RESTORING FIRE-ADAPTED ECOSYSTEMS ON FEDERAL LANDS

A COHESIVE FUEL TREATMENT STRATEGY FOR PROTECTING PEOPLE AND SUSTAINING NATURAL RESOURCES

U.S. Department of the Interior

USDA Forest Service

USDA FOREST SERVICE
BUREAU OF INDIAN AFFAIRS • BUREAU OF LAND MANAGEMENT
BUREAU OF RECLAMATION • NATIONAL PARK SERVICE
U.S. FISH AND WILDLIFE SERVICE • U.S. GEOLOGICAL SURVEY

August 2, 2002

This document provides clear justification for a cohesive strategy, and accurately describes the problem of ecosystem degradation brought about by a lack of fuel management. The recognition that landscape-level, cross-boundary treatments are important for achieving success aligns well with the strategies of our organization, as does the emphasis on treating ecosystems, not just fuel loads. We also appreciate the acknowledgement that communities and ecosystems are linked, and only through community involvement will we achieve long-term sustainability of our natural resources.

This document represents a significant step forward in addressing our current fuels and ecosystem crisis. Only through collaborative effort will the goals of the Federal Wildland Fire Policy and National Fire Plan be achieved. We commend you for your efforts.

Paula Seamon
Acting Director, Fire Management Program
The Nature Conservancy

I commend the individuals who developed this document. Not only is it a solid synthesis of previous work by the Department of the Interior and USDA Forest Service staffs, it also presents fresh ideas and useful analysis.

William Wallace Covington
Director, Ecological Restoration Institute
Northern Arizona University

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To coordinate a sound, collaborative approach for reducing wildland fire risk to communities, and to restore and maintain fire-adapted ecosystems.

Purpose and Need – Reducing Risks to Human Communities and Restoring Ecosystems

For the last several decades, unwanted wildland fire in the United States has resulted in an increase in fatalities, property losses, local economic disruptions, and fire-damaged landscapes. Historically, the Federal, State, Tribal, and local land management agencies approached fuel treatment independently. Because hazardous conditions extend across agency and ownership boundaries, this generally resulted in ineffective and inefficient treatments at the landscape level. Today, it is obvious that a coordinated effort under a single, national strategy is necessary.

The cohesive strategy specifically aligns resource and fire programs within the Department of the Interior bureaus and the USDA Forest Service with a common purpose of reducing risks to human communities and to restore and maintain fire-adapted ecosystems. To ensure these actions are coordinated on the ground, the cohesive strategy establishes common priorities for fuel treatments. Thus, this collaboration will provide the ability to address fuel hazards and land health irrespective of Federal, State, Tribal, and local administrative boundaries.

The cohesive strategy is based on the premise that management of fire—at the appropriate intensity, frequency and season, and by the appropriate means—is essential to the health of fire-adapted ecosystems. Through its treatment priorities and implementation elements, this strategy provides an effective framework for reducing the risk and consequences of unwanted wildland fire to communities and ecosystems while, simultaneously, providing forest products and biomass energy production opportunities.

Setting the Guidelines for a National-Scale Fuel Treatment Program

The cohesive strategy establishes the groundwork and guidelines for a national-scale fuel treatment strategy that will:

- Complement Federal land stewardship responsibilities by providing an ambitious fuel treatment program.
- Expand fuel treatment program capabilities through increased reliance on the use of contracts.
- Improve the utilization of products from mechanical fuel treatments, and increase biomass production potential by developing and promoting efficient biomass residue uses and encouraging assessments of biomass energy opportunities on public lands.

Funding and Treatment Priorities

The cohesive strategy does not attempt to treat all acres, nor does it eliminate all risks. Strategic patterning and sequencing of treatments can substantially reduce risk to priority areas while minimizing environmental disturbance and treatment cost. The cohesive strategy establishes priorities for collaboratively distributing hazardous fuel treatment funds. These priorities—using nationally consistent criteria—identify planning emphasis for ecosystem restoration and maintenance and community protection. Specific criteria will be adjusted as coarse-scale fire risk data are refined.

This prioritization process utilizes a three-tiered system in which the criteria become more specific moving from the national to the local level. Specific project-level treatment decisions can only be made at the local level. The need for restoration and maintenance treatments will be determined at the local level through prioritizing values to be protected on landscape and sub-basin scales. The priorities provide a focus for collaboration between State, Tribal, and local stakeholders.

