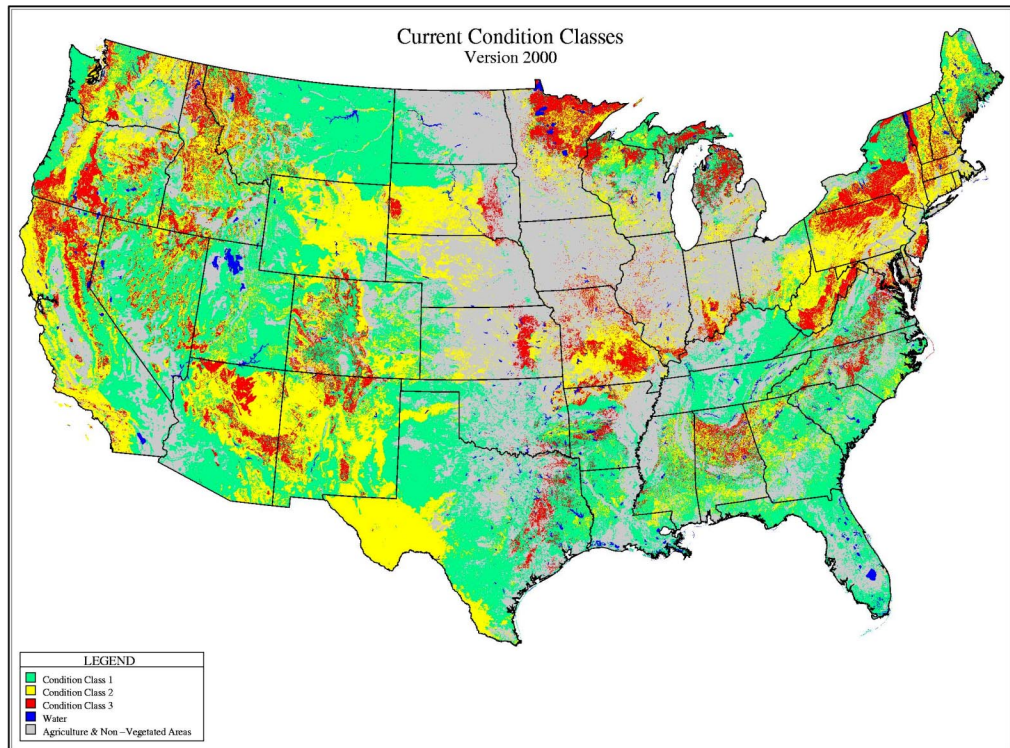
It is now widely recognized that the triumphs of this program created artificial conditions on lands accustomed to fire as an ecological process and led to unnaturally intense fires. Some forests today are clogged with brush and small diameter trees, setting the stage for severe, stand-replacement fires. Under natural fire regimes, these fuels would have been burned earlier, before they accumulated. In some instances, the prevention and suppression of fires has allowed natural populations of grasses and small brush, which would have supported small, ground fires harmless to large trees, to be displaced by dense thickets of small trees capable of serving as ladders allowing intense fires to reach into the crowns of even the largest trees.

Logging and other resource-management practices also have increased the likelihood of fires in some areas. A review of the relationships between fire and forest-management practices in the Sierra Nevada, for example, found that logging and related practices common in the past could increase the amount of fuel accessible to fires and cause the climate in the immediate area to become drier, thus increasing the fire hazard (Weatherspoon, 1996).

Figure 1-3 illustrates the changes in fire conditions resulting from past fire-related and other resource-management programs. The area colored in red on the map is in condition class 3, which indicates significant changes to the ecosystem and dramatic changes to the fire regime. In the western United States, the risk of unnaturally severe fire is especially high in the northern Rockies, the highlands of the Southwest, the mountains of the Pacific Northwest, and along the flanks of the Sierra Nevada, as well as in the Southwest, southern California, and parts of the Great and Upper Snake River Basins.



**Figure 1-3: Current Fire Conditions**



Source: Hardy and Bunnell (2001)

## POPULATION GROWTH

The dangers of wildfire in the West increase not just as wildlands become more flammable but also as more people live nearby. Recall that, in 2000, 85 percent of all large wildland fires were caused by humans. If the number of human-caused fires is proportional to the number of people living near and visiting wildlands, then, all else equal, one must expect the number of fires to continue to increase into the foreseeable future as the region's population grows.

The 2000 census documented, again, that the West is the fastest growing region of the United States. Four of the states in the interior west—Nevada, Arizona, Colorado and Utah—topped the list with the fastest growth rates. The data in Table 1-5 confirm the long-run nature of rapid population growth in the West. In the next fifty years, the region is expected to contain almost 50 million more people than in 2000.

**Table 1-5: Population in Western States, 1940-2050**

	1940	1960	1990	2000	Projections	
					2020	2050
<b>Population</b>						
United States	132,164,569	179,323,175	248,709,873	285,230,516	322,590,500	395,461,000
Western states	13,883,265	27,194,165	51,127,810	61,359,463	78,974,000	109,304,000
% of U.S total	11	15	21	22	24	28
<b>Percent Increase</b>						
United States	NA	35.68%	38.69%	14.68%	13.10%	22.59%
West	NA	95.88%	88.01%	20.01%	28.71%	38.41%

Source: Center of the American West (2001) with data from the U.S. Census Bureau.

As the population in the West increases, so does the population living adjacent to or among wildlands, in the area researchers call the wildland-urban interface. Indeed, many are drawn to the western states precisely because of a desire to live close to undeveloped and wild lands. Cities and towns continue to expand into the surrounding wildlands, and the number of people moving to rural areas because of the quality of life and proximity to the outdoors has grown.

The data in Table 1-6 illustrate the magnitude of the expansion into the wildland-urban interface. Most notable is the extent of the development at the fringe of cities and towns, in low-density-suburban and exurban areas, which has outstripped overall population growth over the past forty years. These conclusions are reinforced by several studies that focus explicitly on the wildland-urban interface (W-UI). One documents the increasing numbers of people living near national forests (U.S. General Accounting Office, 1999). Another finds high rural population growth across the Northern Rockies and Great Basin near wild lands (U.S. Department of Agriculture, 2001b). And a third, a report to the governor of Colorado, expresses concern over record-setting population growth, particularly in the fire-prone foothills of Colorado (Hubbard et al., 2001).

Such development patterns increase the opportunities for human-caused fires and expand the number of people, structures, and livestock potentially in harm's way should wildland fires ignite. These factors, by themselves, indicate that fire-related risks will increase in the foreseeable future, more attention will be focused on wildfires, and more money will be spent on efforts to fix fire-related problems. What remains less clear is how all this will affect economically disadvantaged individuals, families, and communities.



**Table 1-6: Percent Change in Population and Developed Acres in the Western States, 1960-2050**

	Percent Change			
	1960 - 1990	1990 - 2020	2020 - 2050	1990 - 2050
Population	88	54	38	114
Urban/Suburban Acres (> 2 units per acre)	139	54	34	107
Low Density Suburban Acres (1 unit per 0.5 to 10 acres)	120	77	33	135
Exurban Acres (1 unit per 10 to 40 acres)	112	53	19	83
Rural Acres (< 1 unit per 40 acres)	-6	-8	-6	-13

Source: Center of the American West (2001) with data from the U.S. Census and U.S.G.S. National GAP Analysis Program.

## RISK TO HOMES AND OTHER STRUCTURES

The combination of homes and flammable vegetation in the wildland-urban interface requires extra precautions to make homes and other property safe from wildfire (Radtke, 1983). The recent severe fire seasons have highlighted the danger to homes in fire-prone areas. NIFC reports that 861 structures were lost to fire in 2000, with over 200 homes destroyed in the Cerro Grando fire in Los Alamos, New Mexico alone. These losses led to calls for increased fire suppression resources and hazardous fuels reduction programs to reduce the fire risk to homes. But, research indicates that there are other, more important factors contributing to the probability that a home will survive a fire.

**The wildland fuel characteristics beyond the home site have little if any significance to W-UI home fire losses.**

Source: Cohen (1999)

Post-fire research on the characteristics of homes that survived wildfires reveals that the flammability of the house itself and its immediate surroundings are the key factors in the survivability of the house. A fire will spread to a house only if a path of flammable materials leads to the house or if firebrands—essentially, large sparks from a fire—travel through the air and land on a flammable part of the house. A non-flammable roof and a zone of at least 30 feet around the house free of vegetation lead to a high probability of survival. Thinning or clearing vegetation at distances from a house is "inefficient and ineffective" at preventing the home from catching fire (Cohen, 1999).

Using fire-resistant materials in a home's construction, mowing and pruning in the immediate vicinity of the house, moving firewood and other flammable materials away from the house, and thinning dense trees within 200 feet of

the house have been identified as the most important recommendations to protect homes from wildfire (Nowicki, 2001).

In Chapters 2 and 3 we address the extent to which residents and homeowners, particularly those in poverty, are motivated and able to make their dwellings safe from fire. In the next section we describe the array of fire-related programs that have evolved over time to protect people and resources. One program, "Firewise," educates homeowners about the steps they can take to reduce fire risk on their own property. We find a greater emphasis, however, on efforts based on the misperception that the build-up of hazardous fuels, particularly in forests, is to blame for home losses to wildfire.

## **FIRE-RELATED PROGRAMS**

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Federal programs to manage wildfire have always had a politically-charged character. Firefighting has been a top priority of federal agencies, the Forest Service in particular, since the early 1900's. The evolution of fire policy has been attributed as much to surpluses in the funding, labor, and equipment available to fight fires as to advances in the understanding of fire behavior and the natural role of fire in ecosystems (Pyne, 1997). We highlight the evolution of fire management programs briefly as context for the ongoing debates over fire policy and then briefly describe the National Fire Plan adopted in 2000 and a new strategy unveiled in 2001, which is set to govern fire-related programs for the next decade.

## **HISTORICAL PROGRAMS<sup>4</sup>**

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Modern fire policy has its roots in the early twentieth century. The "big blowup" fire of 1910 caught the nation's attention and led to official policies to extinguish—or suppress—all wildfires as soon as possible. The legendary fire consumed millions of acres in Idaho and claimed the lives of over 70 firefighters. Suppression has been the dominant fire policy ever since.

People soon realized that complete suppression of fires required massive human and financial resources, and more might be lost than saved, monetarily, in fighting fires where the risk to economically valuable resources was slim. In 1916 an attempt at economic efficiency in fire

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<sup>4</sup> Most of the historical information in this section is drawn from the writings of Stephen Pyne (1997), a highly regarded historian specializing in the history of wildfire. For readers seeking a far more thorough and engaging account than we provide here, we direct you to Pyne's book.

suppression—to ensure that the expense of fire suppression did not exceed the values at risk—was undertaken. A firefighting policy called "least cost plus loss" directed foresters to minimize the sum of the cost of firefighting and the fire damage to resources. Loss estimates were based on the market value of the timber at stake. These calculations were inexact; they were impossible where other values besides timber were at risk, insofar as those values had not been quantified.

With economics in mind, fire policy was modified again in 1935. The new "10 a.m. policy" authorized immediate suppression of fires with the use of as many resources as necessary to control or extinguish the blaze by 10 a.m. the following morning. This policy rested on the notion that immediate suppression of fires would reduce overall losses.

**The necessity of preventing losses from forest fires requires no discussion. It is the fundamental obligation of the Forest Service and takes precedence over all other duties and activities**

Chief Forester Henry Graves, 1913

Over time, fire-suppression efforts were fueled by large budgets and abundant labor. Pyne describes early Civilian Conservation Corps directives to put the unemployed to work fighting fires. As the supply of firefighters grew, fire crews were sent into the backcountry to fight remote fires.

Recognizing, however, that fire suppression alone would not adequately reduce the risk of wildfire, the Forest Service turned to fire prevention. A Forest Service ad campaign featuring the enduring image of Smokey Bear and the motto, "Only you can prevent forest fires" originated in the 1940's. The simple message, aimed primarily at children, focused on preventing human-caused fires, but some have argued that the emphasis on preventing wildfire obscured evidence of the natural role of fire and served to promote fire suppression policies.

A renewed emphasis on fire suppression came in 1972 with the "10-acre" policy, which emphasized immediate attack and, in turn, increased costs. By the 1970's, however, fire research had affirmed the ecological benefits of fire, and agencies adjusted fire policies to some degree by including "prescribed fire" as a fire management tool. Limited amounts of prescribed fire were intended to prevent large fires by using small fires to reduce fuel loads.

Recognizing that fire had benefits as well as costs, economic efficiency became important again. The old least-cost-plus-loss policy was revised to reflect the fact that there are some benefits to fire. The new policy involved minimizing fire program costs plus the net change in value of the resource (Mills and Bratten, 1988). In concept, the changes were consistent with principles of managing fire to maximize the net benefits to society. In practice, though, the concepts were impossible to apply fully, given the practical analytical barriers to quantifying the benefits of fire and the changes in the value of natural resources in a given setting.

The current economic efficiency policy guiding fire management comes in the form of computer models and official mandates, which vary by agency, to assess alternative strategies for dealing with individual fires. The Forest Service, for example, is required to perform a "wildland fire situation analysis" (WFSA) for fires that elude initial attack. A WFSA is supposed to include evaluation of social, economic, and environmental consequences as well as the value of the resource and the cost of fire suppression. Evidence gathered in the 1990's indicates that the assessments are done infrequently, and it is unclear the extent to which the analyses actually guide decisions in the field (MacGregor and Gonzalez-Caban, 1999). And, existing fire-management decisionmaking tools routinely overlook a number of hard-to-measure values in practice (Loomis et al., 1999).

Another policy adjustment made in the 1970's was to allow some natural fires to burn without suppression. The use of prescribed burns and decisions to let some natural fires burn came from the recognition that fire plays an important natural role. In 1995, federal fire policy required that federal agencies draft fire management plans supporting fire reintroduction as a management tool for all areas subject to wildland fire (U.S. Department of the Interior and U.S. Department of Agriculture, 1995). Both actions—letting natural fires burn and setting prescribed fires— however, have received heavy criticism, as they have resulted in some of the most notable conflagrations that have captured public attention, including the 1988 fires in Yellowstone National Park which were allowed to burn until they reached uncontrollable proportions; and in 2000, a prescribed fire in Bandelier National Monument, which raged out of control, destroyed hundreds of homes, and threatened Los Alamos National Laboratory.

## **THE NATIONAL FIRE PLAN**

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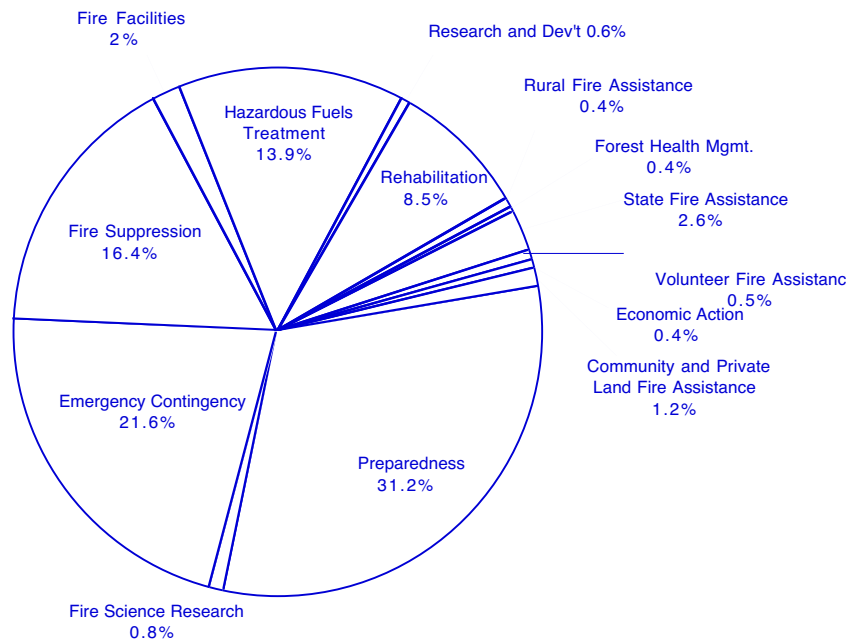
The West currently may be in the midst of yet another revolution in fire policy. We say "may be" because it is not yet clear if the rhetoric associated with national fire plans for 2001 and beyond will manifest itself on the ground.

**National Fire Plan for 2001.** In the wake of the 2000 fires, Congress allocated over \$2.8 billion to the Forest Service and Department of the Interior for fire-related programs under the 2001 National Fire Plan (U.S. Department of Agriculture and U.S. Department of the Interior, 2001). Many hoped that the new plan would shift fire-related programs away from the historical emphasis on fire suppression, while others anticipated it would initiate aggressive action to reduce fuel loads in the national forests, and still others believed it would provide assistance to communities. In reality, most of the funding went to activities related to fire suppression. The breakdown of the fire-related budget for 2001, shown in Figure 1-4, reveals that more than 70 percent of the funding was allocated to suppressing fires, getting prepared to suppress fires, building fire facilities, and establishing an emergency contingency fund to cover fire-suppression costs. Another 13.9 percent was

allocated to reducing fuel loads, 8.5 percent to rehabilitating burned areas. Less than 5 percent was allocated to assisting state and local fire agencies.

Foremost among the actions and outcomes incorporated in the plan for 2001 is a commitment to build the most efficient possible level of readiness in the federal firefighting organizations, anticipating that the fire season in 2001 and subsequent years would be as severe as, if not more so, that in 2000. To help accomplish this objective, the plan called for investing \$96 million in 171 fire facilities and air tanker bases, and hiring up to nearly 4,500 additional firefighters and other personnel.

**Figure 1-4: FY 2001 Budget for Federal Fire-Related Programs, FY 2001**



Source: ECONorthwest with data from United States Departments of Agriculture and Interior (2001).

The plan also calls for accelerated efforts to prevent wildfires. Many of these efforts will focus on reducing the amount of fuel on wildlands, especially federal forest lands. The plan calls for fuel-reduction treatments on 3.2 million acres of federal lands and 395,000 acres of private lands in 2001. This part of the plan also expresses a commitment of \$12.5 million to invest in technologies and programs that promote economic and entrepreneurial opportunities in processing forest products removed through activities that reduce hazardous fuels.

Additional effort is to be given to helping reduce fire risks in communities at the wildland-urban interface. The plan calls for collaboratively identifying wildland-urban-interface communities adjacent to federal lands and vulnerable to wildland fire, and beginning efforts to develop and enhance community-based programs to ensure adequate protection against wildfire both in and around these communities. It also emphasizes the objective of assisting 4,000 rural and volunteer fire departments to improve their fire-protection capabilities. The limited funding allocated to this objective, however, means that the improvements will be limited and unlikely to meet the target of ensuring adequate fire protection.

Implementation of the National Fire Plan for 2001 has so far produced mixed results. Firefighting readiness has increased, but federal agencies have had difficulty recruiting the desired number of firefighters, and the news media report the agencies are having problems placing adequately trained managers with inexperienced crews. Efforts to identify communities with a

wildland-urban interface exposed to risks from potential fire on federal lands have, to some observers, been disorganized and unable to separate communities with a greater risk from those with less risk (Hill, 2001). Understandably, some communities might see the program as primarily an opportunity to secure funds from the federal Treasury, whatever the wildfire risk.

Reports in late 2001 also call into question the plan's commitment to accountability (U.S. Department of Agriculture, 2001c). Members of Congress have raised doubts about the federal agencies' ability to control spending, and initial data indicate that, even though the acreage burned is far less than anticipated,

given the 2000 experience, the Forest Service's expenditures on fire suppression will exceed the budget by about \$230 million (Milstein, 2001).

**Looking Ahead.** National fire policy continues to evolve. In August, 2001, the Bush Administration adopted a new, 10-year strategy implementing the National Fire Plan (U.S. Department of the Interior et al., 2001). The strategy, which currently is merely an outline, lacks important details, and a comprehensive implementation plan is not due until May, 2002.

The broad statement of strategy gives the sense, however, that future fire policy will be more of the same. In keeping with the history of fire policy, the new policy calls, once again, for the use of cost-effective fire protection, but provides no description of what that would entail. Other areas of the policy seem just as ambiguous.

Suppression remains at the heart of this strategy, but it lacks an explanation of where or how to target firefighting efforts, vaguely

### Key Points of the National Fire Plan for 2001

Firefighting - Ensure adequate preparedness for future fire seasons

Hazardous Fuel Reduction - Invest in projects to reduce fire risk

Rehabilitation and Restoration - Restore landscapes and rebuild communities damaged by wildfire

Community Assistance - Work with communities to ensure adequate protection

Accountability - Be accountable and establish adequate oversight and monitoring for results

emphasizing protection of "communities and the environment." On the one hand, it recognizes that suppression is "especially" important near homes and communities, but there is no indication that the intent is to do anything but suppress more fires regardless of cause, location, or values at risk.

Citing "disruptions in natural fire cycles," the new plan calls for reducing hazardous fuels on federal lands. To do this, the plan targets hazardous fuels near communities "most at risk" but provides no method of evaluating risk. As we discuss further in Chapter Two, our research reveals that, all else equal, poor households and communities are likely to face higher risk of economic loss as a result of wildfire. The adopted strategy does not, however, acknowledge the potential role of using socioeconomic factors to calculate risk and set priorities for fire-prevention and -suppression activities.

Also absent from the strategy's statements about reducing hazardous fuels is a distinction between techniques to treat forest and non-forest lands. This omission creates doubt that the policy will achieve a meaningful reduction in risk to communities threatened with wildfire on non-forest lands, which are the bulk of wildlands in the West.

**At this point it remains unclear whether the influx of money under the FY 2001 plan or the new, 10-year strategy signals a change in fire-management policy or simply extends historical practices.**

The plan also calls for emergency work in the short-term to rehabilitate burned areas and long-term restoration of lands that have experienced severe fires. The community-assistance component of the strategy includes local involvement in hazardous fuels reduction, promoting markets for small-diameter materials, enhancing sustainable livestock grazing, and educating the public.

At this point it remains unclear whether the influx of money under the FY 2001 plan or the new, 10-year strategy signals a change in fire-management policy or simply extends historical practices. Some conservation groups, for example, see decisions to pursue fire prevention by emphasizing logging to reduce fuels on national forest lands as out of step with evidence indicating that forest fires on national forests are less of a hazard than fires on other lands. Conservationists and community representatives have asked why there is not a greater emphasis on reducing fuels around structures at the wildland-urban interface and a lower emphasis on reducing fuels farther afield.

## REFLECTIONS

Wildfires seem tailor-made for today's news and entertainment media. They provide dramatic video coverage, personal drama, and weighty pronouncements about millions of acres and billions of dollars. Moreover, the whole production has the aura of the nation going to war. And what a



glorious war it is! The audience easily recognizes the enemy as evil, the fire-fighters as heroic, and their quest as noble.

Wildfires are far less amenable to the more prosaic challenge of designing and implementing fire-related programs capable of meeting a complex mix of ecological and economic requirements. Here, fire-suppression must share the stage with and often step aside for the less photogenic chores of preventing fires, reducing fire risks, and allowing fires to burn under natural fire regimes.

But little, if anything, comes easy in this arena. Developing optimal fire-related programs requires first defining widely-shared ecological and economic objectives, and, as with most resource-management issues in the West, controversy over fires can rage as violently as the fires themselves. Public institutions with decades of experience mobilizing to fight fires find they cannot easily redirect their momentum. This is especially so when private vendors of firefighting supplies and services believe their interests are best served not by change but by more of the same and press political leaders accordingly. And even the most well-intentioned plans can vaporize in a second when a fire ignites and people clamor for immediate firefighting action.

The National Fire Plan, intended to provide clear direction for replacing the historical emphasis on fire suppression seems, instead, to have left the federal fire program pointing in all directions at once:

- Directions to deemphasize fire suppression and increase the recognition given the natural ecological role of fire seem to butt heads with increased funding for firefighting equipment and personnel, for, once fires are ignited, it can become nearly impossible for institutions not to move these new resources to the fire lines.
- Directions to increase fire protection for at-risk communities seem to have quickly become an exercise in tail-chasing, where deciding which communities are eligible for assistance depends on the types of assistance being offered and this, in turn, depends on the characteristics of the eligible communities.
- Directions to reduce the risk of catastrophic fires seem to have lost their way within the broad uncertainty about the distribution of risk across different types of landscapes and land ownership. Instead of producing a strategy matching the most immediate actions with the highest risk, they seem to have yielded prescriptions for logging the national forests well away from at-risk communities, even though fires on other lands and in non-forest landscapes may constitute the majority of the wildlands where severe fires may occur.
- Directions to produce an efficient, comprehensive fire program seem to have become lost in ambiguities about the full costs and benefits of different actions in different places at different times. Intensive fire-suppression efforts, fuel-reduction, or other activities may yield net benefits at some places and times, but net costs at others. The agencies



have not demonstrated the capability to distinguish among the different settings and justify their actions in a timely and comprehensible manner.