The national fuel treatment priorities give preference to areas in which the greatest risks to people, communities, and key resources occur—as determined by fire history and fuel hazard.

Specific goals and measures of success in managing hazardous fuels and restoring ecosystems included in this cohesive strategy were developed in *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan, (May 2002).*

Long-Term Outcomes of the Cohesive Strategy

Localized benefits will be realized as treatments are completed. On a national scale, reversal of broad trends—including risks to: people and property, native species, watersheds, and air quality; and long-term site degradation—will not be measurable for at least several years.

Through Federal collaboration with State, Tribal, and local entities, implementation of this strategy will:

People and Communities

- Increase wildland fire safety to the public and firefighters.
- Reduce risk of unwanted wildland fire to communities, including their critical elements such as resource-related jobs, communication infrastructure, transportation networks, municipal watersheds, and utilities.
- Reduce risk to recreational opportunities and associated wildland attributes, viewsheds, the myriad quality-of-life values, and cultural and historic resources and landscapes.
- Strengthen rural economic sustainability and increase opportunities to diversify local economies (such as through the use of forest products and biomass residues, which also reduces air quality impacts).
- Increase public education and understanding for the importance of implementing hazardous fuel risk reduction activities on both Federal and private lands.

A national survey (*Wildland Firefighter Safety Awareness Study*, Tri-Data, 1996), revealed that nearly 83 percent of all firefighters identified "fuel reduction" as the single-most important factor for improving their margin of safety on wildland fires.

Natural Resources

- Improve the resiliency and sustainability of wildland ecosystems to benefit and maintain: water quality, air quality, wildlife and fisheries habitat; and threatened, endangered, or other special status plant and animal species or habitat.
- Decrease the amount of lands severely degraded by unwanted wildland fire or by other disruptions to natural fire regimes.

Expenditures

- Reduce Federal expenditures on wildfire suppression and rehabilitation, particularly in the wildland-urban interface.

I PURPOSE AND NEED OF THE COHESIVE STRATEGY

"The most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation. This accumulation has caused an increasing number of large, intense, uncontrollable, and catastrophically destructive wildfires. These fires not only compromise the forests' ability to provide timber, outdoor recreation, clean water, and other resources, but they also pose increasingly grave risks to human health, safety, property, and infrastructure."

U.S. General Accounting Office 1999 Report
Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats

Developing an Integrated Strategy to Reduce Fire Risk

The 1999 through 2001 fire seasons focused attention on the critical, at-risk condition of Federal lands. Addressing this condition by reducing **fuel**, protecting communities, and restoring land health in fire-prone areas is the charge of both the USDA Forest Service and the Department of the Interior.

This integrated strategy, *Restoring Fire-Adapted Ecosystems on Federal Lands – A Cohesive Fuel Treatment Strategy For Protecting People and Sustaining Natural Resources*, represents the next step—a combined effort between the USDA Forest Service and the Department of the Interior.

Why is this Strategy Needed?

For the last several decades, unwanted wildland fire in the United States has resulted in an increase in fatalities, property losses, local economic disruptions, and fire-damaged **landscapes**.

It is estimated that about two-thirds of Federally managed wildlands in the lower-48 states are at risk of catastrophic wildland fire.

Historically, the Federal, State, Tribal, and local land management agencies approached fuel treatment independently. Because hazardous conditions extend across agency and ownership boundaries, this generally resulted in incomplete and ineffective treatments at the **landscape level**. Today, it is obvious that a coordinated effort under a single national strategy is necessary.

*Throughout the report, the **individual highlighted terms** are defined in Chapter X Glossary.*

Cohesive Strategy

Goal

To coordinate a sound, collaborative approach for reducing wildland fire **risk** to communities, and to restore and maintain land health within fire-prone areas.

Measuring Success

National-scale success from implementing this strategy will take several years to be realized, however, localized benefits will begin to accrue as soon as hazardous fuel treatments are applied. Annual assessments of change in land condition (Fire Condition Class) from the previous year will determine to what degree the strategy's goal is achieved.

A Unified, Federal Approach

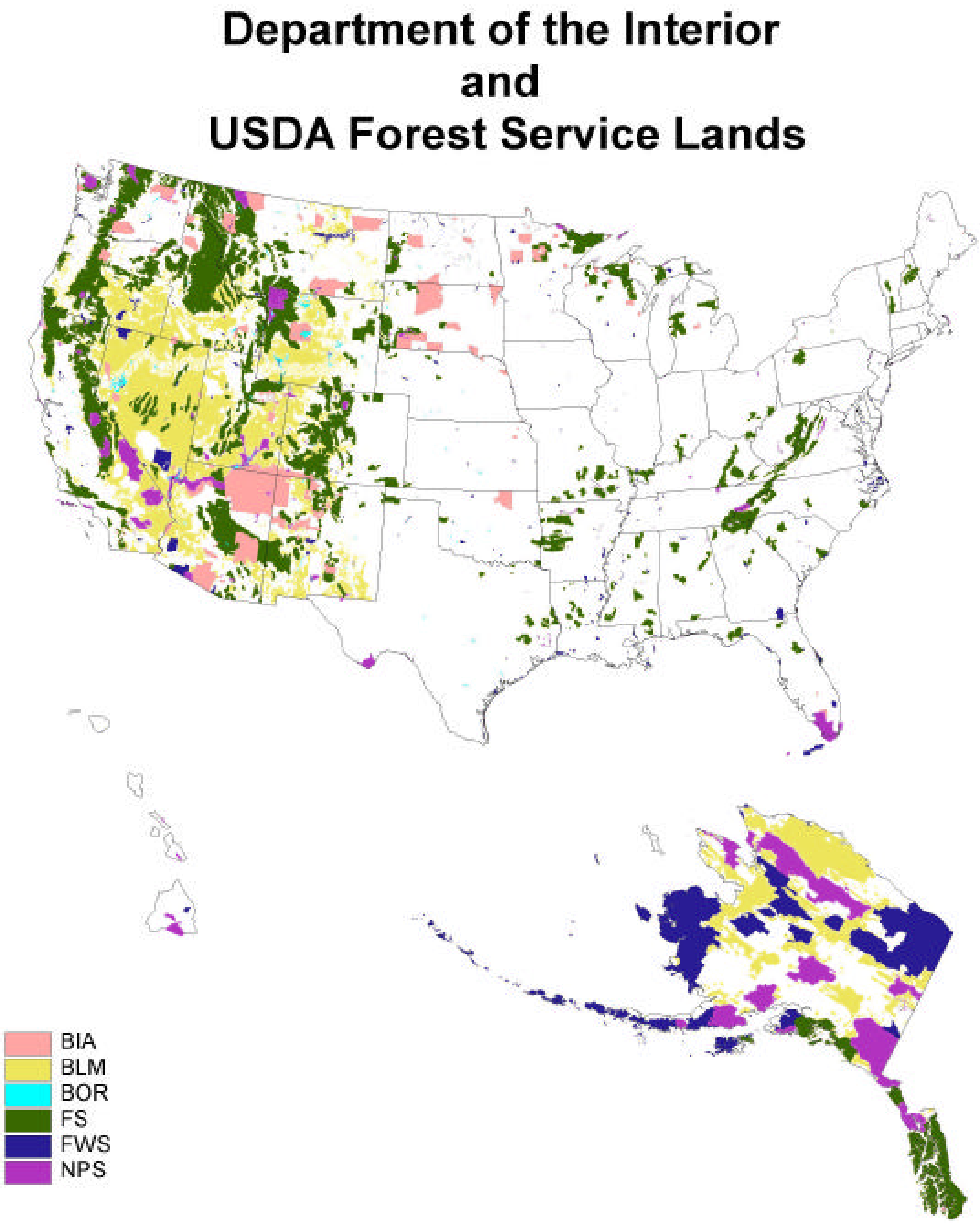
The implementation of this cohesive strategy—a coordinated effort under a single, unified approach—will restore **fire-adapted ecosystems**, protect people and their communities, and help sustain natural resources on Federal lands. To ensure successful outcomes, the strategy promotes key collaboration in planning and implementation with States, Tribes, local governments, and stakeholders.

The cohesive strategy is based on the premise that management of fire—at the appropriate intensity, frequency and season—is essential to the health of fire-adapted ecosystems. Through its treatment priorities and implementation elements, this strategy provides a significant framework for reducing the risk and consequences of **unwanted wildland fire** to communities and **ecosystems**.