It is not surprising that the agencies would have difficulty implementing a major expansion of fire-related programs. Nor is it surprising that the agencies, in responding to the task, would turn first to doing more of the same, rather than effecting a change-over in objectives, programs, and activities. Given the concerns about the orientation and efficacy of current fire-related programs, however, a reevaluation of the programs from new perspectives seems in order. One particularly useful reevaluation would look at fires and fire-related programs from the perspective of those who are most vulnerable to the consequences of fires and fire-related programs: poor individuals, families, and communities.

In the following chapters we introduce a framework for such a reevaluation and then take the first steps to apply it. We begin by describing what poverty means in the context of wildfires and fire-related programs.



## CHAPTER 2: WILDFIRES AND POVERTY—OVERVIEW

We now turn to the relationships between wildfires and poverty. In this chapter we describe—as well as we can, given the available data—the individuals, families and communities who are living in poverty and exposed to wildfires, and then describe the different ways in which wildfires and fire-related programs can affect these groups. This description is brief and sets the stage for a more deliberate discussion in the subsequent chapters. Next, we describe the reverse relationship: the different ways in which poverty can increase the risk of wildfire. We conclude with some reflections on how the relationships between fires and poverty might evolve in the future. First, though, we develop a working definition of poverty in the context of wildfires.

### WHAT DOES POVERTY MEAN IN THE CONTEXT OF WILDFIRES?

Asking questions about the relationships between wildfires and poverty raises other questions: What do you mean by poverty? How many poor individuals, families, and communities are exposed to wildfires? Where?

**Poverty, in the context of wildfires, means people and communities unable, because of inadequate financial or non-financial resources, to take the steps necessary to protect themselves, their families, their homes, and other assets from the risks of wildfire.**

In a simpler world, there would be agreement on the definition of poverty and readily available data showing the number and location of people falling within this definition. In reality, there are numerous definitions of poverty and a miasma of different data, none of which is on point. Accordingly, we begin with a conceptual definition of what poverty means in the context of wildfires and do the best we can with data prepared for other purposes using other definitions.

We adopt this conceptual definition: poverty, in the context of wildfires, means people and communities unable, because of inadequate financial or non-financial resources, to take the steps necessary to protect themselves, their families, their homes, and other assets from the risks of wildfire. This definition extends more broadly than those that equate “poverty” with “people with low incomes” and especially with “people whose incomes fall below the Federal Poverty Level.” Low income is, of course, a telling characteristic of poverty, but it is not sufficient in the context of understanding the relationships between poverty

and wildfires. A family may have income above the poverty level but still be unable to muster the resources needed to protect against wildfires.<sup>1</sup>

Our broadening of the definition of poverty is not new, reflecting the reality that the poverty line defined by the federal government captures only one aspect of economic well-being. A recent report about poverty in Idaho addresses the poor and the "near poor"—described as those whose incomes are less than twice the federal poverty line. Only those near this higher level, or above it, were found to be able to "meet their basic needs without resorting to public assistance and provide them some ability to deal with emergencies and plan ahead" (Northwest Policy Center and Northwest Federation of Community Organizations, 2001). This finding gets close to the essence of our treatment of poverty in this report. A more robust depiction of poverty is presented in a report advocating a "self-sufficiency standard" for the state of

**To our knowledge, no one has previously attempted to describe the magnitude and spatial distribution of the intersection between poverty and wildfire across the western states.**

Colorado. In contrast to poverty, "Self-Sufficiency means maintaining a decent standard of living and not having to choose between basic necessities – whether to meet one's need for child care but not for nutrition, or housing but not health care" (Pearce and Brooks, 2001). For people living in areas at risk of wildfire, we would extend this profile to include the ability to expend resources to fire-proof one's home and surroundings.

Broadening the definition of poverty beyond conventional federal definitions increases the number of individuals, families, and communities that qualify. It also, however, makes it more difficult to count them and determine their location (Dalaker and Proctor, 2000). This is especially so for the intersection between poverty and wildfire for, to our knowledge, no one has previously attempted to describe its magnitude and spatial distribution across the western states.<sup>2</sup> In the next section, we summarize some of the information that is more or less relevant.

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<sup>1</sup> By using "the inability to protect oneself against wildfires" to represent poverty and lumping together notions about poor people and poor communities, we purposefully overlook distinctions that may have important implications for fully understanding the relationships among wildfires, fire-related policies, and the individuals, households, and communities at the bottom of the economic ladder. We do so after concluding that our treatment of these distinctions is reasonable and useful for initiating an examination of these relationships, whereas a more rigorous dissection of them might prove distracting. We look forward to examining these distinctions in the future.

<sup>2</sup> One study mapped the location of "special populations" at risk in Colorado (Case et al., 2000).

## INCIDENCE OF POVERTY, IN THE CONTEXT OF WILDFIRE RISKS

Wildfires pose economic risks for about 19 million people living in poverty in the West. This number represents the 31 percent of the region's total population—based 1990 Census poverty data—whose family incomes are less than twice the federal poverty line, which, as we explain above, provides a rough standard for determining when people lack the means to protect themselves from wildfire risks. Many of these people live where wildfires pose a direct risk to life and property. All, however—even those living in central cities—face indirect risks. These can materialize, for example, when wildfires burn a municipal watershed and residents must rely on water from bottles, or fire-related programs reduce the availability of social services for the poor by consuming funds that otherwise would be used for these services.

Although the indirect impacts on the poor from fires and fire-related programs can be devastating, much interest focuses on the direct risks. Insights into the magnitude and location of the exposed populations can be gained by looking at data for the wildland-urban interface and rural poverty.

## POVERTY AND THE WILDLAND-URBAN INTERFACE

The intersection of residential and commercial-industrial development with expanses of natural vegetation is called the wildland-urban interface, or W-UI. It encompasses homes and other buildings in proximity to forests, rangelands, grasslands, and brush. A variety of definitions of the W-UI have been employed, sometimes encompassing urban and suburban development near wildlands but excluding developments that are completely rural (Hardy et al., 2001). Our use of the term is broad. To capture the full extent of human exposure to wildfire, we include development in rural areas and at the fringe of suburban or urban areas near wildlands. In some cases, though, the human-wildfire interface can include development farther inside the suburban boundaries, but still in fire's reach under certain conditions.

### Communities in the Wildland-Urban Interface

- More than 22,000 communities at risk of wildfire across U.S.
- 11,376 communities at risk of wildfire near federal lands
- 9,457 communities are near lands managed by USDA and DOI
- 2,007 communities are near lands managed by other federal agencies
- 9,600 communities have no hazardous fuels reduction treatments ongoing or planned for FY 2001

Source: Federal Register (2001)

Stimulated in part by the adoption of the National Fire Plan for 2001, states, tribes, and federal agencies have taken steps during the past year to identify which communities are located in the wildland-urban interface. These efforts produced a list, printed in August 2001, of more than 11,000 communities in the vicinity of federal land and at risk of wildfire (Federal Register, 2001).

A larger list—more than twice as long—identifies all communities at risk of wildfire, whether or not they are near federal land. Neither of these lists, however, recognizes the importance of poverty as a determinant of the extent of the risk the communities face. That is, the lists weigh a community of trophy homes and one of trailer parks as equally "at risk."

Many images of homes engulfed by flames at the W-UI bear little relationship to images of poverty. Burgeoning suburbs with lush golf courses, resort communities, and the rural homes pictured in *Sunset* magazine reflect the spreading wealth located at the edge of many western communities and the desire to live with spacious views of urban and/or wild landscapes.

**Table 2-1: Communities at Risk of Wildfire, by State**

State	Number of Communities at Risk of Wildfire	
	List of Communities Near Federal Land	State Foresters' List of All Communities
Arizona	122	122
California	845	845
Colorado	714	1599
Idaho	442	428
Montana	182	372
Nevada	245	245
New Mexico	60	60
Oregon	367	504
Utah	398	548
Washington	159	255
Wyoming	260	260
Total	3794	5238

Source: ECONorthwest with data from Federal Register (2001) and The National Association of State Foresters (2001).

The images of suburban-rural wealth stand in stark contrast with other images of the W-UI. These include run-down public and private housing on some Indian reservations, rows of trailer houses at the edge of many towns, and below-code houses constructed far from the inquiring eyes of city hall or the county courthouse.

Though no study has compiled statistics on the number of poor individuals, families, or communities exposed to wildfire risk throughout the western United States, rough estimates extrapolated from existing data are useful.

Table 2-2 provides the results of one study that found over 48 million people across the continental United States in the area we classify here as the W-UI, which is the sum of the urban and suburban populations near

wildlands—labeled the "immediate W-UI " in Table 2-2—and the population in less populated wildland and rural areas (Hardy et al., 2001). Because 21.8 percent of the population of the lower 48 states reside in the western states, we estimate that, roughly, 21.8 percent of the W-UI population—10.5 million people—occupy the W-UI in the West. Assuming the W-UI has the same demographics as the rest of the Western states, 31% of the population—3.3 million people—have incomes less than twice the federal poverty line and are more likely to have difficulty recovering from the effects of wildfire.

**Table 2-2: Population Distribution by Land Class**

Land Use Class	Approximate Population	
	Lower 48 States <sup>a</sup>	Western States <sup>b,c</sup>
Wildland	1,216,103	264,824
Rural	8,831,385	1,923,165
Immediate Wildland-Urban Interface	38,573,910	8,400,041
Subtotal Wildland-Urban Interface	48,621,398	10,588,030
Urban-Suburban	187,969,804	40,933,211
Agriculture	30,412,573	6,622,789
Other	1,498,618	326,346
Total	268,502,393	58,470,375

<sup>a</sup> Based on 1998 population estimates used by Hardy et al (2001).

<sup>b</sup> Based on U.S. Census data, the 11 western states had 21.8 percent of the population of the lower 48 states.

<sup>c</sup> Calculated as 21.8 percent of the totals for the lower 48 states.

Source: ECONorthwest, based on ambient population density estimates in Hardy et al (2001).

Another study, from Colorado, estimates that 25 percent of the state's population lives in areas at high risk of wildfire (Hubbard et al., 2001). If this percentage applies throughout the region, then roughly 15 million people are directly at risk of fire. If one assumes that 31% percent of them—the regional average—have incomes less than twice the federal poverty line, then the W-UI of the western states contains about 4.7 million people who lack the means to protect themselves against wildfires.

## RURAL POVERTY

Because the West has such wide, open spaces, in many landscapes issues associated with wildfires in the West are restricted to rural areas with either unincorporated communities or small towns. But not in others, as evidenced by the fire in 2000 that burned a neighborhood of Los Alamos, New Mexico, and the numerous fires annually in urban-suburban neighborhoods in southern California. Nonetheless, the urban-rural distinction can provide some additional insights, insofar as data from the Census Bureau, the Bureau of Economic Analysis, and other agencies report separately for rural and urban areas and between nonmetropolitan and metropolitan counties.

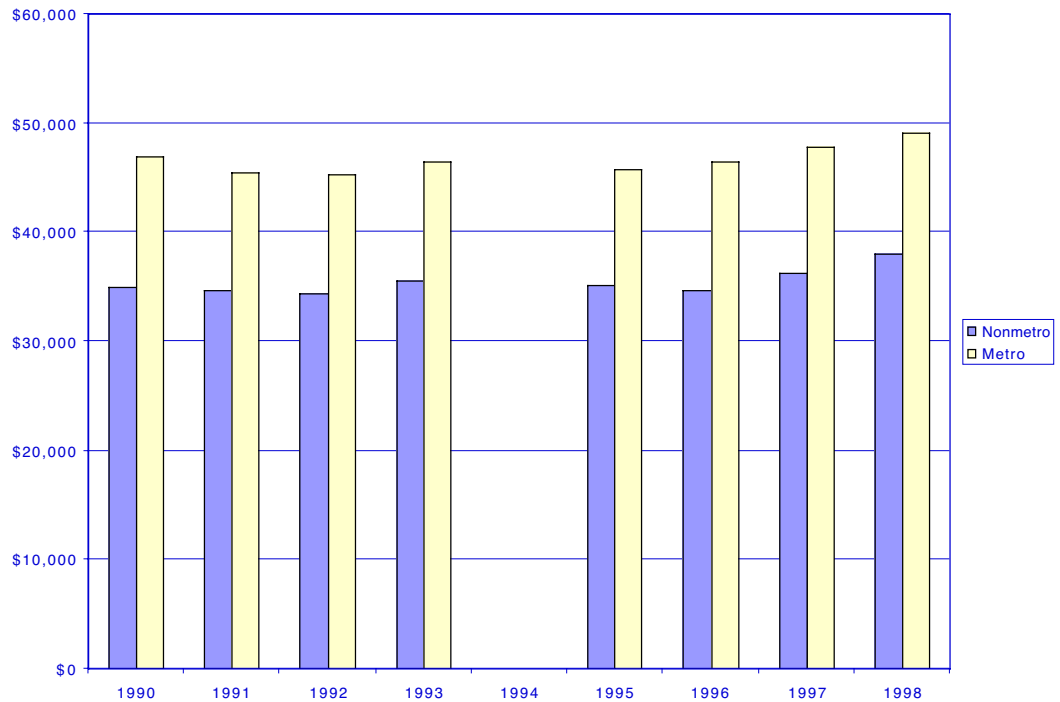
In 1999, nonmetropolitan areas of the eleven western states contained 7,389,063 people, 12 percent of the total. Of these, 14.3 percent, or 1,056,636 had family incomes below the federal poverty line. If the regional average discussed above applies to these counties, then 31 percent, or 2,290,611 people had incomes less than twice the poverty line and, hence, probably lacked adequate means to protect themselves from wildfires.

**These data reaffirm that there are large numbers of people in rural areas of the West, living on the edge of economic catastrophe, and exposed to fires and fire-related programs that pose risks of pushing them over the edge.**

The data in Figure 2-1 indicate that nonmetropolitan areas have not just a higher incidence of poverty but also lower incomes for those above the poverty line. The data in Figure 2-2 confirm that the higher incidence of poverty is a long-standing characteristic of the West's nonmetropolitan areas. A full analysis of these data lies beyond the scope of this report, and one must be careful not to overstate their meaning. Lower incomes in nonmetropolitan areas, for example, may be offset to some extent by lower costs for

some living expenses. Taken together, however, these data reaffirm that there are large numbers of people in rural areas of the West, living on the edge of economic catastrophe, and exposed to fires and fire-related policies that pose risks of pushing them over the edge. Moreover, many communities in these areas are themselves impoverished, lacking the financial wherewithal to mount an effective response.

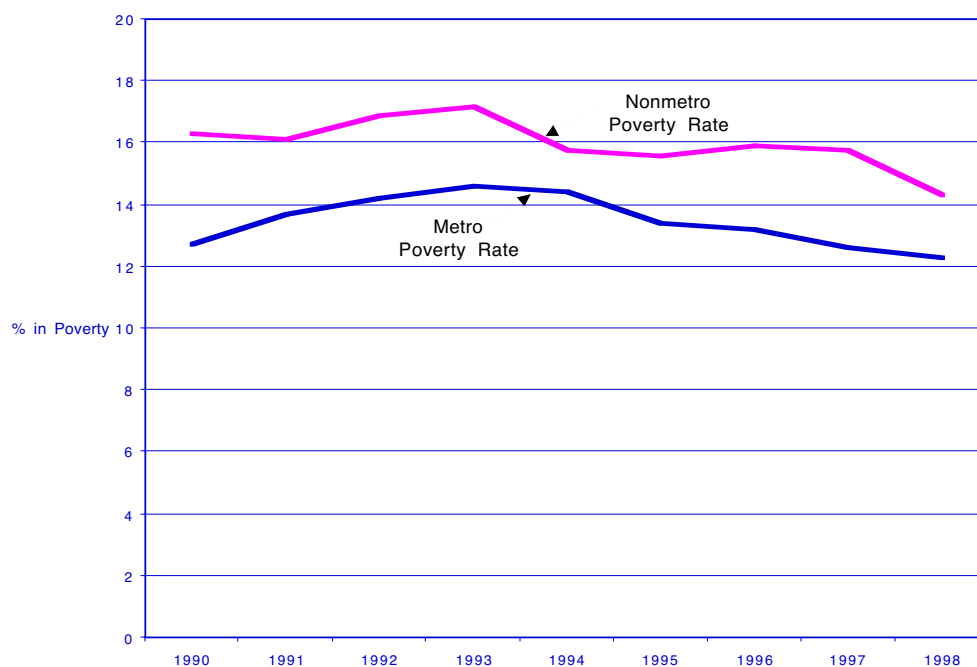
**Figure 2-1: Metro and Nonmetro Median Income**



Source: Economic Research Service (2000, p. 103) (Calculated by ERS using data from the March Current Population Survey, 1991-99.) No data were available for 1994.



**Figure 2-2: Metro and Nonmetro Poverty Rates**



Source: Economic Research Service (2000, p. 103) (Calculated by ERS using data from the March Current Population Survey, 1991-99.) Changes in data classification in 1994.

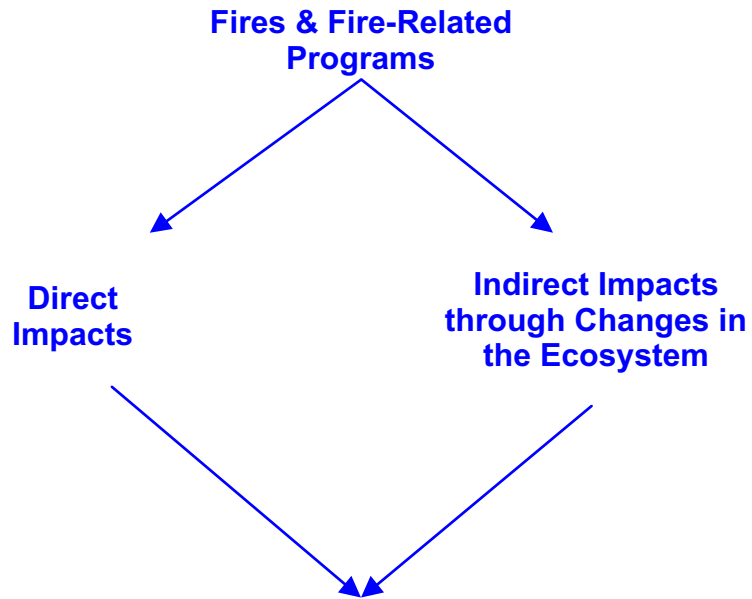
In the next two sections of this chapter we sketch the types of economic impacts fires and fire-related programs can have for impoverished people and communities and then describe the risks that poverty poses for wildlands and wildland-management programs.

## POTENTIAL IMPACTS OF WILDFIRES AND FIRE-RELATED PROGRAMS ON POVERTY

Wildfires and fire-related programs can have positive impacts on poverty, negative impacts, or both. The impacts can manifest themselves through countless channels.

Figure 2-3 illustrates the major ways that wildfire and fire-related programs affect individuals, families, and communities. Actions by public agencies provide one channel of impact. These actions include fighting fires, logging, restoration, management of recreational areas, research, etc. The other primary channel involves changes in the mix of ecological goods and services derived from wildlands, such as changes in the frequency of flooding, availability of recreational opportunities, supply of drinking water, and protection of sacred places. An overview of ecosystem-related impacts on poverty is provided in the Appendix.

**Figure 2-3: Major Impacts of Wildfires and Fire-Related Programs on Impoverished Individuals, Families, and Communities**



**Changes in the Health and Welfare of Impoverished Individuals, Families, and Communities**

- **Health impacts**
- **Changes in jobs and incomes**
- **Changes in the economic value of property and other assets**
- **Changes in the cost of living**
- **Changes in cultural, social, and spiritual values**

**Health impacts.** Wildfires can cause death, injury, and illness, to residents of affected communities as well as firefighters. In 2000, wildfires are credited with the deaths of 16 firefighting personnel (National Interagency Fire Center, 2001b). Smoke from both natural and prescribed fires can cause heart and lung problems (Gwynn and Mott, 2000).

**Impacts on jobs and incomes.** Fire-related programs generate many types of job opportunities associated with researching fires, fighting fires, preventing fires, and rehabilitating landscapes after fires. The jobs can cross a wide range of skill levels and occupations, from low-skilled jobs setting up food tents at fire camps, to bosses of fire crews, to land managers and fire-policy researchers. They also can extend outside the normal images of the activities immediately associated with fires. Programs that involve long-run management of wildlands and communities to restore natural fire regimes and to establish a sustainable co-existence between communities and wildfires, for example, could create jobs in vegetation management on both sides of the wildland-urban interface.

**The most common perception is that fires destroy or diminish the economic value of property and other assets, and programs that prevent, suppress, and rehabilitate after fires necessarily increase the economic value. In reality, things are more complicated. As fires destroy some things, they can be essential to maintaining the economic productivity and value of natural ecosystems. Fire-related programs can protect the economic value of some assets, but at the same time lower the value of others.**

Fires also can destroy jobs, and so can fire-related programs. Fire's destructive impacts on jobs are most obvious. When it burns trees that otherwise would have been raw material for a sawmill, it can eliminate jobs for loggers and mill workers. When it consumes the vegetation and affects soil chemistry, it can lead to higher flooding downstream that can eliminate jobs in exposed businesses and communities. When it causes streams in a municipal watershed to become muddier, so that the water utility has to curtail deliveries to and/or raise rates for consumers, it can eliminate jobs throughout a local economy.

Ironically, fire-related programs might have similar impacts. If a forest-thinning program to reduce fuel loads on a national forest converted sufficient amounts of material into logs or wood chips for the forest industry, it might depress prices and cause the elimination of jobs for employees of other forest landowners. Roads built to facilitate fire-prevention, fire-suppression, or fire-rehabilitation activities might increase the risk of downstream flooding or increase the muddiness of streams in a municipal watershed (Trombulak and Frissell, 2000) and adversely affect jobs downstream.

**Changes in the economic value of property and other assets.** The most common perception is that fires destroy or diminish the value of property and other assets. The images that come to mind are flames consuming timber, forage, and scenic vistas, as well as structures, vehicles, and other human-built assets. Against this backdrop, programs that prevent, suppress, and rehabilitate after fires necessarily increase the values of wildland and human-built assets.

In reality, things are more complicated. As fires destroy some things, they can be essential to maintaining the economic productivity and value of natural ecosystems. Fire-related programs can protect the economic value of some assets, but at the same time lower the value of others. Much of the worry about fire risks throughout the West stems from the feedback effect of past fire-suppression programs that, inadvertently have resulted in higher risks for some properties and assets.

There are countless examples of the complex impacts of fires and fire-related programs on the value of properties and other assets. The related issues and management implications are equally complex. Chapter 4 delves into these more thoroughly and introduces the relevant literature.

**Changes in the cost of living.** Fires and fire-related programs can have numerous impacts, both short- and long-run, on the local cost of living. During a fire, supplying the demands of firefighters and support personnel for food, telecommunications, and personal services can overwhelm the capacity of local communities and temporarily drive up prices for local residents. Or, a fire and fire-suppression activities might disrupt transportation routes so that local residents incur additional costs to commute to work.

**Current cultural, social, and spiritual values of the West are deeply intermingled with the legacy of past wildfires and fire-related programs. Looking forward, fires and fire-related programs, through random events or by design, will enhance, diminish, or reshape these values. In the process, the impacts on some poor people and communities could be immense.**

In the long run, changes in the cost of living might occur if responding to a fire or to fire risks depletes the resources and consumes the attention of governmental agencies and non-governmental organizations, and thereby reduces their ability to provide a wide array of social services. Similar impacts could occur if a fire and fire-related activities alter the structure of the local economy, e.g., by inducing the closure of a major employer and taxpayer, so that the costs of sustaining local public services increase for others.

**Changes in cultural, social, and spiritual values.** Fires and fire-related programs have had profound impacts on the cultural, social, and spiritual values of groups throughout the history of the West. Wildfire, itself, has historically had spiritual value to some Indian people, and some groups used fire extensively as an integral element of their social, economic, and cultural lives. Euro-American and other immigrants to the West also have used fire to help clear land and create desired communities and landscapes. Westerners' current perceptions of what a natural western landscape would look like and their preferences about how it should look are undoubtedly heavily influenced by decades, even centuries of fire-related programs overlaying natural fire regimes.

In sum, current cultural, social, and spiritual values of the West are deeply intermingled with the legacy of past wildfires and fire-related programs. Looking forward, fires and fire-related programs, through random events or

by design, will enhance, diminish, or reshape these values. In the process, the impacts on some poor people and communities could be immense.

Consider just one example.<sup>3</sup> The harvesting of native plants from the forests of northeastern Oregon has long been important to the region's Indian people: the plants had nutritional and cultural value and the gathering of the plants was an important social event. Much of the land now is administered as the Umatilla National Forest. Logging, road-building, fire-suppression, and other fire-related activities on these lands have diminished the supply of the native plants.

In its current fire-management policies, the Umatilla National Forest provides mechanisms for consulting with tribal authorities to ensure that fire-related programs do not unnecessarily harm cultural sites. Forest Administrators, working with tribal authorities, also have investigated the feasibility of cultivating native plants in a tribally-owned nursery and planting seedling in the forest to reduce fire risk and rehabilitate burned areas. The tribal council, however, has been reluctant to pursue this proposal, fearing that any commercialization of native plants would lead the Forest Service to ban tribal members from collecting plants from within the national forest boundaries. It also fears that a tribal nursery eventually would be displaced by federal contracting rules that would favor non-tribal nurseries.

Thus, despite sincere efforts to integrate tribal interests into the agency's fire programs, the results are mixed. Important vegetative (as well as archaeological and cultural) sites have greater administrative recognition and protection than before. But, the agency and tribe cannot forge a mechanism enabling the tribe to help rebuild native plant populations, build economic and social infrastructure associated with a nursery. If the agency or a third-party should further pursue commercialization of native-plant cultivation, tribal members could face foreclosure of activities with immense cultural, social, and spiritual value.

## **CONDITIONS THAT AGGRAVATE THE RISKS TO POOR PEOPLE AND COMMUNITIES**

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Considerable evidence supports the conclusion that poor households and communities are especially vulnerable to the risks of wildfires and fire-related programs. We attribute this increased risk to a combination of factors including the physical condition of built structures, the availability of emergency services, and the extent of financial assets.

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<sup>3</sup> This example is based on interviews with Louie Dick (former member of the tribal council), Earle Lothar (Public Affairs Officer for the Umatilla National Forest), and Jeff Blackwood (Forest Supervisor).

**Inadequate self-protection for housing and other structures.** Poor households are less likely than richer neighbors to live in housing with adequate self-protection against fire. Poor communities are more likely to have a greater concentration of housing and other structures with inadequate self-protection.

**Factors Increasing the Vulnerability of Poor Households and Communities to Fire-Related Risks**

- Inadequate self-protection for housing and other structures.
- Inferior fire-protection services.
- Greater concentration of assets exposed to fire.
- Poor health and limited access to healthcare.
- Limited financial ability to cope with fire-related disruptions of economic activity and social services.

These conclusions are supported by data from several sources. They rest on a general definition of self-protection that embraces meeting or exceeding building codes, having non-flammable roofing, and a defensible space surrounding each structure that is free of flammable material commensurate with local fire-protection standards.<sup>4</sup>

One recent study of rural housing found that low-income rural residents experience a variety of housing problems with greater frequency than higher income residents (Housing Assistance Council, 2000).

Although the study did not explicitly address susceptibility to fire, it seems reasonable to assume that a higher incidence of inadequate plumbing and heating correlates with a higher incidence of inadequate self-protection against fire.

Another study identified serious fire risks related to the design and structure of buildings in rural areas because of "less strict adherence to building codes and greater use of low-cost building designs and materials" (Federal Emergency Management Agency, 1997a). The situation is compounded by the finding that nearly three-quarters of rural residential fires occur in homes without operational smoke detectors (Federal Emergency Management Agency, 1997b). Taken together, these conditions set up a high potential for loss of life and property in rural fires.

**Depending on where they live, Native Americans have two to six times the risk of fire death as non-natives.**

Source: Wolf, 1997

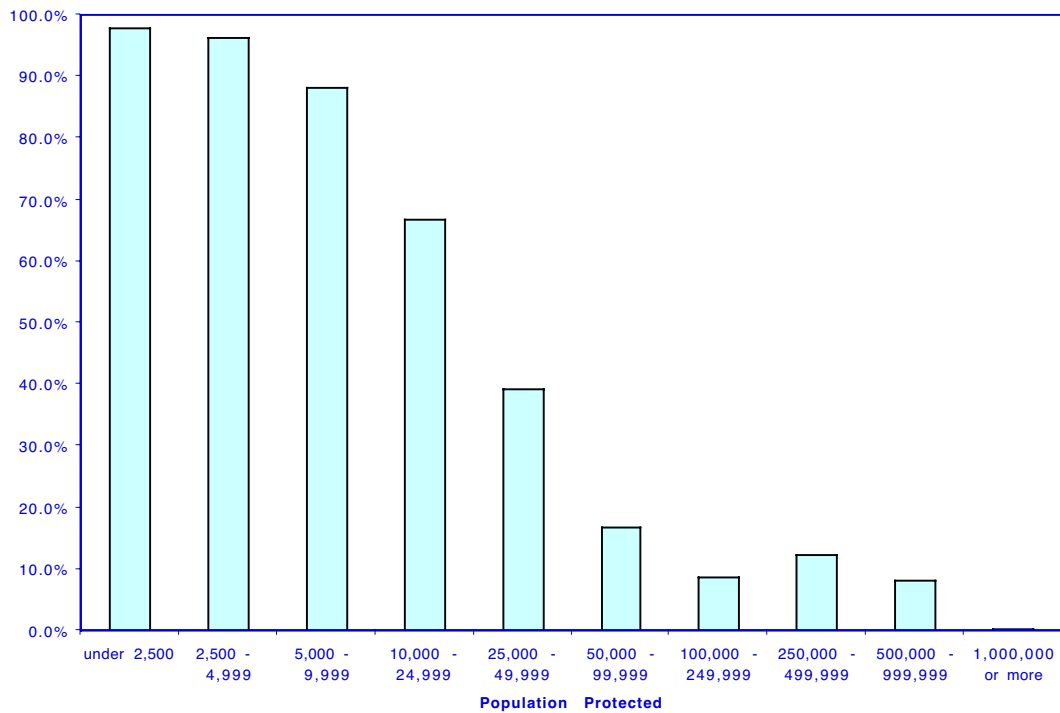
In addition, it is unlikely that those in poverty would be able to take significant steps to protect themselves from wildfire due to the expense or time involved. Approximately 21 percent of rural households are considered cost-burdened because they spend more than 30 percent of their monthly income on housing (Housing Assistance Council, 2000). Thus, although they are able to make their rent payments, they do not have enough disposable income left over to cover other basic needs—such as investments in fire proofing (Federal Emergency Management Agency, 1997a).

<sup>4</sup> Information about self-protection is available from many sources, including <http://www.firewise.org>.

Poor renters may have the least incentive of all residents of the W-UI to take active measures to protect their home from fire. Research suggests that, because homeowners have a large investment in the purchase of their home, they may maintain their homes better and, for example, may be more likely to purchase smoke detectors than renters (Federal Emergency Management Agency, 1997a). Renters, and especially those at the bottom of the economic ladder, remain most vulnerable.

**Inferior fire-protection services.** Another factor influencing wildfire risk is the availability of fire-protection services. Primary responsibility for protecting non-federal lands and property from fire lies with states and localities, and poor, rural communities may not be able to afford the level of fire protection available in urban areas (Fahy and Norton, 1989). As Figure 2-4 shows, most small communities are protected by fire departments that are almost entirely volunteer. Though rural fire departments are often the first line of defense on over 80 percent of wildland fires, they may suffer from a lack of funding for specialized equipment and have difficulty recruiting, retaining, and training citizen volunteers.

**Figure 2-4: Percent Volunteer Firefighters by Community Size, 1999**



Source: Karter (2000)

**Greater concentration of assets exposed to fire.** In the event that fire prevention and fire suppression efforts fail and a home or other assets are destroyed or damaged by fire, the loss falls hardest upon the poor. This is not to say that wealthier people and communities cannot suffer tremendous losses from fire. Instead, it is the recognition that poor people are more likely to lose more—or all—of their assets when their home catches fire (Housing



Assistance Council, 2000). People with higher incomes, in contrast, are more likely to have assets like mutual funds and savings accounts that are not consumed by a fire. They are also more likely to have adequate insurance to cover the financial damage.

**Poor health and limited access to healthcare.** Poverty often is correlated with poor health and limited access to health care (Kurland, 2000; U.S. Census Bureau, 2001) and both factors increase the vulnerability of poor people and communities to fire-related risks. When poor health reduces a person's mobility, he or she either remains longer in a fire's path or secures assistance from neighbors, fire-department personnel, or others. If the latter, then these people and resources are diverted from other fire-response tasks.

Fires can generate additional problems for persons with health problems. Those with respiratory problems may be more intensely affected by smoke. The stress of responding to a fire may trigger life-threatening events for those with coronary problems. These problems are compounded by the limitations on health care typical of poor communities, and especially those in rural areas (Shenot and Bouma, 1998).

**Limited financial resilience to cope with fire-related disruptions of economic activity and social services.** A central characteristic of poverty is low resilience to economic disruption. Poor people can't afford to buy replacement clothes when everything they own goes up in smoke, or to live in a motel for months while their home is rebuilt. They can't afford to take time off from work to calm the fears of children frightened by fire. They can't afford to search for a new job when fires or fire-related programs cause their employer to close shop.

Poor communities have similar problems. They can't afford a planner to design and implement a fire-protection and -response program. They can't afford the cost of building a new water-treatment plant to accommodate source water made muddy by fire and fire-related activities. They can't afford to dip into financial reserves to backfill when budgets for other programs are depleted to bear the costs of fire-response programs.

The evidence is conclusive that those at the bottom of the economic ladder are more vulnerable to the risks of wildfire. These findings are consistent with the conclusions of other studies of natural disasters, which find that the poor are hit hardest in the face of catastrophes (International Federation of Red Cross and Red Crescent Societies, 2001).

## **POTENTIAL IMPACTS OF POVERTY ON WILDFIRES AND FIRE-RELATED PROGRAMS**

Up to this point, we have described the correlation between a household's income level and its ability to protect itself and recover from wildfire losses.

In many cases, though, the conditions that make a poor household and community vulnerable to wildfire also make the surrounding wildlands more vulnerable to being ignited by fire coming from the urban side of the wildland-urban interface. This interaction between poverty and wildfire can increase the hazards for firefighters.

The underlying logic is this: in some instances, poor quality housing conditions may cause fires that spread to wildlands; in other instances, homes that have not been fire-proofed simply fuel the fire, helping it spread more explosively. In either instance, firefighters face more complex, dangerous conditions.

**In some instances, poor quality housing conditions may cause fires that spread to wildlands; in other instances, homes that have not been fire-proofed simply fuel a fire already underway, helping it spread more explosively. In either instance, firefighters face more complex, dangerous conditions.**

A report by the National Fire Administration underscores the basic relationship. "Virtually every study of socioeconomic characteristics has shown that lower levels of income are either directly or indirectly tied to an increased risk of fire" (Federal Emergency Management Agency, 1997a). Even though the study deals mostly with urban fires, there is no apparent reason why its conclusion would not apply to the wildland-urban interface and rural communities.

Low-quality housing, with poorly maintained heating, electrical and plumbing systems, is more often occupied by the poor and more likely to experience a residential fire (Federal Emergency Management Agency, 1997a). Whenever such housing is near wildlands, the associated risk of a housing fire can become a risk of wildfire.

The existence of houses and other structures that have not been fire-proofed can magnify wildfire-related problems for residents, neighbors, and entire communities. A structure built with highly flammable materials and surrounded by dry, dense vegetation is more likely to be ignited by wildfires and to burn more quickly than those that aren't (Cohen, 1999). Thus, when such a structure is threatened with fire, the inhabitants and firefighting personnel have less time to react and face a greater challenge in their efforts to prevent it from igniting. The extra effort required to protect such structures can divert firefighting resources from other tasks and, thus, the overall risk for an entire community increases and the overall cost of fire protection rises.

Homelessness, an extreme state of poverty, may also increase the incidence of wildfire. In many areas, especially in summer, homeless individuals and families often reside in formal or informal campsites. Under the right conditions, any campfire can lead to a wildland fire, and this is especially so for campfires outside designated campgrounds. Hence, the greater the number of homeless persons residing in campsites, the greater the likelihood that their campfires will lead to wildfires. This potential linkage between poverty and wildfire is not a trivial one. In Arizona, half of the fires caused by out-of-control campfires in 1999 and 2000 were caused by transients (Shaffer, 2001).

## REFLECTIONS

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Wildfires and fire-related programs are major, integral elements of life in the West, and so is poverty. Each influences the others, and the net effects, over time, can be circular. Wildfires can deepen the poverty of those who already are poor. Fire-related programs that do not focus on alleviating the vulnerability of the poor may make things worse, at least by diverting attention and resources away from poverty to other issues. A higher incidence of poverty can increase the probability of wildfires, as well as the hazards and costs of fire protection.

The circularity does not have to be negative; it can run in the opposite direction. Fire-related programs focused on alleviating the vulnerability of poor individuals, families, and communities can reduce the risk that they will be harmed by wildfires, the risk that they will ignite wildfires, and the cost of responding to fires, should they occur. Appropriately designed, programs might do even more: generating job opportunities and increasing the value of the goods and services poor individuals, families, and communities derive from nearby wildlands.

We address these opportunities in the remaining chapters.

Before leaving this chapter, though, it is necessary to mitigate some potential misunderstandings. By discussing the links between poverty and wildfires, we do not want to downplay the role of those who are more wealthy. In many areas, it is the wealthy who have extended housing and other developments into the W-UI. While the wealthy have the resources to fire-proof their homes, they do not always take these steps. Furthermore, in some settings, the wealthy may be more successful than their poor neighbors in commanding firefighting resources when wildland fire threatens. Though systematic data are absent, there is anecdotal evidence that wildland firefighters increasingly are called to suppress fires in areas of wealthy new homes scattered throughout the W-UI.

Recognizing both the burden and the risk that development in the wildland-urban interface creates, some states and communities have enacted policies aimed at shifting the responsibility of residential fire protection onto homeowners. Some communities elect not to provide fire service to new developments built in fire-prone areas—apparently to discourage new amenity-oriented developments. In addition, some state and county governments are considering following California, Oregon, Arizona and other states requiring homeowners in fire-prone areas to take certain measures to fire-proof their structures and reduce the risks to firefighters (Rider, 2000).

It is unclear how these actions will affect poor individuals, families, and communities. Given the history of the relationship between fires and poverty, however, there is ample reason to anticipate that these efforts will not specifically help alleviate poverty, and may even worsen it, unless poverty-related concerns are explicitly built into them.

## CHAPTER 3: THE WILDFIRE INDUSTRY AND POVERTY

Wildfire supports a big industry—the collection of public organizations, private firms, and individuals that are involved in fire-related programs. Monetary outlays by the public organizations exceed a billion dollars annually, attracting tens of thousands of workers to join fire crews, and comparable numbers of firms and individuals seeking contracts to provide goods and services.

All this money and activity undoubtedly impacts poverty in the West, but the nature and the distribution of these impacts remains unclear. It is clear, however, that the impacts are not as positive as they could be, insofar as federal agencies lack clear guidelines, policies, and programs to target employment and business opportunities toward poor workers and communities.

In this chapter we describe the wildfire industry and its impacts on poverty. We focus on the largest component of the industry, fire-suppression programs, and the sector that might grow rapidly in the future, programs to reduce hazardous fuels. The description is necessarily general, because relevant data regarding the industry's myriad details are limited, and data regarding the industry's impacts on poverty are even more scarce. Nonetheless, the description shows the overall financial characteristics of the federally-funded part of the industry, and its actual and potential impacts on employment and local communities.

### FIRE-SUPPRESSION PROGRAMS<sup>1</sup>

During the 2000 fire season, federal agencies, primarily the Forest Service, spent almost \$1.4 billion on fire suppression, as shown in Table 3-1. The fire-suppression costs for 2000 were the highest on record, but they reflect a trend toward rising costs. The data in Figure 3-1 show that average fire-suppression costs, after being corrected for inflation and accounting for annual variation, more than doubled between 1986 and 1994 (U.S. General Accounting Office, 1999). A majority of these expenditures occurred in the West.

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<sup>1</sup> We focus on federal programs, because they have the greatest potential to adopt new policies and provide funding to increase the benefits poor individuals, families, and communities derive from fire-related programs. Note, though, that most rural communities are protected by volunteer fire departments, which often are the first ones to engage a wildfire, and provide the initial response for as many as 90 percent (U.S. Department of Agriculture, 2000a).

**Table 3-1: Fire-Suppression Costs for Federal Agencies, 2000**

Federal Agency	Total Suppression Costs
Forest Service	\$1,026,000,000
Bureau of Land Management	\$180,567,000
U.S. Fish and Wildlife Service	\$9,417,000
Bureau of Indian Affairs	\$93,042,000
National Park Service	\$53,341,000
Total	\$1,362,367,000

Source: NIFC (National Interagency Fire Center, 2001b)

Table 3-2 breaks down total, federal expenditures, by type of activity, for the 2001 fire-related budget. (This table shows the details associated with the pie chart in Figure 1-4.) The data show that more than 95 percent of the budget is allocated to two broad categories, “Fire Preparedness” and “Fire Operations”. The categories, however, are somewhat confusing. Nearly all the funds in these two categories are dedicated to getting prepared to fight fires, fighting fires, and rehabilitating areas that have burned. The “Preparedness” funds are essentially used to increase the federal agencies’ fire-suppression capability, and the “Emergency Contingency” funds are essentially additional funding held in reserve to cover extraordinary fire-suppression costs. Adding these amounts to those for “Fire Suppression” and “Fire Facilities” indicates the amount directly oriented toward fire-suppression activities comes to more than \$2 million, nearly three-quarters of the total.

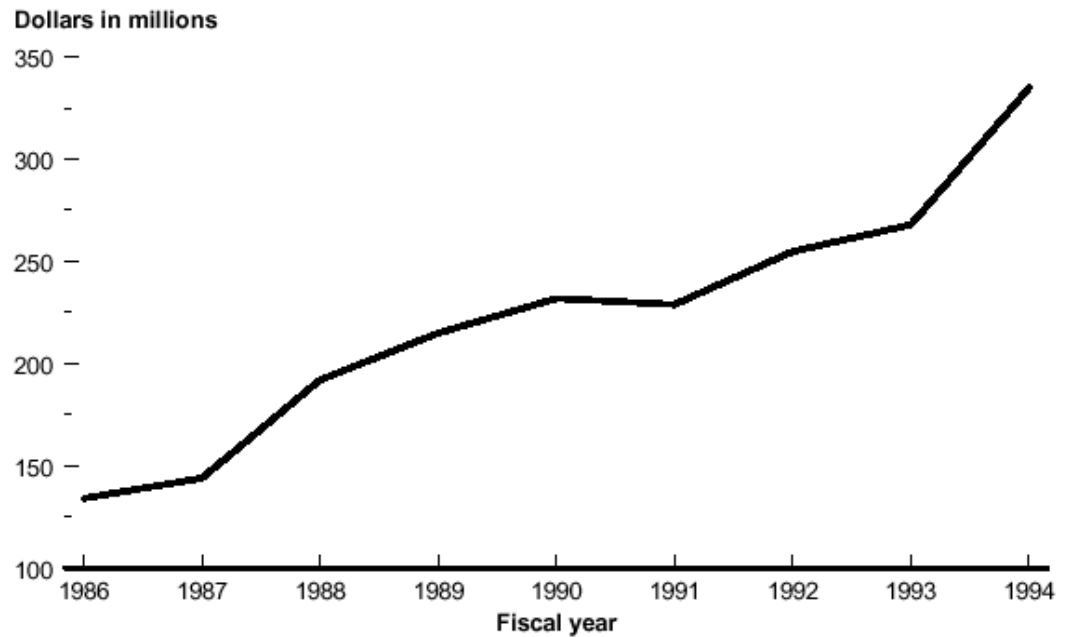
<b>Fire-Suppression Cost per Acre Burned (National Forests; 2000 Dollars)</b>	
2001 (prelim.)	\$1,340
2000	455
1995	947
1994	585
1990	554
1988	394
1985	341
1980	366

Source: Barker, 2001; Taxpayers for Common Sense, 2000

Federal agencies appear to be unable to provide a breakdown of fire-suppression costs into categories that would reveal the extent to which the agencies orient their programs to provide opportunities for poor workers and communities to benefits from the fire-industry’s expenditures. Some insights into the potential opportunities, however, comes from a study of the historical costs associated with providing the initial, fire-suppression response to fires that ignite on federal land (Mills and Bratten, 1988). Their data are somewhat limited in geographic scope and currency, as they represent suppression techniques and strategies in the northern Rockies in the late 1970s, but they nevertheless are instructive, for they show the base-level allocations of personnel and funding among different types of fire-suppression activities. The study’s data, adjusted to 2000 dollars, indicate the

total costs per million acres is about \$900,000 (in 2000 dollars). Additional costs would be incurred if a fire could not be controlled by initial-response teams.

**Figure 3-1: Forest Service's Expenditures for Wildfire Suppression, Fiscal Years 1986-94**



Source: U.S. General Accounting Office (1999).

Note: The expenditures for each year represent the 10-year rolling average in constant 1994 dollars. Since 1990, 95 percent of these expenditures have been in the interior West. Source: GAO's presentation of the Forest Service's latest available data.

The historical make-up of the initial-response program required 154 people for building fire lines (additional personnel would be required for activities other than building fire lines, e.g., flying and maintaining air tankers). Three-fourths of these would be employed as ground crews, and the remainder as smokejumpers, fire-engine operators, and so forth. Historically, most of the emphasis was on fire-suppression activities involving air attack (44 percent of expenditures) and fire engines (29 percent) rather than on activities involving handcrews (27 percent) (Mills and Bratten, 1988).

**Table 3-2 Total Funding for the National Fire Plan and Base Fire Programs, 2001 (\$ in thousands)**

Program	USDA Total	DOI Total	Total	% of Total
Fire Preparedness:				
Preparedness	596,490	307,406	903,896	31.24%
Fire Science Research	16,000	8,000	24,000	0.83%
Emergency Contingency	426,000	200,000	626,000	21.63%
Preparedness Subtotal	1,038,490	515,406	1,553,896	53.70%
Fire Operations:				
Fire Suppression	320,029	153,447	473,476	16.36%
Fire Facilities	44,000	n.a.	44,000	1.52%
Hazardous Fuel	205,610	195,400	401,010	13.86%
Research and Dev't	16,000	n.a.	16,000	0.55%
Rehabilitation	142,000	105,000	247,000	8.54%
Operations Subtotal	727,639	453,847	1,181,486	40.83%
Forest Health Mgmt.	12,000	n.a.	12,000	0.41%
Rural Fire Assistance	n.a.	10,000	10,000	0.35%
State Fire Assistance	75,494	n.a.	75,494	2.61%
Volunteer Fire Assistance	13,280	n.a.	13,280	0.46%
Economic Action	12,500	n.a.	12,500	0.43%
Community and Private Land Fire Assistance	35,000	n.a.	35,000	1.21%
<b>Total</b>	<b>1,914,403</b>	<b>979,253</b>	<b>2,893,656</b>	<b>100.00%</b>

Source: USDA Forest Service and Department of Interior (DOI), [www.fireplan.gov](http://www.fireplan.gov)

Table 3-3 provides more detail and helps explain how fire-suppression costs increase for large fires. The data show the hourly costs (in 2000 dollars) for different types of fire-management inputs typical of fire-suppression programs in the 1970s. For suppressing small fires, the cost of employing the first crew of firefighters is \$615 per hour. For large fires, this rises 20 percent, to \$753. Although the cost per input increases for large fires (except for bulldozers) the overall costs per acre burned tends to decrease, because the acreage increases faster than the input costs (Mills and Bratten, 1988).