The implementation of the cohesive strategy will:

- Better ensure public and firefighter safety.
- Reduce risks from wildland fire to communities.
- Reduce wildland fire costs, losses, and damages.
- Promote efficient uses of forest products and **biomass residue.**
- Improve the resilience and **sustainability** of forests, woodlands, shrublands, and grasslands.
- Conserve priority **watersheds**, air quality, cultural and historic features, species, and **biodiversity**.

The cohesive strategy also responds to the findings of the U.S. General Accounting Office (GAO) report that identified the over-accumulation of **hazardous fuel** in the interior West as a significant wildland fire risk problem that must be addressed by the Federal land agencies. *(Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats, 1999.)*



FEDERAL STEWARDSHIP LANDS – The Department of Interior: Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), U.S. Fish and Wildlife Service (FWS), and National Park Service (NPS). USDA Forest Service (FS). The cohesive strategy focuses on these Federal lands within the conterminous United States (excluding Alaska and Hawaii).

Figure 1

"Restoration-based fuel treatments [and maintenance] are not just for fire management. They benefit human habitats, conservation of biological diversity, watershed function, and air quality, etc. Although fire management benefits alone may justify such treatments, it is important that we all understand that comprehensive ecosystem restoration is fundamental to most of society's goals for wildlands."

William Wallace Covington
Regents' Professor of Forest Ecology;
Director, The Ecological Restoration Institute
Northern Arizona University

Aligning Resource and Fire Programs

In addressing all lands administered by the Department of the Interior bureaus and the USDA Forest Service, the cohesive strategy specifically aligns resource and fire programs within these agencies and bureaus with a common purpose of reducing risks to human communities and restoring and maintaining fire-adapted ecosystems.

To ensure these actions are coordinated on the ground, the cohesive strategy establishes common priorities for fuel treatments. Thus, this collaboration will provide the ability to address fuel hazards and to restore and maintain fire-adapted ecosystems irrespective of Federal, State, Tribal, and local administrative boundaries.

The cohesive strategy builds on the work of all the Department of the Interior bureaus as well as the USDA Forest Service—in alignment with Tribal, State, and local governments. Moreover, the strategy encourages procedures that meet objectives for:

- Community protection.
- Watershed protection.
- Species conservation.
- Forest products and biomass utilization.
- Cultural and historic resource preservation.
- Protection and preservation of Indian trust lands.
- Restoring and maintaining fire-adapted ecosystems.

Cohesive Strategy Premise

- Fire is a natural ecological process that greatly affects ecosystem structure, composition, function, and resilience to disturbance.
- Disruptions of natural **fire cycles** have increased the risk of unwanted wildland fire to communities and to natural and cultural resources.

- Because of ecosystem alteration and degradation, fire risk has been increasing despite management programs intended to reduce unwanted wildland fire.

- Ecosystem degradation from altered fire cycles has been an ongoing and long-term problem. A long-term effort will be required to restore these ecosystems and reduce risks to both communities and the environment.

- A sound program to restore and maintain fire-adapted ecosystems—through the ecologically appropriate use of fire-use, mechanical thinning, and other non-fire fuel treatments—will reduce risks to communities and improve ecosystem resilience and sustainability.

- **Wildland-urban interface** and rural communities, their desirability and their economies, are inextricably linked with the surrounding wildland ecosystems. From a land management perspective, risks to these communities and their adjoining ecosystems must be addressed together.

- Treatments such as mechanical thinning must be considered prior to—or in lieu of—fire use when unacceptable risk is present, and to promote forest products and biomass utilization as encouraged by the National Energy Policy.

- Commercial activities are an important component to comprehensive fuel treatment programs. This includes increased reliance on the use of contracts, including stewardship contracts; service contracts; personal service contracts; and Indefinite Delivery/Indefinite Quantity contracts.

- This cohesive strategy provides a broad, iterative approach to restoring ecosystems and protecting human values. The strategy will be revised periodically as underlying data are refined.

Cohesive Strategy Purpose

- Establish national priorities for fuel treatment. Ensure funding is targeted to the highest risk communities and ecosystems.

- Develop and promote efficient biomass residue and forest product uses that are consistent with management objectives in agency land management plans.

- Emphasize **landscape** scale cross-boundary treatments that reduce hazards while providing benefits to other ecosystem values.