**Table 3-3: Representative Costs (in 2000 Dollars) of Fire-Management Inputs in the Northern Rockies, ca 1970s**

Fire Management Input	Input Composition	Deployment Status		
		Standby	Suppression on Small Fires	Suppression on Large Fires
Category I Crew	20 people w/ handtools	514.8	627.1	767.5
Category II Crew	20 people w/ handtools	60.8	723.0	851.8
Project Crew	2 people w/ handtools and pickup	7.0	72.5	84.2
Helitack Team	2 people w/ handtools	58.5	70.2	91.2
Smokeyjumper Team	2 people w/ handtools	98.2	112.3	138.0
Engine – Small	2 people w/ handtools and pickup engine	53.8	67.9	79.6
Engine – Medium	3 people with 500-gallon engine	79.6	105.3	163.8
Bulldozer – Medium	2 people w/ crawler tractor	100.6	135.7	16.4

Source: Mills (1988) Page 19.

Looking at the costs associated with large fires is important because they historically have accounted for most fire-suppression costs. An analysis of fire-management programs in the northern Rockies concluded that, although one percent of the fires in the region were large enough to burn more than 100 acres, those that did exceed this threshold burned 95 percent of the total acres, accounted for nearly all the fire-related impact on natural resources, and consumed the majority of fire-suppression costs (Mills and Bratten, 1988).

Large fires are not easily generalized, as shown by the data in Table 3-4. The data, for twelve large fires in the same part of the West (Idaho) in 2000, have widely varying costs—on both a per-acre and per day basis. The twelve fires burned about 885,000 acres and, the total costs for the eleven with data exceeded \$105 million. The cost per acre burned averaged about \$121, and ranged from \$2 (Salmon-Challis) to \$357 (Burgdorf Junction) per acre. The cost per day varied from \$ 9,444 (Indian Prospect) to \$ 1,021,429 (Clear Creek).

Over the past twenty years, per-unit, fire-suppression costs also have varied widely, and increased over time. Costs per acre burned on the national forests have ranged from \$341 to \$947, and preliminary data for 2001 indicate the cost has risen to \$1,340 per acre burned (Barker, 2001).

**Table 3-4: Summary of Largest Fires in Idaho, 2000**

Fire	Fuel Type	Days Fought	Acres Burned	Cost	Cost per Day	Cost per Acre Burned
Maloney Creek	Mixed conifer, sagebrush	19	74,000	\$4.3 million	\$226,315.79	\$ 58.11
Burnt Flats	Mixed conifer	27	22,527	\$6.5 million	\$240,741	\$288.54
Burgdorf Junction	Mixed conifer	53	64,348	\$23 million	\$433,962	\$357.43
Three Bears	Conifer	33	33,500	\$821,000	\$24,879	\$24.51
Indian Prospect	Mixed conifer	18	11,100	\$170,000	\$9,444	\$15.32
Salmon-Challis	Mixed conifer, sagebrush	32	182,600	\$457,000	\$14,281	\$2.50
Clear Creek	Conifer, sagebrush	70	216,961	\$71.5 million	\$1,021,429	\$329.55
Trail Creek	Mixed conifer	23	34,795	\$6.9 million	\$300,000	\$198.30
Oregon Trail	Sagebrush	4	23,960	\$550,000	\$137,500	\$22.95
High Point	Sagebrush	1	20,300	Unavailable	--	--
Bell Mare	Sagebrush	3	10,000	\$239,000	\$79,667	\$23.90
Eastern Idaho Complex	Sagebrush, juniper	16	192,450	\$5 million	\$312,500	\$25.98
<b>Total</b>	--	<b>299</b>	<b>886,541</b>	<b>\$119,437,000</b>	<b>\$2,800,719</b>	<b>\$1347.09</b>

Source: ECONorthwest with data from National Interagency Fire Center (2001b) daily situation reports and other news reports.

The variation in costs per unit does not have the same implications for policy and decisionmaking as it would in other arenas. For most public programs, there are pressures for managers to set priorities and allocate financial and other resources so that the return on these resources is as high as possible. This reasoning is commonly described as using resources in the most cost-effective manner. Applied to fire-suppression, the cost-effectiveness reasoning would ensure that, all else equal, firefighters are allocated to fires where the cost per acre or per day are the lowest before being sent to fires where the per-unit costs are higher.

On a broader scale, the fire-suppression program flunks basic concerns of policy analysis and decisionmaking. In most other settings, analysts and decisionmakers are concerned not just with optimizing cost-effectiveness, but with optimizing net benefits. With the net-benefits test, federal agencies would use financial and other resources to suppress a fire only when those things that would be protected from burning are more valuable than the fire-suppression resources committed to fighting the fire. In other words, what is being saved would be more valuable than the labor, machines, and so forth being used to save it.

The managers of federal programs have been widely criticized for not being able to demonstrate that they allocate fire-suppression resources with an eye toward either cost-effectiveness or net benefits. A review by a citizen group, for example, concluded that “Money is wasted to suppress fires that cannot or should not be suppressed.” (Taxpayers for Common Sense, 2000). As an

example, the study cites a fire in Idaho for which the Forest Service incurred fire-suppression costs totaling \$71.5 million, even though the fire was remote (hence, it posed little threat to humans or settlements), in mountainous terrain (hence, it was expensive to fight) and, in the end, the fire was extinguished not by firefighters but by snowfall.

A similar, more recent example also comes from the Elk Creek fire on national forest land in Idaho in August, 2001. This fire also occurred in remote, steep country. It was headed into wilderness and, hence would have served the historical role of natural fire regimes in the area. The Forest Service, however, opted to fight the fire aggressively, and supports the decision because there were structures at risk. These structures, however, lay in another direction from where fire was headed, and had a “summer

population of less than 50” (Barker, 2001). The agency fought the fire even though the cost of doing so may have exceeded the cost of rebuilding the structures, had they burned.

Another example comes from the 860-acre Little Joe fire in Montana. News reports indicate that, here, the Forest Service spent \$4,302 per acre, nearly twice the value of the land and its resources, as indicated by the fact that the agency paid \$2,200 per acre in 1999 for 5,000 acres of adjacent land (McMillon, 2001).

There seem to be several reasons why managers of fire-suppression programs fight fires so aggressively, with such apparent disregard for the concerns about cost-effectiveness and net benefits. The momentum, in public perceptions and institutional behavior, from decades of seeing fires as bad and of fighting fires with a war-like mentality has yet to be redirected in any meaningful way. Hence, when a fire erupts, there invariably is an outcry from some segments of the public, calling for the agencies

to get it under control. Accordingly, the forest manager overseeing the Elk Creek fire risked sanctions if he allowed the fire to burn and it shifted direction and burned the summer-home structures. The agencies’ procedures for fighting fires are powerful and well-oiled. The way they communicate their successes or failure with the public reinforce the notion that letting fires burn is bad, putting fires out is good, and those who fight fires are doing the right thing.

Another powerful factor—money—reinforces the cultural and institutional momentum for disregarding concerns about the cost-effectiveness and net benefits of fire suppression programs. Congress has been willing to pay for fire-suppression activities, apparently without limit. “[T]he blank check for fire suppression signals that there is a bottomless wallet in Washington, D.C. that will pay to extinguish every single fire, regardless of how long it takes.” (Taxpayers for Common Sense, 2000). With unlimited funds, virtually everyone associated with the fire-suppression programs has incentives to

**Another powerful factor—money—reinforces the cultural and institutional momentum for disregarding concerns about the cost-effectiveness and net benefits of fire suppression programs. Congress has been willing to pay for fire-suppression activities, apparently without limit. With unlimited funds, virtually everyone associated with the fire-suppression programs has incentives to spend more rather than less.**

spend more rather than less. Program managers can see their professional prospects rise if they spend more money and control more fires. Vendors and members of fire crews can earn more money during the fire season. Political leaders can tell constituents that local fire-suppression spending helped the local economy.

## FUEL-REDUCTION PROGRAMS

The data in Table 3-2 show that the National Fire Plan for 2001 allocates \$401 million, or 14 percent of the total budget, for the “Hazardous Fuel” program. This program aims to reduce fuel on the national forests and other lands.

**As with the fire-suppression program, the fuel-reduction program also seems to pay little attention to using funds cost effectively and to producing net benefits.**

As with the fire-suppression program, the fuel-reduction program also seems to pay little attention to using funds cost effectively and to producing net benefits. Testimony by the General Accounting Office (July 31, 2001) on the National Fire Plan bluntly pointed out the federal agencies' inefficiencies, observing that they had not yet identified the highest-risk communities and, hence, could not implement a program to lower the risk. Furthermore, any progress that has been made at identifying at risk communities appears to be flawed.

The Department of Interior, for example, lists no communities in California or Idaho at "highest risk" of wildfire. Of the 545 communities on the department's list of communities at highest risk, more than half are in Georgia, North Carolina, and Tennessee, states that the GAO concludes are not prone to severe wildland fire (Hill, 2001).

Criticisms of the program are not new. In a previous review of the program, the General Accounting Office (1999) concluded that it has emphasized selling timber for use by the timber industry rather than reducing targeted fire hazards. Specific criticisms arose from an observation that officials "tend to (1) focus on areas with high-value commercial timber rather than on areas with high fire hazards or (2) include more large, commercially valuable trees in a timber sale than are necessary to reduce the accumulated fuels." These criticisms are especially important insofar as numerous studies have shown that the sale of commercial-timber from the national forests has not produced net benefits, *see, e.g.*, Gorte (1993), The Wilderness Society (1997), and Wolf (2000).

Failure to use funds cost-effectively and produce net benefits raises important concerns, insofar as reducing hazardous fuels in the national forests is a formidable challenge. The GAO report estimated that 39 million acres of Forest Service land have a high level of hazardous-fuel build up. It also concluded that reducing the fuel would cost \$725 annually through 2015 (\$12 billion total) or more than 10 times the current level of funding for

reducing fuels. From this assessment, it seems likely that the hazardous-fuel program will continue to receive considerable funding, and perhaps large increases in funding, for the foreseeable future.

## EMPLOYMENT IN THE WILDFIRE INDUSTRY

The wildfire industry employs tens of thousands of workers, mostly on fire-suppression and related activities. Increasingly, however, workers are being hired in programs aimed at preventing fires, for example, by reducing fuels on wildlands.

**Employment in fire-suppression programs.** Many of these are seasonal firefighters, hired by the federal agencies or working for contractors that provide fire-suppression and other services. Table 3-5 shows the federal employment for fire-suppression jobs in the Forest Service, from 1995-1999. The 2001 National Fire Plan includes additional funding to boost the number of federal fire-related personnel in the Forest Service by about 2,800 and in the Department of Interior agencies by about 1,700 above those for 2000.

**Table 3-5: Forest Service Fire-Suppression Jobs**

	Regular Appointed Personnel	Seasonal or Short-term Personnel	Total Casuals Employed in Fire Suppression <sup>a</sup>	Total Employment
1995	9,627	10,103	13,973	33,703
1996	14,236	10,200	26,405	50,841
1997	8,798	8,199	6,675	23,672
1998	9,449	9,947	10,381	29,777
1999	9,083	8,668	18,026	35,777

<sup>a</sup>The Forest Service counts each reemployment as an employment.

Source: ECONorthwest with data from the U. S. Department of Agriculture

Many of the seasonal workers on fire-suppression and other crews are students on summer break from college. Others, however, come from Indian reservations, communities with high concentrations of migrant workers, and other areas often characterized by low incomes. In the 2000 fire season, as many as 5,000 Indian firefighters— about 20 percent of the total, worked on fire crews (Gadbow, 2001; Struckman, 2001). Fire crews often work on fires hundreds, even thousands of miles from home, and may be gone from their home base for weeks at a time.

In many instances, incomes earned on a fire crew constitute a sizable component of total earning for the year, both for the individual worker and

his or her family, as well as for entire communities. For many workers with low incomes, poor health, or families requiring extended care, however, working on a fire crew is not feasible because firefighting is arduous work often requiring extended periods away from home.

Efforts to obtain current, detailed data about the employment generated by fire-suppression expenditures were unsuccessful. An analysis of the historical fire-suppression program, however, indicates that the expenditure of one million dollars to build fire lines would generate short-run employment for 181 workers. Most of these would work on fire crews, but additional jobs would be created for smokejumpers and operators of fire engines and bulldozers (Mills and Bratten, 1988).

**Employment in fire-prevention programs.** Most fire-prevention efforts currently entail reducing fuel loads, primarily on federal forest lands. There are multiple methods for accomplishing this task. The most familiar are prescribed burns, which employ fire to consume excess fuel, and conventional logging, which removes logs from the forest. Other methods selectively thin a forest by cutting small, dense trees and/or prune the branches from larger trees. The thinned and pruned material is then stacked in piles separated from each other and remaining trees and, in some cases, burned during periods when fire danger is low.

**An analysis of the historical fire-suppression program indicates that the expenditure of one million dollars to build fire lines would generate short-run employment for about 181 workers. Most of these would work on fire crews, but additional jobs would be created for smokejumpers and operators of fire engines and bulldozers.**

**Data for fuel-expenditure and related programs indicate that the expenditure of \$1 million would create full-time employment for 13-23 workers.**

Analysis of data assembled for the interior Columbia River Basin (between the Cascades and Rockies) indicates that a tree-thinning program to reduce fire risks in this region would create one job-year of employment per \$43,125 of expenditures, and that about 500 acres could be treated per worker per year. (U.S. Department of Agriculture and U.S. Department of the Interior, 2000, Ch.4 Pg. 159) At this rate, the expenditure of \$1 million for fuel-reduction would create full-time employment for 23 workers and treat 11,500 acres.

If these rates apply more broadly, then, and if the \$401 million allocated to reducing fuels were spent entirely on workers, it would create about 9,300 full-time, annual jobs, and reduce fuels on 4.6 million acres. In practice, some of the funds would be consumed by overhead, so the actual number of jobs would be less. Offsetting this reduction, however, is the fact that many of the fuel-reduction jobs would be seasonal rather than full-time, year-round and, hence, the actual

number of workers that would be employed would be larger.

A somewhat lower estimate of the job potential for fuel reduction comes from the analysis of related work, the restoration of degraded streams and streamside habitats. A review of federal projects nationwide indicates that one job-year of work is created for program expenditures of about \$75,000



(U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, 1994). At this rate, every million dollars spent on fuel-reduction would generate about 13 full-time jobs.

## THE WILDFIRE INDUSTRY AND LOCAL COMMUNITIES

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The wildfire industry's impact on local communities can be positive, negative, or both. The impacts are most apparent in the short-run, when a fire threatens a community, and fire-suppression activities diminish or eliminate the threat. Other short-run impacts occur when local firms and residents sell goods and services to a fire-suppression team camped nearby. The industry's long-run impacts on local communities are more complex and poorly understood.

**Short-run impacts.** The wildfire-industry's short-run impacts on communities are widely perceived to be entirely positive. Fire-suppression crews prevent homes and other structures from being destroyed, create short-run jobs for local residents, and turn to local vendors for food, lodging, telecommunications, and other goods and services.

Although most materiel for fire crews are provided by large vendors under national or regional contracts, managers of fire-suppression teams have directives to expand the opportunity by buying locally as much as possible. Accordingly, it is not uncommon for some in a local community to look back on a fire as a golden economic opportunity to earn income. Often, however, some local residents cannot take full advantage of the opportunity because they are not adequately prepared or adequate lack organizational, financial, or physical capacity. The local café that normally serves several dozen meals a day, for example, cannot provide two thousand. Federal agencies are working to make it easier for local vendors to sell goods and services to fire-suppression teams, developing contingency agreements so local vendors can anticipate potential demands of fire crews and take care of the paperwork in advance.

**Long-run impacts.** The fire-industry's long-run impacts on local communities materialize in two ways: through its impacts on the ecosystem; and through the role communities play in the long-run management of wildlands.

We discuss the long-run ecological impacts of fires and fire-related programs in the appendix to this report. Here, we only point out that these impacts often are not what was anticipated during the emergency conditions of the fire season. When it is burning, a fire is generally seen as having devastating effects and fire-suppression efforts are seen as preventing the devastation. Over the next several years and decades, though, perceptions can change. Speaking of the 1988 fires that burned more than 700,000 acres of Yellowstone Park, Wayne Minshall, an ecological scientist observed, "Two to



15 years after the fire, [ecological] conditions recover and often get better than they were before the fire.” (Robbins, 2001)

With this longer perspective, the fire’s impacts may turn out to be positive, and those of the fire-suppression efforts may turn out to be negative—the reverse of short-run perceptions. As a forest ecosystem recovers and adjusts,

**Local economic impacts that accompanied the 2000 fire and fire-suppression efforts in the Bitterroot Valley, Montana:**

- 13.5 percent of respondents said they worked in a job that helped fight the fires of 2000.
- 20 percent said they lost hours at work because of the fires.
- 19 percent said they worked more hours because of the fire.
- 20 percent said their businesses lost money because of the fires.
- 11.5 percent said their businesses made more money than usual because of the fires.

Source: Bureau of Business and Economic Research (2001)

it may become more dynamic and useful to a local community. Burned hillsides may become covered with wildflowers, streams may become populated with more fish, and animals dependent on bushes and grass may replace those dependent on mature forests. Tourists driven away during the fire may return in larger numbers to see the changes. The risk of fire in the near future may be reduced markedly. In contrast, areas kept from burning by fire-suppression efforts might remain unchanged, except for posing an even greater fire risk in subsequent years, if, by failing to burn it continues to accumulate high loads of hazardous fuel.

Too little is known to predict with certainty how these variables will play out following

a particular type of fire or for a particular type of community, or how they might be affected by alternative types of intervention. The overall, long-run impact that fires and fire-suppression efforts have on local communities has received little systematic study, and even less is known about how the long-run impacts on poor communities differ from those on richer communities. On the surface, however, it seems erroneous to conclude that fires necessarily affect communities negatively and fire-suppression efforts affect them positively. The relationship is far more complex than this.

## REFLECTIONS

For decades, the wildfire industry has focused on fires, themselves, to the exclusion of other considerations, such as the interactions between fires and poverty. Consequently, the industry has little experience with or knowledge of the extent to which poverty increases the probability that wildfires will ignite. It is similarly limited on its knowledge of the extent to which poverty increases risks of death and devastating economic damage from wildfires. It doesn’t know where areas with a high fire hazard overlap with areas of high poverty. It doesn’t know what steps would be appropriate for identifying and reducing the highest risks to poor individuals, families, and communities.

Why should the wildfire industry have a good understanding of poverty in the West? For these reasons:

- **The wildfire industry has not been able to demonstrate that its programs consistently are cost-effective, i.e., that the benefits from its activities exceed the costs.**

Mostly, the wildfire industry fights fires, with too little regard for the costs. It does so with the momentum built through nearly a century of fighting fires and persuading the public that fires are bad and fire-suppression is good. Once a fire ignites, it seems, the forces pressing for fire suppression become irresistible.

- **To become more cost-effective, the wildfire industry must shift its focus from fighting fires to reducing risk and preventing death and damage.**

There appears to be widespread agreement among scientists and land managers that the most cost-effective approach to fire-management would avoid fire-suppression efforts that would not yield benefits greater than costs, allow low-risk fires to burn unopposed, and devote more resources to fire-proofing areas where the risks of death and damage are highest.

- **Poverty increases the risks associated with wildfires.**

Poverty increases the probability that (1) house fires will occur and ignite wildfires; (2) homes and other structures are not fire-proofed; (3) a community lacks adequate local fire protection; (4) residents, because of health or other problems are less mobile and able to flee a fire; (5) that residents lack adequate fire insurance; (6) and residents will have sufficient economic reserves to absorb the economic shocks that accompany fires. Furthermore, the risks to firefighters increase in areas where houses are more flammable, there is less fire-proofing of structures, and inadequate local fire protection.

- **The wildfire industry should be able to accomplish more, at lower cost, by giving greater emphasis to reducing the fire-related risks to poor people and communities.**

The first step is to identify where poverty significantly increases the risks associated with wildfires. Then the wildfire industry should devise and implement practical, cost-effective methods for reducing the risk. Research indicates that perhaps the most cost-effective method is to fire-proof homes by clearing a surrounding space of all flammable materials. Additional consideration should be given to bolstering local fire-protection services.

In offering this reasoning, we are fully aware that any attempt to develop an effective alternative to the fire-suppression juggernaut is up against long odds. So far, the alternatives to aggressive fire-suppression simply do not

have the visceral, emotional appeal that emerges, for example, when the governor of Montana recently said that letting fires burn, even in a large wilderness area, “is going to kill Montana” (Associated Press, 2001).

Even when federal agencies have addressed alternatives to fire-suppression, the outcomes often remain suspect. Programs to reduce hazardous fuel, for example, have focused, instead, on producing logs from the national forests for the timber industry (U.S. General Accounting Office, 1999). More recently, the Forest Service’s recommended plan for rehabilitating lands burned in the Bitterroot National Forest in 2000 calls for extensive logging of burned trees, primarily to reduce dead trees that would become fuel that could support a future fire. The agency did not even study an option that would entail fire-proofing homes by reducing fuel within a 130-foot perimeter, even though it acknowledged that “research has shown that home protection can be greatly improved by fuel reduction work within 130 feet of a home” (U.S. Department of Agriculture, 2001a, p. 2-23). Thus, the agency excludes from its fuel-reduction plans those places where fuel reduction would provide the greatest protection against future death and damage.

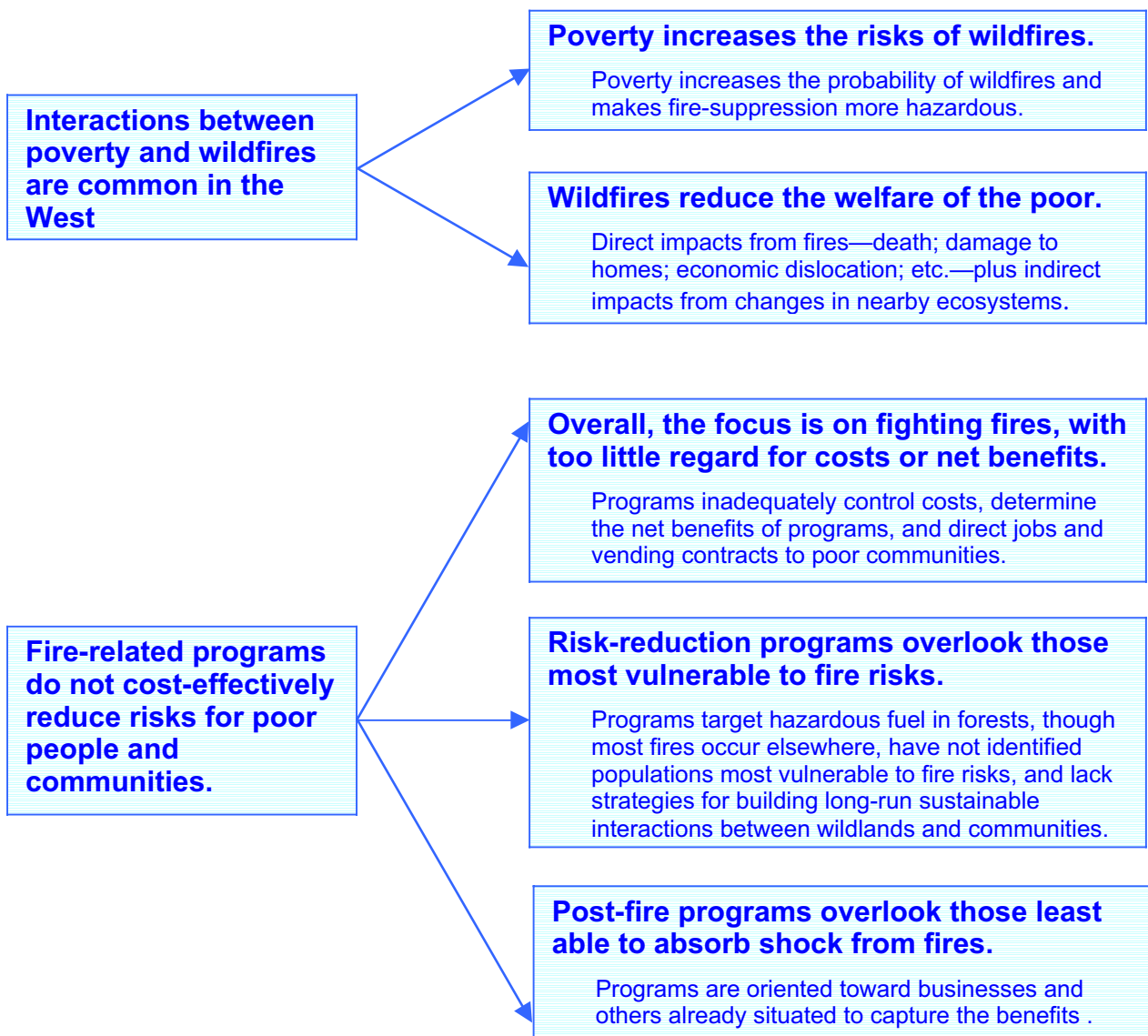
We are not the first to call for an overhaul of the wildfire industry. We do appear to be the one of the first, however, to recognize the linkages between wildfires and poverty and to suggest using poverty as the lens for refocusing the industry, away from fighting fires with little regard for costs and toward effective, cost-effective efforts to reduce risks of death and damage. In doing so, we are not saying that the industry should abandon its fire-suppression efforts. To the contrary, we applaud efforts to fight fires where the benefits of doing so outweigh the costs.

Highlighting the role of poverty in designing the industry’s policies and programs makes sense on substantive grounds because, when fires occur, poor people and communities are the most likely to be devastated. It also may provide the key to unlock institutional change within the wildfire industry. Perhaps past efforts to change the industry have faltered because, whereas the goals of fighting fire are clearly understandable, the goals for alternative programs are not. Charts about cost-effectiveness or the incidence of fires on non-forest lands don’t have the same visual—or political—impact as flames raging across a forest on the television screen. Building fire-prevention programs around the theme of protecting the people, homes, and communities most vulnerable to fires, however, may provide enough clarity to attract sufficient institutional and political support to effect meaningful change in the wildfire industry.

# CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

The preceding pages demonstrate that there is a strong connection between wildfires and poverty in the West, as illustrated by Figure 4.1. In this chapter we briefly summarize the relationships and offer some recommendations for reducing the adverse impacts and increasing the beneficial impacts that wildfires and fire-related programs have on poor people and communities.

**Figure 4-1: Summary of Relationships Between Poverty and Wildfires**



## INTERACTIONS BETWEEN POVERTY AND WILDFIRES ARE COMMON IN THE WEST

Poverty, wildfires, and fire-related programs are part of the western experience. Approximately 19 million western residents live in poverty, i.e., are unable, because of inadequate financial or non-financial resources, to take the steps necessary to protect themselves, their families, their homes, and other assets from the risks of wildfire. In 2000, there were over 25,000 wildfires in the western states, and they burned more than 5 million acres. The federal government spent over \$1.3 billion to suppress fires across the United States, and the overall federal budget for fire-related programs for 2001 is \$2.8 billion.

We estimate that 3 to 5 million poor people living in the West live in or near the wildland-urban interface, and, here, the interaction between poverty and wildfires is most immediate and intense. Poverty increases the incidence of house fires and reduces the probability that residents or their communities have adequate ability to keep the fires from spreading. Hence, where wildlands adjoin or intermingle with the residences of poor people the

**When wildfires occur, poor people and communities can be the most vulnerable to devastating consequences.**

probability of wildfires being ignited by house fires increases. Fires that do ignite in these areas can be more difficult to suppress and pose greater risks to firefighters because of the close proximity between wildlands and poorly protected houses and other structures.

When wildfires occur, poor people and communities can be the most vulnerable to devastating consequences. Insofar as poverty often is associated with poor health and limited mobility, poor people are at greater risk of increased morbidity and mortality from fires. Insofar as poverty limits the ability of residents and communities to muster the financial and other resources needed to fire-proof their homes and other structures, their assets are at greater risk of being consumed by fire. Insofar as poor people and communities have limited financial reserves and insurance, they are less able than richer neighbors to absorb and recover from the shock of responding to a fire emergency, losing assets, and suffering the dislocation of lost jobs and other economic opportunities.

Wildfires also can affect poor people and communities indirectly, by altering the many goods and services they derive from nearby ecosystems. These interactions are introduced in the Appendix. A high fire hazard on wildlands can lower the value of homes and other assets nearby. Fires can affect the risk of flooding, the quality of stream water, and the costs residents and communities incur to cope with flooding and provide potable water. Fires can affect—positively, negatively, or both—the supply of fish, wildlife, and wild plants available for subsistence food, commercial exploitation, and use in activities with important cultural and spiritual value. Fires can affect the jobs derived from ecosystems, e.g., driving tourists away while fires burn, but later attracting them to see how the ecosystem responded to the fires.

In sum, wildfires and poverty interact with one another, all the time and across the entire western landscape. One affects the other, and not just during the high-intensity moments when fires are burning. The effects of fire on poor people and communities can linger for years, even decades, as they cope with the loss of assets and adjust to ecological changes triggered by the fire. Conversely, the risks associated with the prospect of wildfires can have a long-run effect on economic well-being, e.g., by reducing the value of homes and other assets exposed to the risks, making it more difficult to obtain insurance, or causing communities to divert scarce financial resources away from other social programs to provide increased fire protection.

## **FIRE-RELATED PROGRAMS DO NOT COST-EFFECTIVELY REDUCE RISKS FOR POOR PEOPLE AND COMMUNITIES**

Federal programs intended to reduce fire risks and protect the West from wildfires do not reflect—indeed, they largely ignore—the interactions between poverty and wildfires. Instead, they mostly focus on fighting fires.

Sometimes, of course, fire-suppression efforts benefit poor people and communities. Often, though, fire-suppression efforts emerge as little more than a carryover of the momentum the wildfire industry has built through

decades of convincing the public that fire suppression is necessary, whatever the cost. It is common to see millions of dollars spent fighting a fire when the value of whatever is in the fire's path does not outweigh the cost of fighting the fire.

**Fire-related programs can create significant benefits for workers and for vendors, but without greater outreach efforts to level the field, poor people and communities will remain at a disadvantage.**

To the extent that the managers of fire-related programs weigh the potential costs and benefits of their programs, it seems that they do so wearing blinders: focusing intently on some types of costs and benefits while ignoring others. The Forest Service seems partial to activities that produce logs for the timber industry. Little, if any, weight is given to the differential effects fires and fire-related programs

have on poor people and communities, relative to their richer neighbors. Risk-reduction and post-fire-assistance programs do not systematically target poor families and communities, recognizing that they have less ability to reduce risks on their own and suffer greater devastation when fires occur. Instead, programs may be systematically biased against poor people and communities, insofar as the agencies see that the homes and other structures in wealthy communities are more valuable than those in poor ones and, hence, warrant greater effort to protect them.

Fire-related programs can create significant benefits for workers and for vendors of fire-related goods and services, but the programs have had only limited success in directing those benefits to poor people and communities. In



general, poverty reduces the ability to compete for jobs and contracts. It can be difficult and expensive to stay fully informed of the opportunities, and the paperwork, alone, can be overwhelming. Without greater outreach efforts to level the field, poor people and communities will remain at a disadvantage.

In recent years it has become increasingly apparent that fire prevention can be more cost-effective than fire suppression. Recognizing the importance of preventing fires, federal programs will spend more than \$400 million in 2001 to reduce hazardous fuels, primarily from the national forests, where decades of fire suppression have allowed limbs and other material to accumulate to concentrations greater than would have occurred under natural fire regimes.

**In many places fire-related programs have increased the probability of fires that are more intense and have more severe ecological and economic impacts.**

This emphasis on reducing fuels in forested areas, however, has not been reconciled with several relevant facts. Most fires occur elsewhere, so it is not clear why federal agencies do not concentrate their efforts where the fires are. The national forests play a minor role as a source of commercial timber, so it is not clear why the agencies are so intent on keeping trees from burning rather than on keeping other, more valuable things—such as homes and communities—from burning.

Of particular note is research showing that the best way to prevent wildfires from spreading to homes and communities is to create a fire-proof zone around them, by removing flammable materials. (Presumably, such a zone also will prevent house fires from spreading to wildlands.) Despite this knowledge, however, little of the budget for the 2001 National Fire Plan aims at fire-proofing activities. Even less goes to underwriting the costs of fire-proofing the homes and communities of poor people, where fire-proofing could have the greatest impact on reducing risks of devastating outcomes.

Looking at fire-related issues from a longer perspective, it is clear that residents of the West must continue to live with wildfires, recognizing that fires play essential roles in establishing and maintaining western ecosystems, and, hence, can have positive as well as negative impacts on western economies and communities. For the past century, however, federal and other programs have portrayed fires as something bad that must be stifled. This approach has been counterproductive and unsustainable: in many places it has increased the probability of fires that are more intense and have more severe ecological and economic impacts. Significant, meaningful change in fire-related programs must occur if westerners are to live with wildfires in a sustainable manner.

Post-fire programs exhibit many of the same attributes of fire-prevention and fire-suppression programs. They fail to recognize that fires and fire-suppression activities can have more extreme impacts on poor people and communities and target efforts to alleviate these impacts. The rehabilitation of burned areas often focuses on issues other than producing benefits that outweigh the costs. The Forest Service, for example, exhibits a tendency to favor logging of burned trees, even though the agency's conventional—and presumably more productive—logging programs rarely yield net benefits and



planners acknowledge that establishing fire-proof zones would be a more effective way to reduce fire risks to homes and other structures.

## RECOMMENDATIONS

We offer three sets of recommendations, as shown in Figure 4-2. First, we recommend long-run changes in the relationship between wildlands and communities. Next, in order to bring about those changes, we recommend that federal agencies take a number of actions in the short-run to alleviate the poverty-wildfire connection. Our third set of recommendations targets actions the Center for Watershed and Community Health (or others) can take to bring about the necessary actions at the federal level.

**Long-run Goals.** Our long-run recommendations point toward bringing about a more sustainable relationship between wildlands and communities. A more sustainable relationship would allow natural fire regimes to occur, as

much as possible, rather than fighting fires because they are perceived to be bad or because the wildfire industry has access to an almost endless supply of money. Fires ignited naturally would be allowed to burn unless they posed an undue risk to lives and other property. Fire-suppression activities would not be initiated unless the potential benefits clearly outweigh their costs, taking into account the full set of benefits and costs, short- and long-run, direct and indirect.

**Our long-run recommendations point toward bringing about a more sustainable relationship between wildlands and communities. A more sustainable relationship would allow natural fire regimes to occur, as much as possible, rather than fighting fires because they are perceived to be bad or because the wildfire industry has access to an almost endless supply of money.**

The burden for coping with wildfire-related risks must shift. Currently, the taxpayers bear the risks and they focus their efforts on suppressing fires and reducing fuel loads on public lands. In a more sustainable relationship, landowners who place homes and other assets adjacent to wildlands would bear the burden of taking compensating steps to cope with the risks that result. Fuel-reduction activities would be concentrated on the developed lands, rather than on the wildlands, to fire-proof homes and other structures.

Further progress toward a sustainable relationship could be achieved by enhancing the ability of communities to realize benefits from natural ecosystems. For much of the past century western communities often developed around industries that extracted timber, livestock forage, minerals, and other commodities from wildlands. Thus, the assets of the wildlands were converted to other forms of assets: private incomes derived from the wildlands were converted into homes and businesses; taxes derived from the wildlands were converted into schools, roads and other community infrastructure; and families attracted by wildland-related jobs organized themselves into churches, youth clubs, and other social groups.

**Figure 4-2: Recommendations**

<p><b>Long-Run Goals</b> (Federal Agencies and Western Communities)</p>	<p><b>Sustainable Relationships Between Wildlands and Communities, Especially Those with a High Incidence of Poverty</b></p> <ul style="list-style-type: none"> <li>Fire-related programs oriented toward reducing risks and increasing benefits for the most vulnerable households and communities.</li> <li>Investments in the establishment of sustainable wildland-community relationships.</li> <li>Natural fire regimes restored, as much as possible.</li> <li>Limitations on land development that entails an unsustainable relationship with wildlands and wildfire.</li> </ul>
<p><b>Short-Run Actions to Address Immediate Problems</b> (Federal Agencies)</p>	<p><b>Highlight the Wildfire-Poverty Connection</b></p> <ul style="list-style-type: none"> <li>Determine where the risks to poor households and communities are highest.</li> <li>Evaluate alternatives for reducing the risks to poor households and communities and design implementation strategies.</li> </ul> <p><b>Quickly and Efficiently Lower the Risk Wildfires Pose to Poor Households and Communities</b></p> <ul style="list-style-type: none"> <li>Fire-proof poor communities and the homes of poor households.</li> <li>Monitor the activities of fire-related programs to ensure they give appropriate weight to reducing fire risks facing poor households and communities.</li> </ul>
<p><b>Sustained Strategy to Accomplish Long-Run Goals</b> (Center for Watershed and Community Health and others)</p>	<p><b>Initiate Outreach and Dialogue</b></p> <ul style="list-style-type: none"> <li>Broadly disseminate this report. submit summaries of the findings to op-ed pages, and meet with key leaders.</li> </ul> <p><b>Complete Detailed Case-Studies</b></p> <ul style="list-style-type: none"> <li>Study local communities in western regions: the Pacific Northwest, Northern Rockies, Southwest, and California.</li> </ul> <p><b>Hold Symposia on Wildfire and Community Development</b></p> <ul style="list-style-type: none"> <li>Bring together experts in fire-management science and poverty with community representatives</li> </ul> <p><b>Develop Educational and Political Strategies</b></p> <ul style="list-style-type: none"> <li>Specify short- and long-run actions by governmental and nongovernmental organizations.</li> <li>Establish benchmarks for measuring progress.</li> <li>Ensure the long-run viability of institutions charged with implementation of the strategies.</li> </ul>

Over the past two decades, this picture has been shattered. Timber companies have substituted technology for tens of thousands of jobs and slashed wages for remaining workers, especially those with limited skills. Resource-management agencies have lurched backward, away from unsustainable practices. For example, logging on the national forests in Oregon, which has the nation's highest concentration of timber-industry jobs, has fallen more than 90 percent since the late 1980s (Warren, 2001). Across the West, outside the major urban areas, those with the least ability to adjust successfully to these changes, as well as those who just wanted to remain in their communities, are confronting the harsh economic realities that arise when work disappears across vast landscapes.

**Many communities adjacent to wildlands are searching for new ways to derive economic and social well-being from these lands. If extended to a long-run effort, the short-run changes in the policies and institutions controlling fire-management policy, recommended here, offer a singular opportunity for accomplishing this objective.**

Consequently, many communities adjacent to wildlands are searching for new ways to derive economic and social well-being from these lands. If extended to a long-run effort, the short-run changes in the policies and institutions controlling fire-management policy, recommended below, offer a singular opportunity for accomplishing this objective.

Local residents now often have little direct, economic stake in bringing about reductions in fire risks and improvements in the ecological health of the lands surrounding them. It is as though public lands and local communities are neighbors who do not speak, let alone help one another. Land-management decisions are controlled by distant courts, administrators, and

Congress. Local workers have few or no opportunities to derive work and income from the new regime of ecosystem management, for they do not possess the skills, financial assets, and institutional backing that the new regime requires. Though generous without limit in its support for fire suppression activities, Congress fails to appropriate adequate funds to complete the tasks—such as restoring wetlands and watersheds, removing exotic plants, and reducing extraordinary accumulations of fuel—that would improve the ecological health of forests and rangelands, as well as reduce the risk of fire on them. When funding is available, the Forest Service and other agencies often look elsewhere, particularly larger cities where firms and workers are more adept at working the system to get government contracts.

Mounting, though scattered, evidence indicates that outreach programs to increase the number of local residents and firms employed to reduce fire risks and increase ecological health would, if designed correctly, have dual benefits. The work would be accomplished more efficiently, because local workers would bring to the effort a greater knowledge of on-the-ground conditions on public lands. Moreover, as local residents, especially poor ones, derive jobs and incomes from the public lands, they would have a greater ability to invest in fire-proofing their homes and communities. Thus, reduction in the overall risks associated with the wildfire-poverty connection would be accelerated.

**Short-Run Actions to Address Immediate Problems.** We recommend that federal agencies take steps immediately in two areas. The first is to undertake the research and policy analysis needed to highlight the wildfire-poverty connection, so that the public, community leaders, and the decisionmakers of relevant programs better understand the linkages between the two and how to reduce the risks. The second is to take the necessary, but cost-effective actions, wherever sufficient information exists, to lower the risks that wildfires pose to poor households and communities. We anticipate that risk-reduction actions can be implemented immediately in some locations, and then expanded as the fire-related programs and others determine what actions would be appropriate for additional locations.

**We recommend that federal agencies undertake the research and policy analysis needed to highlight the wildfire-poverty connection, so that the public, leaders, and the decisionmakers of relevant programs better understand the linkages between the two and how to reduce the risks. We also recommend that federal agencies take the necessary, but cost-effective actions, wherever sufficient information exists, to lower the risks that wildfires pose to poor households and communities.**

To help stimulate the institutional changes that will be required—shifting emphasis from fire suppression to risk reduction—we further recommend the adoption of tools for monitoring the extent of the actions taken to reduce the risks to poor households and communities. This recommendation should not be overlooked. Currently, monitoring of the fire-related programs concentrates on variables associated with fire-suppression activities: number of fires, acres and structures burned, acres of forest land with higher-than-natural fuel loads, and so forth. As long as these are the yardsticks by which the programs' challenges and successes are measured, then no one should be surprised if the agencies focus on fire suppression and logging of the national forests. Developing new yardsticks measuring the risks to the most vulnerable

households and communities, and the extent to which the fire-related programs have reduced it, is a necessary step for bringing about meaningful redirection of the fire-related programs.

Immediate progress toward relaxing the connection between wildfire and poverty can be made if federal fire programs follow-through with commitments to address fire risks more cost-effectively. Research indicates the most effective step is to fire-proof housing, other structures, and entire communities by reducing the amount of flammable material between them and adjacent wildlands, and these measures would be especially cost-effective when directed toward poor households and communities. Data identifying relevant targets and site-specific measures have been assembled for only a few locations, however. We recommend that the Forest Service and related agencies place the highest priority on reducing fire risks in these areas, while quickly identifying and extending fire-proofing measures to others throughout the West.

**A Sustained Strategy to Accomplish Long-Run Goals.** In principle, the previous recommendation, if carried through, ought to be sufficient to bring about meaningful reductions in the wildfire-poverty connection, as well as

long-run, sustainable interactions between the ecosystems of wildlands and the development patterns of communities. In practice, however, much more will be required. Extensive evidence indicates that merely calling for federal fire-management programs to become more effective will yield little unless supported by a well-planned and -implemented strategy to engage groups across the West in pressing federal officials to adopt and implement fire policies that equitably address the needs of poor households and communities. For a century, fire-management policy has focused on taking aggressive action to suppress fires, with little concern for cost or long-run

**We recommend that a major western initiative be implemented to address the dual issues of poverty and fire management.**

consequences, and repeated attempts to redirect it to a new course have found it a hard ship to steer. Redirecting it now toward the interests of poor households and communities will be equally unsuccessful unless these interests capture the attention of the Forest Service, related agencies, and Congress in a sustained and coordinated effort.

Accordingly, we recommend that the Center for Watershed and Community Health implement a major western initiative to address the dual issues of poverty and fire management.

Developing and implementing a poverty-related strategy to change fire-management policy should entail these steps:

**Step 1: Initiate outreach and dialogue.** Initial efforts should focus on making key community, civic, and government leaders across the West more aware of the linkages between wildfire and poverty and of the opportunities for making fire-related programs more effective in assisting poor households and communities. These efforts should include broad dissemination of this report, the distribution of follow-up summaries to op-ed pages and other outlets, and meetings with key leaders to discuss the issues unveiled in this report.

**Step 2: Complete detailed case-studies with local communities.** This step should augment the general findings of this report with site-specific details. We propose to complete case studies in 2-4 of the regions where wildfire and poverty are both on the front burner: (1) Pacific Northwest (especially eastern Oregon and Washington); (2) Northern Rockies; (3) Southwest; (4) California (especially the Sierra Nevada). From our work on the report, we are confident it will stimulate innovative conversations and promote the identification of common ground in individual communities among disparate groups, including those with a focus on rural poverty alleviation, rural economic development, and environmental conservation. The case studies should focus on identifying initial ideas for converting the report's findings and recommendations into specific proposals for changing fire-related policies so they have a more positive impact on the welfare of poor households, the economies of poor communities, and the productivity of rural ecosystems.

**Step 3: Symposia on wildfire and community development.** The case studies should lead to 2-4 symposia (one in each area) that bring together experts in fire-management science and western poverty, as well as

community representatives from the different case studies, plus others, in an effort to develop concrete proposals for policy changes and related actions pointed toward ensuring that fire-related programs have a more positive impact on poor households, rural communities, and environmental resources. The symposia should be aimed at broadening the involvement of different, interested groups and firmly establish the scientific and policy-based foundation for modifying fire-related programs to address the interests of poor households and communities.

**Step 4: Develop educational and political strategies.** From the case-studies and the symposia, the Center for Watershed and Community Health (or a substitute institution), working with collaborators throughout the West, should develop strategies for bringing about changes in fire-related programs

**These recommendations rest on a simple, but solid foundation. They recognize that public lands and local communities are intertwined, as are the incidence of wildfire on those lands and the economic welfare of those living in the communities.**

so they provide meaningful relaxation in the wildfire-poverty connection in the West. The strategies should specify short- and long-run actions by governmental agencies and nongovernmental organizations, establish benchmarks for measuring progress, and identify individuals and institutions that have accepted responsibility for ensuring that implementation of the strategy has adequate staying power to be effective.

We anticipate that it will take about two years to complete these four steps.

These recommendations rest on a simple, but solid foundation. They recognize that public lands and local communities are intertwined, as are the incidence of wildfire on those lands and the economic welfare of those living in the communities. Both the lands and the communities are healthiest when they interact in a symbiotic manner. This outcome can occur only when the natural resources—forests and rangelands—of a place are used to enhance the skills of workers, financial assets of families, and the social institutions of whole communities; and, in return, the residents of the community employ their skills to enhance the quality of the natural resources, the families invest their assets in reducing the risks their activities impose on the forests and rangelands, and the communities develop institutions dedicated to ensuring that this relationship evolves in a sustainable manner.



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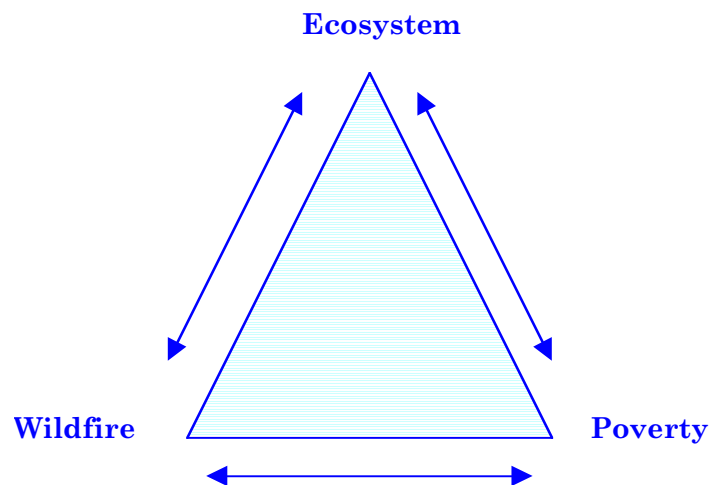
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# APPENDIX: WILDFIRES, ECOSYSTEMS, AND ECONOMIES

Wildfires, and the resource-management programs related to them, can affect the economic well-being of individuals, families, and communities in innumerable ways. The direct impacts—lives lost, homes destroyed, jobs created, etc.—often eclipse some of the strongest and most persistent effects on people, which come through changes in ecosystems. We depict the relationships between wildfires, ecosystems, and poverty as a triangle as shown in Figure A-1.