- Ensure that all land management activities (e.g., forest and range management, wildlife habitat enhancement, and watershed restoration) are planned and implemented to reduce hazardous fuel or, at a minimum, do not degrade fire condition class.

Collectively, these treatments will protect people and communities and restore and maintain **fire-adapted ecosystems**. To be successful in this effort, land management agencies must improve coordination, consistency, and agreement among Federal land managers within the USDA Forest

Ecosystem Restoration

Ecosystem restoration is founded on fundamental conservation principles regarding management actions designed to facilitate the recovery or re-establishment of native ecosystems. Ecosystem restoration's central premise: the restoration of natural systems to conditions consistent with their recent evolutionary environments will prevent their further degradation while simultaneously conserving their native plants and animals.

Ecosystem restoration should not, however, be construed as a fixed set of procedures, nor a simple recipe for land management. Rather, it is a broad intellectual and scientific framework for developing mutually beneficial human/wildland interactions that are compatible with the evolutionary history of native ecological systems. Thus, ecosystem restoration consists not only of restoring ecosystems, but also of developing human uses of wildlands that are in harmony with the natural history of these complex ecosystems.

Covington, et al.

Service and the Department of the Interior. New working relationships must also be forged across the various disciplines within the two departments.

Long-Term Outcomes

Localized benefits will be realized as treatments are completed. On a national scale, reversal of broad trends (including risks to: people and property, native species, watersheds, and air quality; and long-term site degradation) will not be measurable for at least several years.

Through Federal collaboration with State, Tribal, and local entities, implementation of this cohesive strategy will:

People and Communities

- Increase wildland fire safety to the public and firefighters.
- Reduce risk of **unwanted wildland fire** to communities, including their critical elements such as resource-related jobs, communication infrastructure, transportation networks, municipal **watersheds**, and utilities.
- Reduce risk to recreational opportunities and associated wildland attributes, **viewsheds**, the myriad quality-of-life values, and cultural and historic resources and landscapes.
- Strengthen rural economic sustainability and increase opportunities to diversify local economies (such as through the removal and use of forest products and biomass residues to reduce air quality impacts).
- Increase public education and understanding for the importance of implementing hazardous fuel risk reduction activities on both Federal and private lands.

Natural Resources

- Improve the resiliency and sustainability of wildland ecosystems to benefit and maintain: water quality; air quality; wildlife and fisheries habitat; and threatened, endangered, or other special status plant and animal species or habitat.
- Decrease the amount of lands severely degraded by unwanted wildland fire or by other disruptions to natural fire regimes.

Expenditures

- Reduce Federal expenditures on wildfire suppression and rehabilitation, particularly in the wildland-urban interface.

AT RISK – Both communities and natural resources are at risk from increased hazardous fuel.

Figure 2

"These blazes [in several Western states] arise from a number of overlapping causes, including four years of extreme drought and the buildup of undergrowth in the forests. And the scope of the problem is daunting…We must act now or be prepared to see more human suffering and more lands destroyed."

Governor Jane Dee Hull, Arizona
Arizona Republic, June 30, 2002

Integrating Fuel Treatments with Related Programs

Beginning with the 2001 Appropriation Act, increased funding has been targeted to both reduce unwanted wildland fire hazards to communities and to enhance the Federal, State, and Tribal wildland agencies and rural fire departments' firefighting capabilities. These monies are also allocated for both the rehabilitation and **restoration** of burned land, and for helping plan and implement fire and resource management activities.

This cohesive strategy addresses all lands administered by the USDA Forest Service and the Department of the Interior bureaus. Consistent with the National Fire Plan and the 2001 Appropriation Act, the strategy:

- Aligns the USDA Forest Service and the Department of the Interior resource and fire management programs under the common purpose of reducing risks to communities and to restore and maintain fire-adapted ecosystems.
- Encourages development of procedures that unite both Departments' objectives for watershed protection, species conservation, cultural and historic resource preservation, protection and preservation of Indian trust land, and overall land health.

How the Cohesive Strategy Relates to:

The National Energy Policy

This cohesive strategy supports the implementation of the *National Energy Policy*. The strategy recognizes this key point: *"Renewable energy can help provide for our future needs by harnessing abundant, naturally occurring sources of energy, such as the sun, the wind, geothermal heat, and biomass."* Specifically, this cohesive strategy supports the National Energy Policy by seeking to:

- Develop and promote efficient forest products and biomass residue uses consistent with management objectives in agency land management plans.
- As land management plans are revised, enhance opportunities for the use of forest products and biomass in renewable energy production.
- Strengthen rural economic sustainability and increase opportunities to diversify local economies, such as through removal and use of forest products and biomass residues to reduce air quality impacts.