**Figure A-1: The Wildfire-Ecosystem-Poverty Triangle**



The main body of this report addresses the direct relationship between wildfires, fire-related programs, and the poor—which forms the base of the triangle in Figure A-1. From our previous work, we know that ecosystems play an important role in the economic well-being of individuals, families, and communities, both nearby and throughout entire economic regions (Niemi and Fifield, 2000). Yet, there is little known about how the poor, in particular, are affected by ecosystem changes or about how wildfires and fire-related programs affect the relationship between ecosystems and poverty.

In this appendix we offer an overview of what is known about the wildfire-ecosystem-poverty triangle. Why place the discussion in an appendix? It might otherwise distract from the clear case to remedy the direct impacts of wildfire and fire-related programs on the poor.

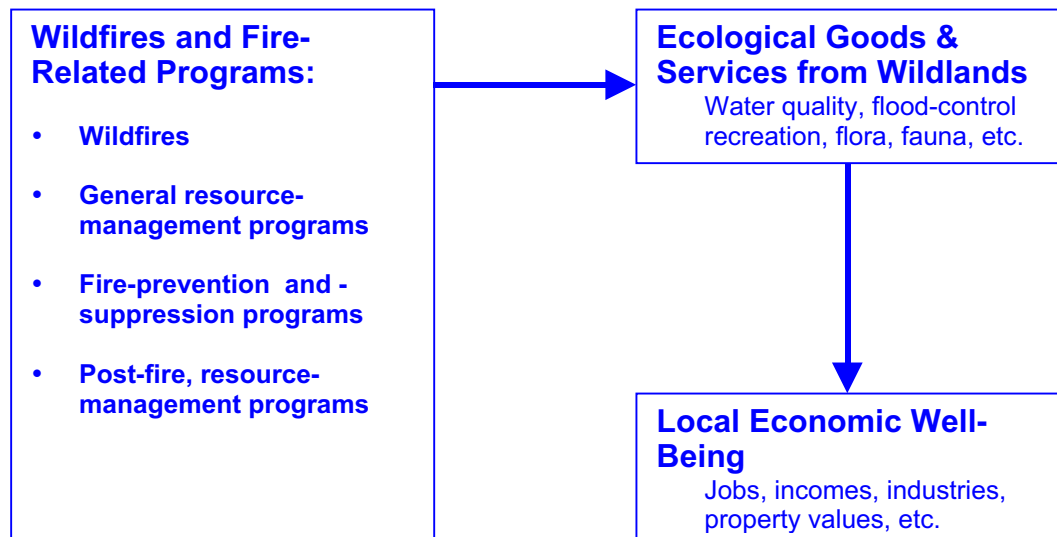
We begin in Part 1 with a description of some of the economically important goods and services derived from western wildlands. We then describe the ecological roles of natural wildfire regimes and how these roles have been and

can be affected by resource-management programs. Then, in Part 2, we extend the discussion and examine the potential economic effects of fire-related ecological changes. We conclude with some reflections on ecological health and poverty in Part 3.

## **PART 1: ECOSYSTEMS AND WILDFIRES**

In this section we trace the effects of historic fire regimes and various fire-related programs on western ecosystems—essentially, the interaction between the first two boxes in Figure A-2. This leads to the subsequent discussion of how wildfires affect local economic well-being through changes in the ecosystem. First, however, we introduce some of the economically important goods and services derived from wildlands.

**Figure A-2: Wildfires and Fire-Related Programs Influence Economic Well-Being by Altering the Ecological Goods and Services Derived from Wildlands**



## ECOLOGICAL GOODS & SERVICES FROM WILDLANDS

Western ecosystems provide a wide range of economically valuable goods and services that underlie the linkage between wildfire and poverty. Figure A-3 illustrates some of them. Ecological goods are specific components of ecosystems—water, timber, forage, etc.—that might be extracted and used directly or converted into other products. Ecological services often entail

resources that remain *in situ*, as when sections of a forest are used for recreational hiking, or when a waterfall is a notable landmark. Additional, economically important services materialize through ecosystem functions, such as the stabilization of soils on upland slopes or a riparian zone's filtration of sediment in runoff from uplands. Further economic value can arise from the overall state of an ecosystem—the systemic or integrated characteristics, such as those associated with old-growth forests, natural stream flows, or robust assemblages of native flora and fauna (Quigley et al., 1996).<sup>1</sup>

Looking at wildfire-and-poverty issues from the ecological perspective is useful because it drives home the fact that an ecosystem and the surrounding economy continuously interact with one another in many complicated ways. Human activities associated with the production, distribution, and consumption of wealth derive many different goods and services from the ecosystem but, in doing so, they alter the ecosystem's physical and biological characteristics. These changes, in turn, affect the state of the ecosystem and the stock of goods and services available for enhancing human standards of living, thereby altering future human activities.

Wildfire and related resource-management programs can play important roles in this cycle of interactions between the ecological system and the economic system. Wildfires have always been part of natural environments in the West. In some places, fires occur frequently, in others, less so, but always helping shape

the overall mix of flora and fauna and, hence, the supply of goods and services available for human use. This is an important point that bears repeating. Wildfires are an integral part of the natural ecosystems that

### Figure A-3: Some Economically Important Goods and Services from Western Ecosystems

#### Goods

**Water supply** (for household and industrial use, irrigation, aquaculture, and aesthetics)

**Animal products** (fish, game, fur)

**Plant products** (timber, forage, mushrooms, ferns)

**Mineral products** (metal ore, nutrients, gravel, building materials)

#### Services

**Flood control**

**Soil fertilization**

**Aesthetics** (scenery)

**Waterborne transportation**

**Hydroelectric generation**

**Recreation** (boating, swimming, fishing, wildlife viewing, hunting)

**Pollution control** (dilution of effluent, removal of pollutants)

**Pest Control** (natural control of noxious weeds, insects)

**Preferred ecological state** (old-growth forest, natural stream flows, robust native biodiversity)

Source: Based on Postel (1997).

<sup>1</sup> For a wide-ranging discussion, from an ecological perspective, of the economic importance of ecosystems, see Daily (1997).

produce the goods and services humans seek to obtain from western ecosystems. This role in the ecological production function has often been overlooked, as our society has seen wildfires as something invariably bad and harmful.

Human activities can and have changed the fire regime—inadvertently, e.g., through extensive logging or grazing or by altering the global climate, and directly, through widespread fire-suppression efforts. In addition, they have altered the overall net cost or net benefit of fire, by changing the value of the

**This is a point that bears repeating. Wildfires are an integral part of the natural ecosystems that produce the goods and services humans seek to obtain from western ecosystems.**

natural and built assets in fire's way. Extensive logging, for example, reduces the value of timber assets at risk of future fires, while building new homes at the forest's edge increase the value of assets at risk.

To describe the impacts of wildfires and fire-suppression programs on the economically valuable goods and services from wildlands, we give an overview in the next section of the fire regimes that occurred historically, before fire-suppression programs had much impact, then describe the ecological impacts of fires. This discussion sets the

stage for the subsequent examination of how suppression programs have altered the frequency, severity, and ecological impacts of fires.

## **HISTORIC FIRE REGIMES**

Scientists distinguish among three types of natural fire regimes in forests.<sup>2</sup> The understory-fire regime occurs most frequently and burns the grasses, brush, and dead organic material near the ground, leaving the branches of taller, fire-resistant trees mostly unaffected. This type of fire typically is the least intense and severe. At the other end of the spectrum are stand-replacement fire regimes, in which fires occur less frequently but burn essentially all the vegetation, including the tallest trees. An intermediate pattern occurs in the mixed-fire regime, in which fires have a variable effect on the vegetation, burning everything in some places and leaving nearby areas essentially untouched.

Many western forests dominated by ponderosa pines historically evolved through exposure to understory-fire regimes, with fires occurring every 5-30 years (Arno, 2000). In some places, such as northern Arizona, fires occurred more frequently, every one or two years, and at least every ten years throughout most of the ponderosa pine forests of the Southwest. In other areas, such as the colder ponderosa pine forests of Montana, fires were less frequent, every 25-50 years.

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<sup>2</sup> For a well-written introduction to the literature on fire regimes, we recommend Brown (2000), from which much of this discussion is extracted.

The mixed-fire regime typically has occurred in the mountainous regions and the coastal areas of the Pacific Northwest, where forests dominated by Douglas fir, California red fir, lodgepole pine and other species have adapted to fire frequencies of less than 30 to more than 100 years (Arno, 2000). As the name indicates, mixed-fire regimes have a variable effect on forests, sometimes burning over large landscapes but leaving some parts of the landscape untouched, thereby creating a mosaic pattern of vegetation types and ages.

Stand-replacement forest fires historically have occurred primarily in areas that usually are quite wet, such as subalpine forests in the mountains and forests in coastal regions. Sometimes such fires occur as crown fires, burning

**“Fire return intervals typically ranged from 2 to 5 years in ecosystems supporting abundant cured or dead fine fuels such as ... Southwestern ponderosa pine, and oak savanna. They ranged from 5 to 35 years for dry site conifers, shrublands including California chaparral, and most grasslands; 35 to 200 years for [drier site] conifers; 200 to 500 years for some ... wetter site conifers; and 500 to 1,000 years for extremely cold or wet ecosystems such as alpine tundra and Northwestern coastal spruce-hemlock forests”**

Source: Brown (2000, p. 185-6)

through the tops of trees and moving at rapid speed, fanned by high winds. They also can burn closer to the ground, moving more slowly but consuming all vegetation and organic fuel from the ground up. Stand-replacement fires have the longest recurrence intervals, from about 70 years in some lodgepole pine forests of the Rocky Mountains to more than 500 years in some coastal forests.

The same three types of fire regimes also apply to lands dominated by grass, brush, and small trees (Payson et al., 2000). These areas cover large expanses in the arid parts of the West—the so-called Great Basin sagebrush ecosystem, alone, covers 247 million acres. Understory-fire regimes occurred in or near ponderosa pine forests of the Southwest, with recurrence intervals of

2-10 years. Mixed-fire regimes, occurring in areas characterized by pinyon pines, junipers, western oak, or sagebrush often occurred with intervals of less than 15 years, and yielding a mosaic pattern similar to that of mixed-fire regimes in forests. Fires in grassland ecosystems are generally considered to be part of a stand-replacement fire regime because they consume all or nearly all the vegetation and abruptly change vegetation patterns, though for a shorter period than stand-replacement fires in forests. Stand-replacement fires also occur in areas characterized by desert shrubs, such as sagebrush, creosotebush, and Joshua Tree. In some grasslands, stand-replacement fires have occurred annually; in other areas, the recurrence intervals may have extended up to 70 years or more.

It also is widely recognized that American Indians in many areas regularly initiated wildfires to reduce fire risks, stimulate the growth of some plants that grow better in open areas, create forage for some types of game animals, and for other reasons. The overall ecological importance of these probably was greatest in areas where natural fires occurred least frequently, and some researchers have wondered if the fires set by Indians should be considered



part of the natural fire regime or a deviation from it, insofar as the natural and set fires may have occurred in different seasons and with different temporal and spatial patterns. Where Indians had a substantial influence on the fire regime for thousands of years, however, they probably influenced the ecological conditions first recorded, and regarded as natural by Euro-American settlers (Brown, 2000).

## **ECOLOGICAL IMPACTS OF WILDFIRES**

In a recent review of the ecological impacts of fires, Brown (2000) observes that fire “is an ecological process that triggers an amazing network of other processes and associated conditions.” To illustrate these, he distinguishes between “first order” and “second order” changes in ecological processes. The

**Fires can dramatically alter the behavior of watersheds, reducing the amount of precipitation that is absorbed by soils and plants, increasing the amount of precipitation that becomes surface runoff, and altering the quantity and quality of water in streams.**

“first order” impacts include the ecological changes that occur during and immediately following a fire, such as mortality of plants and animals, vaporization of organic material, generation of smoke, and physio-chemical changes in soils and streams. “Second order” impacts can be numerous and vary from one fire to the next, and among sites affected by the same fire. Illustrative examples include changes in microclimates, soil nutrients, vegetation, wildlife habitat, and patterns of water runoff within the burned landscape.

These and other changes in ecological processes may not be observed by anyone other than ecological scientists, but some of their resulting impacts will be far more noticeable, especially the impacts on streamflows and water quality, the mix of flora and fauna, and the risk of future fires.

**Streamflows and water quality.** Fires can dramatically alter the behavior of watersheds, reducing the amount of precipitation that is absorbed by soils and plants, increasing the amount of precipitation that becomes surface runoff, and altering the quantity and quality of water in streams.<sup>3</sup> The quantity and quality of runoff from a watershed depends on the intensity of precipitation, the stability of geologic features and soils, and the amount of ground cover (by live plants and litter from dead plants). In most geologic regions and with normal precipitation levels, when watersheds have healthy soils and extensive ground cover, a small percentage of precipitation becomes surface runoff and generates little erosion, as shown in Figure A-4.

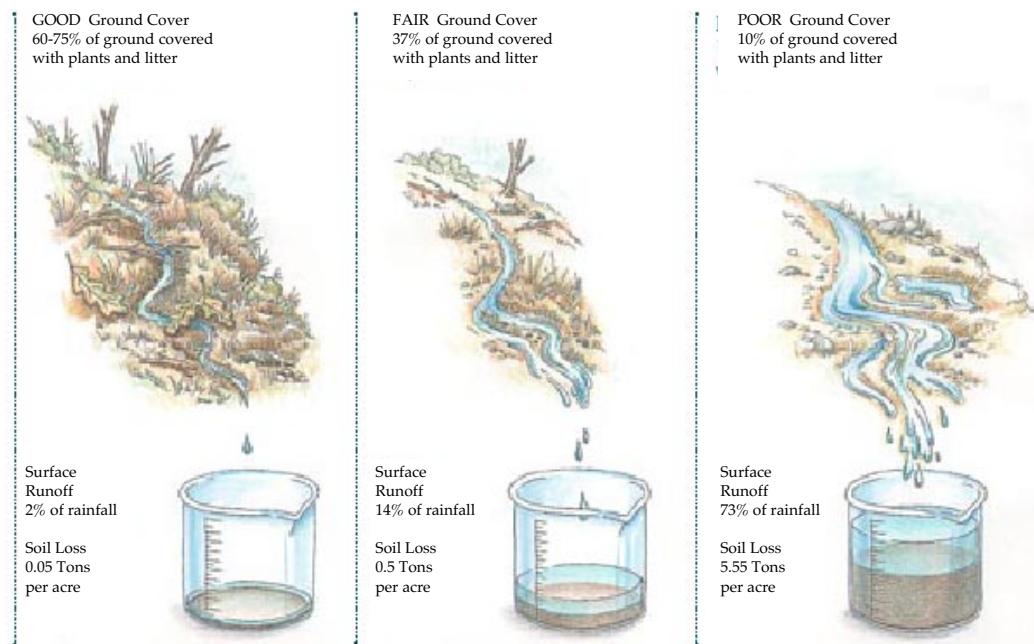
Fires that raise soil temperatures for long periods can leave them so they repel rather than absorb water. This, together with the burning of live plants and litter, can leave watersheds unable to hold back precipitations. A greater percentage of precipitation becomes surface runoff, which moves downhill

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<sup>3</sup> For an introduction to the effects of fires on watersheds, see Robichaud (2000).

faster, eroding more soil, increasing stream sedimentation, and increasing the risk of flooding. A fire's impact on a watershed diminishes with time, as soils become more absorbent and new vegetation grows. The impacts may not be noticeable, if the burned area receives little precipitation for some time after the fire. They can be dramatic, however, if a high-precipitation event occurs soon after the fire and before the area's soils and vegetation can recover.

**Figure A-4: The Effects of Watershed Condition on Runoff and Erosion from Rainstorms**



Source: Sedell, et al. (2000, p. 10)

**Mix of flora and fauna.** Wildfires alter the variety of life, or biodiversity, of the burned and nearby areas.<sup>4</sup> (In some cases, the impacts can extend for considerable distance, as when a fire affects habitat conditions in streams many miles away.) In general, fires result in increased biodiversity, especially if the fires occur in highly variable, natural patterns of seasonal timing, location, intensity, and frequency. Biodiversity may be diminished, however, if fires occur far more frequently than in the past. Increases in biodiversity can be slow to emerge in some cases, such as large, extremely hot fires that kill all plants and organisms above the ground and in the top layers

<sup>4</sup> For an introduction to the effects of fires on biodiversity, see Brown and Smith (2000) and Smith (2000).

of the soil, so that the seeds for new plants have to be carried in from the outside.

Although ecologists would be concerned about the effects on all species, the general public may be more concerned about just a few species, especially birds, game mammals, and commercially valuable plants. Some of this concern is misplaced. The vegetation of many burned areas recover quickly, though it may take a long period for the stages of succession (one species gradually squeezing out others) to play out. The impacts on animals also may be minimal, as evidenced by this statement from an overview of the relevant

**“Fire can cause dramatic and immediate changes in vegetation, eliminating some species or causing others to appear where they had not been present before the fires. However, in burned areas with a high component of surviving trees and resprouting understory vegetation, within a few years it can be difficult to determine that a fire recently occurred.”**

Source: Miller (2000, pp. 32-3)

literature (Lyon et al., 2000): “Despite the perception by the general public that wildland fire is devastating to animals, fires generally kill and injure a relatively small proportion of animal populations.” Many plants and animals thrive in recently burned areas, while others thrive in areas that have not experienced fire for a long time. A landscape that has experienced a natural fire regime should exhibit a range of plants and animals adapted to these extremes and intermediate conditions. Thus, the fire regime that naturally occurs in an area generally should yield the full range of biodiversity that naturally would occur in the area. Deviations from this fire regime, such as occurs when fires are prevented or suppressed

for longer than the normal fire-recurrence interval, tend to reduce the biodiversity. Conversely, biodiversity can be reduced if fires occur far more frequently than normal (Brown, 2000).

In some situations, humans may not want the natural mix of flora and fauna and use fire to stimulate the growth of a different mix. Some American Indians, for example, used fire to halt the growth of trees and stimulate the growth of grasses and shrubs, and the animals, such as deer, that thrive on them. More recently, humans have suppressed fires to encourage the sustained growth of trees that have greater commercial value.

**Risk of future fires.** Fires burn fuel and a common conception is that wildfires burn all of the fuels in the burned area. This outcome may occur, especially in some stand-replacement fires, such as those that occur in grasslands. In other cases, though, as a fire consumes some fuel, it can increase the availability of fuels for future fires by killing, but not consuming, trees and shrubs. The dead limbs and stems become drier than before the fire and can more readily ignite in the future.

As an illustration of this potential, increased risk of future fires appears to have been created by fires during 2000 in the Bitterroot National Forest, in Montana. Before the fires, the forest typically exhibited fuel loads, mostly from small pieces of dead wood, of less than 15 tons per acre. After the fire,

the remaining dead limbs and stems were as high as 25 tons (and, in places, as low as 5 tons) per acre (U.S. Department of Agriculture, 2001a).

## ECOLOGICAL IMPACTS OF FIRE-RELATED PROGRAMS

In this section we briefly describe the ecological impacts of three categories of fire-related programs: (1) general resource-management programs for forests and rangelands, namely industrial timber production and roads; (2) programs specifically aimed at preventing and suppressing wildfires; and (3) programs that focus on rehabilitating wildlands that have been burned.

**Industrial timber production.** The most obvious, fire-related ecological effect of timber production is the removal of large trees and their replacement

**“Every resources management issue we will face will have a fire component as part of the solution. The solution may be aggressive fire suppression or the use of fire in some form.”**

Source: Agee (1997, p.196)

with seedlings that eventually will grow to become large trees that, again, will be removed. The full impacts, however, can extend far beyond this time-shift in the aging of trees. In many places, the logging of large trees has removed from the forest the most fire-resistant elements of the ecosystem, and the subsequent growth of tree seedlings and brush has created vegetation that is highly susceptible to fire. Some of the most extreme conditions occur when the new growth is so dense it is called dog-hair, the overcrowding leads to high mortality, and areas of the landscape are covered with dry, highly flammable fuel that can burn almost explosively.

Logging can have a more immediate impact on fires when limbs and other organic matter, commonly called slash, are left on the logging site. Leaving this material is widely considered an important step for reducing undesirable impacts on wildlife habitat, erosion, and other ecological variables (Swanson and Franklin, 1992), but, as it dries, the material also represents additional fuel for future fires. Agee (1997), for example, describing a 1987 fire in a forest near Mount Rainier containing multiple logged areas, observes that the fire jumped from one logged area to another, fueled largely by the slash material, even though the logged areas were not contiguous.

Timber production also can have extensive impacts on ecological goods and services less closely tied to fire. These vary from place to place and by logging method, but a recent summary of the cumulative impacts of logging identified these categories of impacts: increases in air pollution; reductions in the natural productivity of soils; increases in erosion and mass-movement of soils; changes in the timing of streamflows and increases in waterborne sediment; changes in aquatic and terrestrial habitat for fish, birds, mammals, and other species; and changes in the overall integration of the various components of ecosystems (Beschta et al., 1995).

**Roads.** Many of the West's wildlands contain an extensive road network. Most of the more than 386,000 miles of officially-recognized roads on the national forests are in the West, and there are many thousands of additional miles that are not acknowledged officially (U.S. Department of Agriculture, 2000b, p. 3-21). Thousands more exist on lands managed by the Bureau of Land Management.

For the most part, the roads on wildlands were developed as an integral element of the effort to support logging, grazing, mining and other industrial activities. In many circumstances many of the most undesirable ecological impacts of these activities stem, in fact, from the roads rather than the activities themselves (Trombulak and Frissell, 2000). This is especially true for impacts on water quality in streams, insofar as roads persistently increase the frequency of landslides and other ecological processes that can deliver sediment to streams. In some situations, roads also can increase the runoff from hillsides by directing to the surface precipitation that otherwise would sink into the ground. Thus, whenever fires increase the risk of flooding, erosion, and sedimentation, the existence of roads can magnify the risk considerably.

**For the most part, the roads on wildlands were developed as an integral element of the effort to support logging, grazing, mining and other industrial activities. In many circumstances many of the most undesirable ecological impacts of these activities stem, in fact, from the roads rather than the activities themselves.**

Roads interact with fires in other ways as well. In particular, they increase the public's access to wildlands and, hence, distribute the risk of human-caused fires over the landscape. Conversely, however, during a fire, roads can become essential to fire-suppression efforts by giving firefighters faster access to lands ahead of the fire and by serving as a fire break. On balance, it is hard to weigh the overall interaction between fires and roads, although there is strong evidence that, overall, roads have strongly negative impacts on natural ecological systems (Trombulak and Frissell, 2000).

**Fire-Prevention and -Suppression Programs.** For more than a century, wildland managers in the West have worked to prevent fires from starting and to suppress those that do get started, and the effort intensified after major, deadly forest fires in 1910, with the Chief Forester of the Forest Service declaring "[P]reventing losses from forest fires ... is the fundamental obligation of the Forest Service and takes precedence over all other duties and activities" (Pyne, 1997). Although much of this effort aimed at preventing and suppressing human-caused fires that were not part of natural fire regimes, firefighters also worked to curtail natural fires.

These firefighting efforts were successful, more or less, throughout the West. As forests and rangelands have gone without fire for longer—sometimes much longer—than the natural fire-recurrence interval, ecosystems have evolved accordingly, acquiring characteristics that previously were rare or even unknown. For example, in forests that once were characterized by fire-resistant trees standing tall above lands kept largely clear of brush and small trees by frequent, understory fires, decades of firefighting efforts have



allowed brush and small trees to flourish. Birds and other species reliant on habitats with open space disappear, sometimes within less than ten years (Smith, 2000).

The build-up of brush and small trees, which are not resistant to fire, increases the amount of fuel per acre available to a fire, if one should ignite.

**“A problem today is that plants adapted to short fire return-intervals can be harmed by fires burning with high intensity and severity in accumulated fuels that resulted from long fire-free periods.”**

Source: Brown (2000, p. 187)

When a fire does start, it becomes a stand-replacement fire because the additional fuel can support hotter, larger, more severe flames that kill all vegetation, including the large trees that would have been largely unaffected by more natural, understory fires. Areas that, under the natural fire regime, could have continued producing one set of ecological goods and services for decades with a series of understory fires now are dramatically altered.

Programs to prevent and suppress natural fires thus can result not in protecting wildlands and the flow of goods and services from them but in ensuring that, eventually, more severe fires would bring about changes far more stark than those that were initially feared. Rather than protecting the trees, animals, streamflows, soils, water quality, etc. associated with natural fire regimes, the prevention and suppression programs first pushed ecosystems into fire-free conditions and set the stage for stand-replacement fires.

**Post-Fire Programs.** Limited scientific literature provides guidance for what actions to take after an area has burned, but this lack seems not to slow the desire to do something. Once a wildfire occurs, it is common to hear expressions of regret that the fire destroyed one ecosystem, followed quickly by calls for action to jump-start the reestablishment of a replacement ecosystem. Besides representing a failure to see fire as an integral element of the ecosystem, this behavior often overstates the ability of humans to direct ecological events and may lead to actions with undesirable impacts on the goods and services that the ecosystem will produce in the future.

Controversies over post-fire programs often revolve around two, closely linked concerns: preventing erosion and logging burned trees. As explained above, wildfires, especially intense fires, can substantially increase the likelihood of flooding and erosion over the next several years by reducing the ability of soils to absorb precipitation and eliminating vegetation and organic litter that help arrest runoff over the soil surface. At the same time many forest fires do not fully consume all the trees, instead burning the small limbs and leaves and some of the bark, but leaving most or all of the stem intact, though dead. Those seeking to restore a new ecosystem often call for logging the dead trees and removing them, thereby lowering the amount of fuel available for future fires. Moreover, the dead trees are seen as having less of a role in the ecosystem than when they were live and logging them would convert the dead stems into economically useful timber. Post-fire, salvage logging, though, can greatly exacerbate the risk of erosion and flooding.

Or, it might not have these effects. McIver and Starr (2000) summarize the relevant literature and conclude that, “like most practices, postfire logging is certain to have a wide variety of effects, from subtle to significant.” They report that, while some logging practices, especially those that entail building roads and dragging logs over soils, can have a detrimental effect on the natural function of watersheds, some logging practices might reduce erosion under some conditions. Whatever its impact on erosion and runoff, post-fire logging alters the subsequent composition of plant and animal communities in the burned area and across a larger landscape. For example, it reduces the nesting habitat for woodpeckers, increases the likelihood that exotic plant species will become established on disturbed soils, and reduces the populations of insects attracted to fire-killed trees.

**Whatever its impact on erosion and runoff, post-fire logging alters the subsequent composition of plant and animal communities in the burned area and across a larger landscape.**

## **PART 2: WILDFIRES, ECOSYSTEMS, AND ECONOMIES**

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In the preceding sections, we have presented a quick overview of the history of wildfires, and the parts they, and fire-related programs play in shaping western ecosystems. In this section, we extend the presentation to describe how these ecological changes can affect western economies and especially the economic well-being of poor people and communities.

Here’s a quick summary of the three elements of the analysis. (1) Fires and fire-related programs alter the ability of wildland ecosystems to provide goods and services. (2) Changes in the mix of ecological goods and services derived from wildlands affect the jobs, incomes, and other characteristics of local and regional economies. (3) Ecological changes and changes in local and regional economies affect the economic welfare of poor individuals, families, and communities.

We begin with a conceptual framework for understanding the relationship between ecosystems and economies. We then apply the framework, first to describe trends in the economic importance of different goods and services, and then to examine the potential economic consequences of the changes in ecological goods and services caused by wildfires and fire-related programs. We conclude with some reflections on the extent to which wildfires and related programs, by bringing about ecological change, represent economic disaster, economic opportunity, or both for local communities.



## ECOSYSTEMS AND ECONOMIES—A CONCEPTUAL FRAMEWORK<sup>5</sup>

To help elucidate the economic consequences of fire-related changes in an ecosystem, we turn to a fundamental focus of economic analysis: competition. In the distant past it was common to conclude that there was no economic competition for the resources available from western wildlands—they were free for the taking.<sup>6</sup> But not now. Today, no piece of wildland can satisfy all the human demands for ecological goods and services that might be derived from it. Hence, through public policy, market mechanisms, or inertia, wildland resources are allocated to one use and deprive competing uses. These choices have wide-reaching ramifications for local economies and for the current and future residents of nearby communities and entire regions.

**To evaluate the economic consequences of fires and fire-related programs, one must know what their impacts will be on the competition for wildland resources: which competitors and uses will benefit, which will not, and how these initial impacts will ripple through the overall economy.**

To evaluate the economic consequences of fires and fire-related programs, one must know what their impacts will be on the competition for wildland resources: which competitors and uses will benefit, which will not, and how these initial impacts will ripple through the overall economy. Moreover, it is essential that one view these impacts in the context of regional, national, and even global forces and trends that, throughout the West, are fundamentally altering the ecosystem's role in supporting jobs, creating wealth, and shaping entire economies. Old demands—typically tied to a commodity-oriented, resource-intensive industry—are becoming weaker relative to new

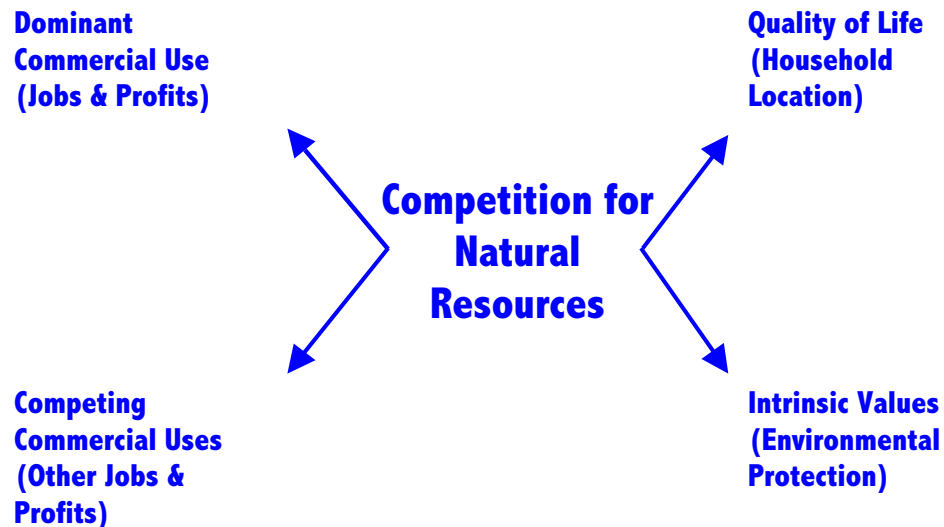
demands, lacking the commodity orientation, that have emerged over the past decade or so. Without a full understanding of these trends and their economic implications, firefighters, land managers, community leaders, and individuals trying to manage wildlands to benefit local economies can resemble armies that make the mistake of preparing to fight the last war rather than the next one. The consequences for the poor are not trivial. The punishment for such mistakes usually fall most heavily on the individuals, families, and communities at the bottom of the economic ladder.

In this section we offer a conceptual model of this evolving competitive landscape. One could categorize the competition in any of a number of ways, but we propose a taxonomy that distinguishes among four types of demand derived from the goods and services wildlands provide. The four types of demand are illustrated in Figure A-5. The left side of the figure shows two

<sup>5</sup>The discussion in this section relies extensively on previous work, including Courant et al. (1997) and Niemi (1999).

<sup>6</sup>Of course, perceptions that there was no competition for western wildlands ignore the long-lived competition among different Indian groups for some resources and between Indians and Euro-American settlers. They also overlook the implicit competition among the current and future generations over the sustainability of resources and resource uses over time.

**Figure A-5: The Competing Demands for Natural Resources**



types of commercial demand for resources, i.e., for elements of wildlands that help firms earn profits. The right side shows two types of consumers' demand for elements of wildlands that directly influence individuals' quality of life and standard of living. Each type of demand exists independently, but the competition among them is best understood by assuming that one type, the "Dominant Commercial Use" prevails, and then looking at the consequences for the others.

### **Competition From Commercial Uses**

The most easily identifiable commercial demands entail the extraction or development of natural resources. We use the term, extraction, to embrace activities, resource uses, and industries associated with crop production, timber production, grazing, mining, and other activities that chemically, electrically, or physically remove one or more elements (flora, fauna, mineral, or energy) of the ecosystem from its source.

We use the term, development, to refer to the occupation of a site by human structures, such as occurs during urbanization. Development also includes intense human activity—draining a wetland, changing the composition of a forest's floral community, concentrating off-road-vehicle traffic, and so forth—that substantially alters a forest's ecosystem processes. Logging, mining, ranching, and development are the most important of the commercial demands, although there are many others, including industrial tourism. Commercial demand for natural resources comes from private and public enterprises, which we define broadly, to include chartered institutions, such as private corporations, incorporated cities, and public agencies, as well as households that farm land, build a house, and recreate, and other groups that sponsor extractive or development activities.

**Dominant Commercial Demand.** We separate the commercial demands for natural resources into two groups. We first identify a specific extractive or development use of a specific piece of wildland that has three important characteristics: it directly uses natural resources; depletes the stocks of resources; and has a dominant position relative to competitors because of its economic competitiveness, political support, or historical inertia. The

**In public discussions of fires and fire-related programs, the economic importance of the dominant commercial use of wildlands usually is expressed in terms of jobs and incomes for local residents, as well as profits for local firms. In many cases, this commercial use is portrayed as the sole way for local residents to derive jobs, incomes, and profits from wildlands.**

identification of a particular use as the dominant one is arbitrary, but purposeful. This type of demand usually is associated with a familiar extractive industry, such as farming, ranching, logging, or mining, or with common development activities: developed recreation, urbanization, bridge construction, and the like. In general, only one commercial industry benefits from a particular use of wildland resources, but sometimes there may be more than one. Logging, for example, may benefit the timber industry and some sectors of the recreation industry (Quigley et al., 1996).

In public discussions of fires and fire-related programs, the economic importance of the dominant commercial use of wildlands usually is expressed in terms of jobs and incomes for local residents, as well as profits for local firms. In many cases, this

commercial use is portrayed as the sole way for local residents to derive jobs, incomes, and profits from wildlands.

**Other Commercial Demands.** After identifying the dominant commercial use, we then identify the competing commercial demands—alternative, actual or potential, commercial uses that incur costs from the dominant use. We purposefully distinguish between the two categories of commercial uses to drive home the message that there often is competition, within the extractive and development sectors, for natural resources. This message is important because, too often, the competition for forest resources is characterized as simply a jobs-vs.-environment contest between a (dominant) industry seeking to use a resource as a productive input and those who want to protect the environment. By highlighting competing commercial industries that incur economic costs from the dominant one, we emphasize the point that the positive consequences arising from one set of extractive or development activities frequently have negative effects on one or more others.

### **Competition Directly From Consumers**

On the left side of Figure A-5, natural resources are economically important because they are inputs in the production of other things, such as housing, transportation systems, and hydroelectricity that consumers want to have. On the right side, the connection between these resources and consumers is more direct. That is, consumers consider these resources economically important for what they are and for how they directly contribute to consumers' well-being. Figure A-5 shows there are two types of demand for

forest resources coming directly from consumers: one affects consumers' residential location decisions; the other does not.

**Quality-of-Life Demand.** We use the term, quality-of-life demand, to represent consumption amenities that influence location decisions. Sometimes wildlands produce amenities, such as recreational opportunities, scenic vistas, and healthy environments, that contribute directly to the well-being of people who have access to them. In the language of economics, these are known as consumption amenities. Their contribution to consumers' well-being makes consumption amenities economically important in their own

**This mechanism allows natural-resource consumption amenities to affect where goods and services are produced. Thus, the quantity and quality of natural resource amenities can affect the levels and types of jobs (and economic activities in general) throughout the local and regional economies, including sectors with no direct link to the use of ecosystem resources.**

right, but they also influence the location decisions of households and firms (Knapp and Graves, 1989; Mathur, 1993; Mueser and Graves, 1995), thus, adding to their economic interest. The nearer people live to these amenities, the better their access and the greater their consumer surplus.

Whitelaw and Niemi (1989) have likened this relationship to a *second paycheck* residents receive by living in a place where they have easy access to amenities, so that the total welfare of residents within commuting distance of the amenities is the sum of this second paycheck plus the purchasing power of their money income. The size of the second paycheck

affects behavior in the local and regional economies by influencing household demand for residential location.<sup>7</sup> If the second paycheck is large enough, it will attract households that otherwise would have located elsewhere. The influx of people increase both the labor pool and the number of consumers. The former attracts firms seeking workers, and the latter attracts firms seeking consumer sales. Both mechanisms allow natural-resource consumption amenities from wildlands to affect where goods and services are produced. Thus, the quantity and quality of natural resource amenities can affect the levels and types of jobs, incomes, profits, and economic activities in general throughout the local and regional economies, including sectors with no direct link to the use of ecosystem resources.

The strength of the quality-of-life impacts on the economy depend on many variables, including the distinctiveness of the amenities available from the wildlands and how these interact with households' preferences and other building blocks of economic development, such as transportation and communication systems. It is clear, though, that quality-of-life impacts can be

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<sup>7</sup> That location-specific consumption amenities are an important influence in residential location decisions is well documented. The early contributions are Rosen (1979) and Roback (1982). For more recent work on this topic see Beeson (1991), Berger and Blomquist (1992), Blomquist et al. (1988), Brady (1995), Brown (1994), Browne (1984), Cooper (1994), Cromartie (1998), Cushing (1987), Figlio (1996), Gabriel et al. (1996), Gottlieb (1994), Greenwood et al. (1991) and Sherwood-Call (1994).

powerful. Researchers from the USDA Economic Research Service, for example found that amenities influence economic growth throughout the Rockies (Vias, 1999), and the rural West (Cromartie and Wardwell, 1999). Repeated surveys have found that recent in-migrants resoundingly say that having access to the state's quality of life is a primary motivation for moving to Oregon and that they are willing to accept a reduction in incomes to do so (Helvoigt, 1999). Separate studies have documented that western counties with higher acreages of wilderness or unroaded areas on federal lands experience faster growth in jobs and incomes (Rudzitis, 1999; Southwick Associates, 2000).

**Intrinsic-Economic-Value Demand.** The lower right corner of Figure A-5 represents the demand for elements or characteristics of an ecosystem that people value for their intrinsic properties. Intrinsic values, often termed “existence values,” do not entail an explicit current use of the resource.<sup>8</sup> They

**Demands related to intrinsic values, by themselves, are unlikely to have any manifest economic effect on jobs, income, or other indicators of economic activity. Still, the resource affects the real well-being of real people, and this well-being belongs in any comprehensive analysis of the value of the resource.**

arise whenever individuals place a value on maintaining the existence of a species, scenic waterfall, or other resource for its own sake, or on the prospect that the resource will be useful, for example, to future generations. Actions that increase the robustness of the resources, for example, by preventing degradation of critical habitat for an endangered species or by ensuring the flow of the waterfall, increase the welfare of those concerned about these issues, and actions that degrade the resources decrease this welfare.

Unlike the other three demands for natural resources, demands related to intrinsic values, by themselves, are unlikely to have any manifest economic effect on jobs, income, or other indicators of economic activity. The protection of scenic vistas and trout in the Rockies may be of intrinsic value to some residents of Miami, Los Angeles, and other distant places, but the effect of this on economic activity in the region of the forests will be small unless it is articulated through tourism (in which case it appears as a commercial demand) or the political system. Still, the resource affects the

real well-being of real people, and this well-being belongs in any comprehensive analysis of the value of the resource.

For some environmental issues, intrinsic values may be surprisingly large, especially to those who are used to equating the economic importance of wildlands to their extractive and development uses. Consider wild and unroaded lands, for example. The large, undisturbed landscapes of these areas offer opportunities for private, secluded recreation, provide habitat for native species, and support scientific monitoring and research that cannot be conducted on lands that have been heavily roaded or developed. Given these

<sup>8</sup> Some argue that the intrinsic value category, alone, does not fully recognize the value of the life-support services ecosystems provide that make the earth habitable (Baskin, 1997). We do not debate the point here but, instead, expand the category of intrinsic values to include this life-support value.

characteristics, plus a widespread desire to protect wild lands for future generations, most Americans see unroaded areas as national assets that warrant protection. In a nationwide poll conducted in January, 2000, 76 percent of respondents supported the protection of roadless areas in national forests from logging, road-building, and other development (DiVall and Onorato, 2000).

### Tradeoff Mechanisms and Ripple Effects

We have constructed the analytical framework associated with Figure A-5 to demonstrate the complex and growing competition for wildland resources in the West. A central message to be drawn from the framework is that, when

**There are economic tradeoffs that ripple through local and regional economies from any use of wildland resources. Hence, when trying to trace the economic consequences of fires or fire-related programs that affect wildland resources, one cannot look solely at the historical use of the resources but, instead, must also look at the impacts on the competing uses.**

one type of demand enjoys the use of a given set of natural resources, some competing demands go without. In this context, there are economic tradeoffs that ripple through local and regional economies from any use of wildland resources. Hence, when trying to trace the economic consequences of fires or fire-related programs that affect wildland resources, one cannot look solely at the historical use of the resources but, instead, must also look at the impacts on the competing uses. To illustrate this principle, we extend our framework, again setting the dominant commercial use as the winner of the allocative process and looking at the costs on the others (but emphasizing that the same logic applies when resources are allocated to the other three types of demand). These costs materialize through two mechanisms: direct displacement and subsidies.

**Direct displacement.** This type of cost can materialize via two pathways: competitive bidding and negative externalities. The former materializes when an increase in the output of a resource use, other things equal, reduces the output of other uses. To extend the framework associated with Figure A-5, expanding the output of the dominant

commercial use reduces the value of competing commercial uses, the quality of life for residents, the intrinsic value of the wildland resources, or perhaps all three. There currently is considerable concern in the Pacific Northwest, for example, about the impacts of logging and related activities on the quality of surface water available downstream for municipal-industrial water use (Bernton, 1996) and on the viability of wild salmon populations (Independent Multidisciplinary Science Team, 1999). With reductions in water quality, the affected water utility would have to curtail production or incur additional costs to obtain water from other sources; with reductions in salmon populations, the commercial fishing industry forgoes production and people for whom salmon have special cultural or spiritual values experience a reduction in those values.



Displacement also occurs when the production of the dominant commercial industry is accompanied by negative externalities.<sup>9</sup> Negative externalities are ubiquitous when extractive and development activities affect the quality of air, water, habitat and landscapes.<sup>10</sup> Increased sedimentation from timber production, for example, can create additional costs for downstream fisheries, landowners, municipal-industrial water users, and public agencies (Meehan, 1991; Reid, 1993). These costs arise not because of competitive bidding for the use of the relevant resource but because the downstream effects are external to the incentives facing those who determine the upstream economic activities.

**These costs arise not because of competitive bidding for the use of the relevant resource but because the downstream effects are external to the incentives facing those who determine the upstream economic activities.**

**Subsidies.** The second mechanism by which the dominant commercial use of natural resources can impose costs on those with other, competing demands comes into play when government subsidies distort the prices or production levels of the dominant commercial industry. Similar distortions can arise from regulatory and other actions, such as trade policy, but, to conserve space, we lump them all under the rubric of subsidies. Subsidies draw money from, and thereby restrict the output and profits of other commercial industries. They also lower the disposable incomes of households. Hence, subsidies are akin to externalities.

Subsidies may be conspicuous, as when states give tax concessions to dominant commercial industries or protect them from competition (Black and Smillie, 1988; Nauth, 1992), but they may be more hidden, as when firms in other sectors of the economy have to subsidize unemployment insurance in some highly cyclical resource-extraction industries (Meyer and Rosenbaum, 1996). Regardless of their visibility, subsidies suppress the level of production in other industries and lower the well-being of affected households. These effects may materialize in the vicinity of the forest resources used in the production of the dominant commercial industry, but not necessarily.

## **THE MIX OF GOODS AND SERVICES FROM WILDLANDS—PAST, PRESENT, AND OUTLOOK<sup>11</sup>**

There exists no comprehensive evaluation of the value of the different ecological goods and services derived from wildlands throughout the West

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<sup>9</sup> In some cases externalities are positive. We include such cases as a part of the input demand.

<sup>10</sup> There is an extensive literature regarding when a particular cost or benefit is or is not an externality, or whether a particular price or production phenomenon stems from displacement, an externality, or a subsidy. See, for example, Baumol and Oates (1988 pp. 14-15).

<sup>11</sup> The discussion in this section relies extensively on previous work, including Niemi and Fifield (2000).



and of how they are affected by fires and fire-related programs. A rough idea of their value can be obtained, however, by looking at data for the nation's national forests, most of which lie in the West. We first examine the economic importance of easily measured goods and services, then look at two that are not so easily measured: cold, clean water; and wild and unroaded areas.

**Easily Measured Goods and Services.** In 1995 researchers at the Forest Service estimated the contributions to the Gross Domestic Product, or GDP, of different ecological goods and services from the national forests (U.S. Department of Agriculture, 1995). GDP is a common indicator of the value of all goods and services produced domestically and provides a widely accepted measure of the nation's overall economy. As it usually is calculated, however, GDP ignores the environment, personal recreation, and other unpriced goods and services. Hence, the researchers attempted to fill in some of the blanks.

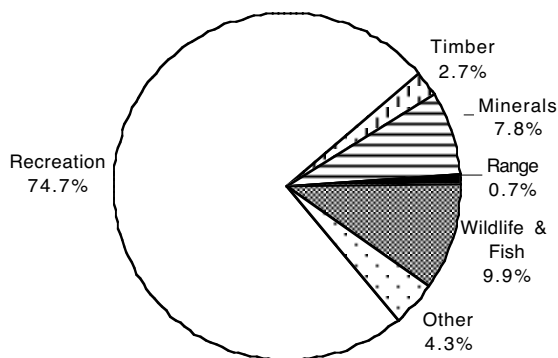
They estimated that the most easily measured goods and services from the national forests would contribute \$145.1 billion to GDP, about two percent of the national total, by the year 2000. Recreation accounts for three-quarters of this contribution, or \$108.4 billion, as shown in the left side of Figure A-6, and fish and wildlife account for another \$14.4 billion. In contrast, the researchers found that timber, forage, and minerals—the goods that historically were so important—now account for less than 12 percent of the total. Moreover, the researchers predicted that, for the foreseeable future, the value of the services would increase, relative to the value of timber, range, and minerals.

The right side of Figure A-6 shows a similar pattern for jobs derived from the national forests. Recreation, alone, accounts for more than three-quarters of the total, whereas, by contrast, timber accounts for less than 3 of every 100 jobs derived from the goods and services that the national forests provide the American public.

## Figure A-6: An Accounting of the Most Easily Measured Items Shows that Services, Not Timber, Account for the Bulk of the Value and Jobs Produced by the National Forests

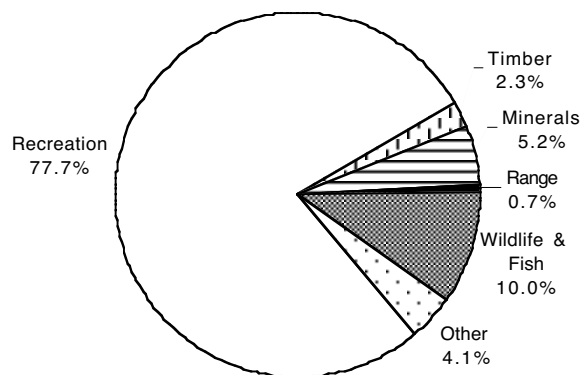
### Contribution to Gross Domestic Product

Total Value: \$145 billion (1999 dollars).  
Excludes carbon sequestration, clean water and other services provided by national forests.



### Contribution to Jobs

3.3 million jobs derived from the national forests.  
Excludes carbon sequestration, clean water and other services provided by national forests.



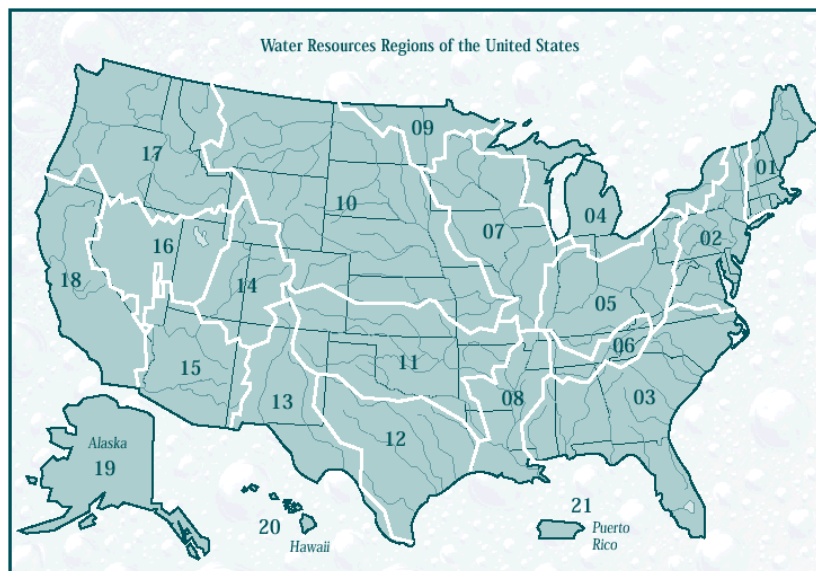
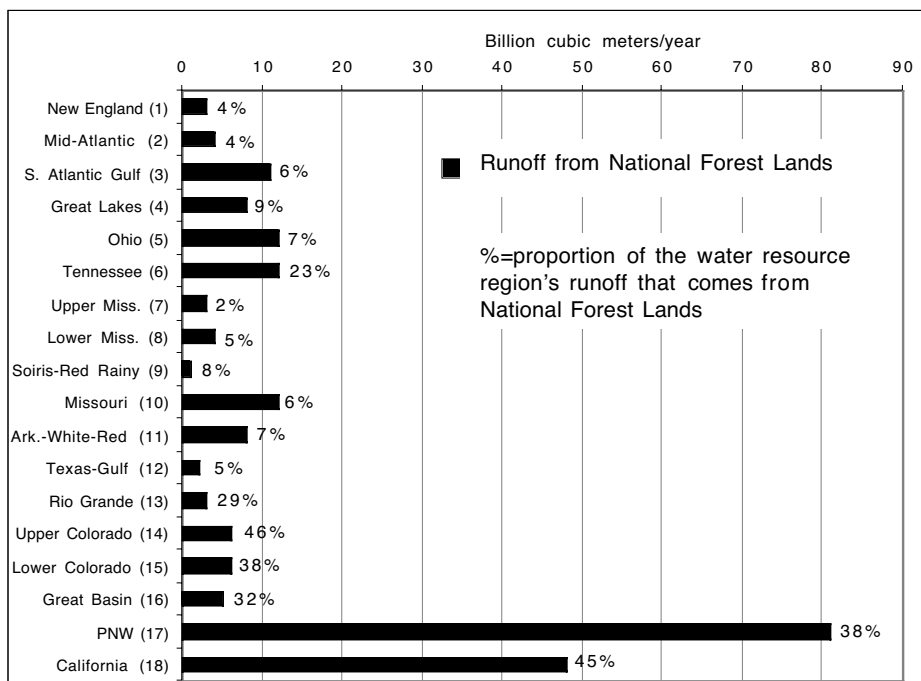
Source: U.S. Department of Agriculture (1995).

Figure A-6, however, tells only part of the story, for the researchers did not include three of the most important services the national forests provide: (1) the delivery of clean, cool water; (2) the provision of unroaded, wild areas; and (3) the sequestration of atmospheric carbon. Thus, even though the data on the easily measured values and jobs clearly show that recreational and other services derived from the national forests far outweigh timber and the other goods, adding into the mix these other services makes the services even more important. The following discussion offers some insights into the relative magnitude of the first two of these additional services from national forests, which have direct implications for fires and poverty.

**Clean, Cold Water.** The national forests are the largest single source of new surface water in the United States, producing 14 percent of the total surface water runoff from the contiguous 48 states (Sedell et al., 2000). The percentage is much higher in the West, as illustrated in Figure A-7, which shows the amount of water and percentage of total runoff coming from national forests in each of the 18 water-resource regions in the contiguous states.

Table A-1 reorganizes the data to show the amount of water from national forest lands that is used for instream flows and offstream uses by Forest

**Figure A-7: The Contribution and Proportion of Water from National Forest Lands Make the Greatest Contribution to 18 Water-Resource Regions of the Contiguous United States**



Source: Sedell et. al. (2000).

Service region (shown in Figure A-8). Water coming from national forest lands generally is not priced and, hence, Forest Service economists had to estimate appropriate values. They determined that, even though the value of water varies widely from place to place, some rough aggregations are possible. In the western regions listed in Table A-1, water that remains instream is worth \$17 per acre-foot, while water used offstream is worth \$40

per acre-foot. For the entire national forest system, the total value of all water flowing from the national forests is conservatively estimated to be \$3.7 billion per year (Niemi and Fifield, 2000). By this estimate, the water coming from the national forests is worth slightly less than the timber value in the left pie chart in Figure A-6. The water-value estimate, however, is rough and “conservative” and future refinements may show that the actual value is greater. Most of the value occurs on western forests.

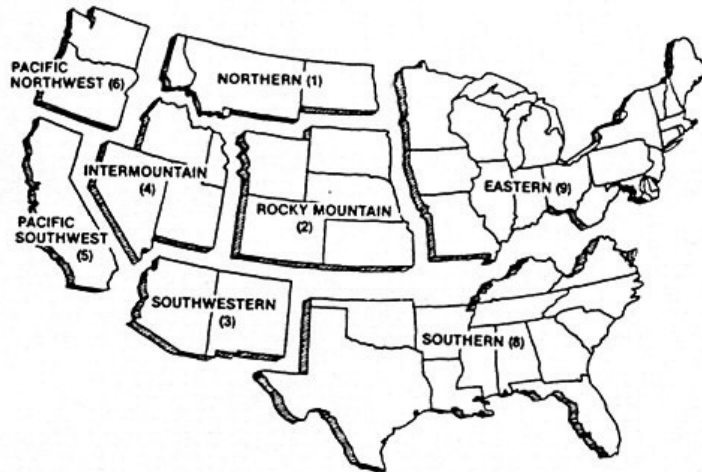
**Table A-1: Water Supply from Western National Forests by Forest Service Region**

Water from Western National Forests			
Region	Instream Flow	Offstream Use	Total Value
Rocky Mountain	9,144,792	2,150,811	\$241,493,904
Southwestern	7,428,051	1,971,245	\$205,126,667
Intermountain	11,458,855	4,785,689	\$386,228,095
Pacific Southwest	33,201,475	9,496,005	\$944,265,275
Pacific Northwest	44,658,346	4,806,316	\$951,444,522
<b>Total</b>	<b>105,891,519</b>	<b>23,210,066</b>	<b>\$2,728,558,463</b>

Source: Sedell et. al (2000).

Some unquantified portion of the values shown in Table A-1 represents the quality of the water coming from the national forests, the remainder reflects the amount of water and its timing. Forest management and different forest uses can affect many of these attributes. Logging can increase the amount of sediment in stream water or remove shade cover that keeps water cool and suitable for fish habitat. Some recreational activities, if not managed correctly, can affect the concentration of pathogens in streams and increase siltation. Roads can affect both the timing and quality of runoff (Brown and Binkley, 1994). Water from the national forests generally is cleaner and cooler than stream water originating from other sources, largely because the national forests occupy higher lands and often have experienced less intensive development.

**Figure A-8: Forest Service Regions**



Source: U.S. Forest Service.

**Unroaded, wild areas.** Wild lands without roads have some special economic values: for recreation, the protection of species, and increasing human understanding of ecological processes. Measuring these values is difficult, but some useful insights into the general size was revealed by recent research regarding the 78 million acres of federal lands in the Columbia River Basin (Haynes and Horne, 1997). Forest Service economists working in the area found that the values recreationists placed on activities taking place in a wilderness area were roughly double the values of similar activities on federal lands outside wilderness areas. They also found that the existence value of unroaded areas was roughly equal to the total value of all recreation occurring on federal lands.

**Combined, the research results for the nation as a whole and the Columbia Basin indicate that the special values associated with wild and unroaded areas constitute the largest component of the total value of the goods and services derived from the national forests.**

In other words, the special values associated with wild and unroaded areas exceed the value of recreation on all federal lands in the region. The national analysis described above indicates that recreation accounts for three-quarters of the total value of in the accounting of easily measured goods and services derived from the national forests. Combined, the research results for the nation as a whole and the Columbia Basin indicate that the

special values associated with wild and unroaded areas constitute the largest component of the total value of the goods and services derived from the national forests.

## PART 3: IMPLICATIONS FOR POVERTY

The evidence and discussion in this appendix can be boiled down to these essential points:

- Wildfires and fire-related programs for managing wildlands affect the mix of goods and services derived from wildlands.
- The relative economic importance of the various ecological goods and services has shifted dramatically. The value of services—especially the special services associated with wild and unroaded areas, recreation, water, and wildlife and fish—now far outweighs the value of timber, grazing, minerals and other goods derived from wildlands.
- The mix of goods and services has important implications for the development of local and regional economies. In particular, areas where wildlands provide high-quality amenities typically experience faster growth in jobs and incomes.
- The increasing value of ecological services, relative to the value of goods, and the ability of amenities to stimulate economic development appear to be driven by powerful national economic forces.

How does all this affect poor individuals, families, and communities in the West? There is no simple answer to this question, for the importance of

**How does all this affect poor individuals, families, and communities in the West? There is no simple answer, for the importance of ecological services and the impacts of fires and fire-related programs vary among groups and across space.**

ecological services and the impacts on fires and fire-related programs vary among groups and across space. In some places and for some individuals, families, and communities, fires and fire-related programs can have a marked impact on their economic well-being. Others may be substantially insulated.

To gain further insights into the implications for poverty, we briefly examine three related questions: To what extent does the mix of goods and services available from wildlands directly influence the economic well-being of the poor? To what extent does the influence wildlands exert on overall economic conditions, locally and regionally, affect the poor? How is the fundamental relationship among the goods and services derived from wildlands, local and regional economies, and the poor affected by wildfires and fire-related programs? Each of these questions requires far more investigation than it has received and than we can give it here. Nonetheless, the following discussion briefly outlines the major issues.

## DIRECT USE OF ECOLOGICAL GOODS AND SERVICES BY THE POOR

For the nation as a whole, and for wildlands as a whole, the most important ecological goods and services are recreational services, the special services of wild and unroaded lands, the maintenance of wildlife and fish, and the delivery of clean, cold water. The provision of logs, minerals, and forage are of minor importance relative to the services, though their value is not zero and, in some places, their value can outweigh the value of wildland services.

To our knowledge, no research has determined the extent to which the poor share these national, aggregate preferences, and existing information does not provide clear guidance. Some recreational experiences on public lands are

**To our knowledge, no research has determined the extent to which the poor share these national, aggregate preferences, and existing information does not provide clear guidelines.**

free and readily accessible to many poor individuals and families, especially those living outside the city centers of large metropolitan areas. Others, however, such as skiing, require considerable income and wealth.

Wildlands also provide housing opportunities for many low-income individuals and families, especially during months when the weather is good. Some national forests, for example, have experimented with establishing camps for homeless families in the summer in Oregon. In Arizona, the emphasis has been on providing camping/housing in mountain areas in the summer to provide homeless people relief from the torrid heat of Phoenix and Tucson.

Access to reliable, cheap water for domestic consumption and subsistence gardening can be especially important for poor families and communities. Insofar as healthy ecosystems are able to meet this requirement better than degraded ecosystems, then the poor will realize more intensely the benefits of maintaining ecological health. In general, healthy ecosystems tend to deliver a more reliable supply of surface water throughout the year than those that have been degraded so that precipitation runs off quickly and is not absorbed into the ground. Watersheds that deliver clean water to a municipal water utility can reduce the utility's treatment costs and lower consumers' bills. The savings from a forested watershed in Oregon that delivers exceptionally clean water amount to more than \$10 per capita per year (Niemi and Whitelaw, 2001).

Poor and disadvantaged communities also capitalize on opportunities to harvest subsistence and non-industrial commercial products from wildlands. Some Indian groups continue to harvest salmon, deer, and plant products from federal lands throughout the West. Other groups have long augmented diets with fish and wildlife and plants, such as mushrooms. In some areas, the gathering of wild mushrooms, blueberries, fir boughs, ferns, and other products for sale to commercial wholesalers is a growing source of income for low-income groups, including migrant families.



These examples illustrate how some poor individuals, families, and communities derive economic benefits from ecological goods and services in ways that are similar to but not always the same as those for society as a whole. Sometimes the poor benefit more, sometimes less from a given mix of goods and services. It seems reasonable, though, to conclude that the well-being of most poor individuals, families, and communities would be enhanced, all else equal, if the overall levels of goods and services derived from wildlands were to increase, i.e., if they were able to produce both more goods and more services. This argues for concluding that alleviating poverty can be consistent with actions to avoid the degradation of ecological productivity of wildlands and to repair the productivity when it has been degraded. This conclusion would not hold, however, if enhancing ecological productivity necessarily entailed other, adverse impacts on the poor. We examine this issue in the next section.

## **WILDLANDS, LOCAL/REGIONAL ECONOMIC CONDITIONS, AND THE POOR**

A commonly-voiced concern is that recreational and other services from wildlands are luxuries provided to the economically elite at the expense of the poor and, hence, if one wants to alleviate rural poverty in the West, one should strive to arrest and reverse actions that favor the production of ecological services over goods.

For example, many believe that this outcome repeatedly has materialized during the past decade when logging, grazing, and mining have been curtailed in the interests of environmental protection, thus depriving unskilled workers of jobs and incomes. Considerable evidence, however, indicates this assertion is not valid, generally, in the West, although it may apply in some instances to some groups. A study of counties in the Interior Columbia Basin, for example, found that per capita income in counties with wood-products facilities were no higher than in counties without (Haynes and Horne, 1997). Perhaps more important, the national shift toward greater emphasis on ecological services, relative to goods, appears to be so powerful that trying to make the most of the trend seems more likely to have positive impacts on poverty than trying to reverse it.

**Perhaps more important, the national shift toward greater emphasis on ecological services, relative to goods, appears to be so powerful that trying to make the most of the trend seems more likely to have positive impacts on poverty than trying to reverse it.**

This conclusion is supported by several factors. One is that the number of jobs displaced by environmental-protection actions generally is far less than the estimates put forth by those opposed to these actions (Goodstein, 1999; Hodges, ).

Advocates of logging on federal lands, for example, claimed that restrictions to protect the northern spotted owl on more than 24 million acres would lead to the loss of up to 150,000 jobs in western Washington, Oregon, and

northern California. Subsequent analyses, though, showed that the actual impact was less than 10,000 (Goodstein, 1999; Niemi et al., 1999).

Furthermore, even when commodity production from wildlands is curtailed, for environmental-protection or other reasons, the impacts on displaced workers are not necessarily negative. A national survey of workers displaced (fifty or more workers displaced at one time for all reasons) in 1997-98 found that 83 percent had found replacement jobs (50 percent had found replacement jobs within 8 weeks) and more than half of those who found full-time new jobs earned as much or more than before (Helwig, 2001). Workers displaced in rural areas generally have done as well as or better than workers in metropolitan areas (Hipple, 1999). With the current slowdown in the national economy, things may not turn out so well for workers displaced in the future. If the economy regains its robust character, though, most workers should be able once again to adjust quickly to disruptions.

None of this is to say that workers with the least skills and wages have done as well as their more-skilled colleagues. Nor is it to downplay the negative, even traumatic, impacts of losing one's job and economic dislocations.

Instead, the existing, aggregated evidence indicates that a shift toward the production of services and away from goods on wildlands does not necessarily mean economic devastation for workers.

**Increasing the production of wildland amenities, such as clean-flowing streams and scenic vistas, has stimulated considerable growth in jobs and incomes in some areas, whereas areas that have retained an industrial emphasis on extractive use of natural resources generally exhibit economic contraction.**

Furthermore, increasing the production of wildland amenities, such as clean-flowing streams and scenic vistas, has stimulated considerable growth in jobs and incomes in some areas, whereas areas that have retained an industrial emphasis on extractive use of natural resources generally exhibit economic contraction. These gains have not consistently trickled down to low-skilled workers, and the West exhibits a growing schism between families with high and low earnings. It is not unique in this regard, however, for this separation is characteristic of the nation as a whole and related to factors, such as education and access to telecommunication infrastructure, unrelated to wildlands.

In short, we read the available evidence and conclude that managing western wildlands to produce more services, relative to goods, does not necessarily adversely affect poor individuals, families, or communities. Some undoubtedly are adversely affected, however, and impacts on them should be addressed. Others, though, will benefit from the greater emphasis on services. Thus, it is seems hard to justify increasing the production of goods from western wildlands as a reliable strategy for reducing poverty in the West.

Moreover, one should not overlook the strength of the economic forces underlying the strong national support for protecting unroaded areas, preventing the extinction of species dependent on wildland habitat, providing reliable water supplies, and increasing the supply of other ecological services from wildlands in the West. These forces stem from fundamental changes in the national and global economies that diminish the amount of wealth that

property owners, workers, and communities can derive from natural resources and strengthen the economic returns to high-quality services. In addition, the American public appears less inclined than in the past to sustain the environmental externalities, public subsidies and other spillover costs associated with historic, conventional operations of logging, mining, and grazing. These and other factors are summarized in survey research, which, for the past decade, has repeatedly affirmed the public's preference for managing western wildlands in a manner that preserves and enhances their ecological services. Against this backdrop, it seems that the most efficient and effective option for those seeking to alleviate poverty is not to try to stop this train but to jump aboard and try to steer it to their best advantage.

## **WILDFIRES, ECOSYSTEMS, AND POVERTY**

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The preceding discussion sets the stage for addressing this question: To what extent do wildfires and fire-related programs affect local and regional economies by altering the mix of goods and services derived from wildlands, and, thereby, influence the economic well-being of poor individuals, families, and communities in the West?

**We outline two important, first steps: acquire a better understanding of the benefits and costs poor individuals, families, and communities derive from the ecological goods and services of western wildlands; and make the decision-making processes of fire-related agencies more accountable for their ecological impacts that affect poverty.**

Nobody knows the full answer to this question, for each fire and fire-related program may have both positive and negative effects on poverty, and the actual effects will vary from fire to fire, place to place, and group to group. Tracing through all the possibilities is a daunting task that awaits future investigation. As an interim measure, we outline two important, first steps for increasing the likelihood that the future impacts on poverty from fires and fire-related programs are positive: acquiring a better understanding of the benefits and costs poor individuals, families, and communities derive from the ecological goods and services of western

wildlands; and making the decision-making processes of fire-related agencies more accountable for their ecological impacts that affect poverty.

## **CLARIFYING ECOSYSTEM-POVERTY LINKS**

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The reality today is that countless resource-management decisions, including fire-related decisions, affecting millions of acres of public land in the West are being made with little understanding of how they might affect poor individuals, families, and communities. As we have explained above, these

impacts arise through two channels: changes in the supply of ecological goods and services available for consumption by poor groups; and changes in the number and character of jobs derived from wildlands and beneficial to the working poor.

**Ecological goods and services available for consumption by poor groups.**

Increasing the supply of ecological goods and services readily available to poor groups will require some targeted investigation, together with efforts to ensure that interest groups and decision-makers are fully aware of the implications. Further efforts seem especially warranted in these areas:

- **Water supply.** Water is a scarce resource in nearly all corners of the West, and, as population grows, it will become even more so. Increased scarcity will result in increased costs, which will disproportionately strain the resources of the poor. Fires and fire-related programs can heavily influence the reliability and cost of a poor community's access to supplies of water. What this relationship is and how it varies across the West need to be determined and incorporated into fire policies.
- **Subsistence foods and fuel.** Public lands can be important sources of game, fish, plants, and firewood for poor groups. The supplies of and demands for these products have been quantified in some places, but much, additional clarification is needed, especially with respect to how fire and fire-related programs (a) affect the supply of these things, and (b) can be modified to increase their supply.
- **Recreation.** More research is needed to clarify the characteristics of wildland-recreation opportunities sought by poor individuals, families, and communities, identify how this demand varies and compares with the actual supply of opportunities across the West, and how it is affected by fires and fire-related programs.
- **Flood control.** As explained above, fires and fire-related programs can affect the risk of flooding. Further investigation is needed to identify the areas where poor groups sit in potential flood zones and to determine how fire-related programs might be modified to reduce the risk.
- **Spiritual and cultural values.** Some Indian communities and other groups place considerable value on places, plants, animals, landscapes, and ecosystems, and each of these can be affected by fire. Indeed, wildfire itself can have spiritual or cultural value. Some resource managers have initiated efforts to work with tribal organizations and other groups to identify the values, map their location, where appropriate, and develop processes for ensuring that fire-related programs are consistent with these values. More remains to be done.

**Jobs derived from wildlands and beneficial to the working poor.** For the most part, decisions regarding the management of the West's wildlands have not been made with an eye toward their impacts on the number and character of jobs available for the working poor. Environmental impact

statements and scientific assessments focus more on questions about how resource-management alternatives will affect the aggregate numbers of jobs, by location and industry, rather than by income group. This lack of specificity has not prevented controversy and dispute about the impacts on poverty for a wide range of recent changes in resource management issues—logging, grazing, mining, protection of threatened and endangered species—with one side saying the shift away from ecological goods and toward services has increased poverty and the other saying the reverse. The same is true of fires and fire-related programs.

But the truth is, the impact on the working poor is not well understood at all and the managers of fire-related programs would be essentially shooting in the dark if they wanted to modify their programs to increase the benefits for the working poor (or, conversely, avoid harming them). Further investigation is needed in these areas:

- **Qualifying the working poor for fire-related jobs.** What outreach is needed to attract the working poor to fire-related jobs? What training is needed? What support services so that, say, single parents can work on fire lines for extended periods?
- **Fires and local community-economic development.** How can fire-related programs be tailored to reinforce the overall economic-development prospects of a specific community, with hopes that greater economic growth will have a ripple effect on benefits for the working poor?
- **Regional and urban economic impacts.** It is important to recognize that actions affecting the production of ecological goods and services on wildlands can affect not just the working poor in adjacent rural areas but also those in more distant urban areas. This can occur largely through an extension of the local ripple effect, but it also may be targeted, for example by stimulating the development of service and trade businesses, linked to ecotourism, that have dual business sites: one urban and attracting tourists; and one rural and showing tourists features of rural wildlands.

**Through jobs in watershed restoration, species protection, and so forth, public lands could become the basis for robust, persistent, economic strength in communities throughout the West, while increasing the lands' ability to produce ecological goods and services.**

Probably far more important than these more targeted efforts, though, are the opportunities for completely changing the economic relationship between poor communities and adjacent wildlands so that members of the community can realize substantial economic returns from participating in stewardship management of the resources. The logic goes like this. Poverty can be alleviated by increasing the assets which poor people can use to increase their standard of living. Many discussions about poverty alleviation focus on the assets belonging to the poor themselves and their communities: private property assets, such as homeownership; financial assets, such as savings; family and social assets, such as the savings of relatives or the

services of local agencies; and human assets, such as skill levels. Wildland assets also can be important.

In the past, communities extracted resources from wildlands—through logging, grazing, and mining—and converted them into the other forms of assets. As these extractive activities are curtailed on western lands, however, these opportunities have been foreclosed. This does not mean, though, that there are not opportunities. In principle, at least, it is possible for residents of adjacent communities to serve as the local stewards for lands owned by the national citizenry. Through jobs in watershed restoration, species protection, and so forth, public lands could become the basis for robust, persistent, economic strength in communities throughout the West, while increasing the lands' ability to produce ecological goods and services.

The expanded emphasis on reducing fire risks in the West seems to offer a golden opportunity to design and test stewardship models.

## REFLECTIONS

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Fires will come and go across the West, as will different fire-related programs, creating both risks and opportunities for poor individuals, families, and communities. Throughout it all, though, there will remain this fundamental reality: westerners must live with their ecosystems, and vice versa. Wildlands will provide a mix of ecological goods and services, this mix can be modified by humans to provide more or fewer benefits for the region's poor. Wildfires and fire-related programs will have a big impact on the mix of goods and services.

Presently, neither resource managers nor advocates for poverty alleviation have clear, supportable ideas for how to shape fire-related programs to increase the benefits for poor communities and for the poor residents of adjacent rural areas or more distant urban ones. If society is to employ wildlands and management programs, including fire-related programs, as effective, long-run tools for poverty alleviation, there must be a far better understanding of how these lands and their management affect the direct use of goods and services by the poor and influence local and regional economies.