The Federal Wildland Fire Policy

This cohesive strategy also supports the implementation of *The Federal Wildland Fire Management Policy and Program Review*. The strategy emphasizes many of the policy's key points, including: *"Wildland fire, as a critical natural process, must be reintroduced into the ecosystem. This will be accomplished across agency boundaries and will be based on the best available science."*

The 10-Year Comprehensive Strategy

The 2001 Appropriation Act also directed the Secretaries and Governors to develop a "long-term strategy to deal with the wildland fire and hazardous fuels situation, we well as the needs for habitat restoration and rehabilitation in the Nation" (PUBLIC LAW 106-291)

A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: The 10-Year Comprehensive Strategy (August 2001), signed by the Western Governors and the Secretaries of Agriculture and of the Interior, outlines a comprehensive approach to the management of wildland fire, hazardous fuel, and ecosystem restoration and rehabilitation on Federal and adjacent State, Tribal, and private forest and range lands across the United States. This 10-Year Comprehensive Strategy reflects the views of a broad cross-section of government and non-governmental stakeholders. It establishes a core set of principles including such concepts as collaboration, priority setting, and accountability.

Primary goals of the 10-Year Comprehensive Strategy:

- Improve wildland fire prevention and suppression.
- Reduce hazardous fuels.
- Restore fire-adapted ecosystems.
- Promote community assistance.

The 10-Year Comprehensive Strategy—through its Implementation Plan—requires the Departments of the Interior and Agriculture to:

- Develop common and consistent national performance measures and reporting procedures for each goal.
- Identify common priorities.
- Set specific timeframes for accomplishment over the ten-year period.

II BACKGROUND

"In the forest I met a great fire and stopped to watch it . . . It came racing up the steep chaparral-covered slopes of the East Fork canyon in a broad cataract of flames, devouring acres of them at a breath . . . But as soon as the deep forest was reached the ungovernable flood became calm like a torrent entering a lake, creeping beneath the trees . . . slowly nibbling the cake of compressed needles . . . with flames an inch high."

John Muir

Fire Ecology History

Nearly all forests, woodlands, shrublands, and grasslands in North America evolved with and adapted to wildland fire ignited either by lightning or burning by Native Americans. Fires occurred across these lands at a variety of frequencies and severity, including:

- 1 to 2 year fire cycles in the southeastern longleaf pine forests (low severity).
- 5 to 15 year fire cycles in interior west ponderosa pine forests (low severity).
- 30 to 80-year fire cycles in the southwest Oregon mixed conifer forests (moderate severity).
- 20 to 50 and 35 to 150-year fire cycles in two species of sagebrush in the Great Basin (moderate severity).
- 60 to 200-year fire cycles in Alaska's boreal forests (high severity).
- 200 to 500-year fire cycles inside the coastal rain forests of the Pacific Northwest (high severity).

Plant species within these **fire regimes** adapted to fire by developing survival or recovery mechanisms such as: thick tree bark; an ability to sprout; seeds that require heat to germinate, and an ability to flourish in recently burned landscapes.

For thousands of years, the magnitude of burning that occurred in what is now the conterminous United States (excluding Alaska and Hawaii) was much greater than today. According to the National Interagency Fire Center, approximately five million acres burn annually on Federal lands today that historically burned more than 25 million acres.

Fire Regime

A generalized description of fire's role in an ecosystem, characterized by fire frequency, seasonality, intensity, duration and scale (patch size), as well as regularity or variability.

This reduction in wildland fire has resulted in a tremendous increase in combustible vegetation and litter. Consequences of this fuel accumulation include adverse changes in **ecosystem composition, structure**, and **function**. As recent wildland fire seasons have illustrated, these changes have prompted an increase in unwanted wildland fires that burn more intensely and severely.

Land Use History

Euro-American Settlement and Fire Exclusion

Many of today's wildland fire threats and **ecosystem health** issues were triggered more than a century ago. As Euro-Americans moved west during the 19th Century, they basically reshaped ecosystems to meet their needs. Forest clearing for agriculture purposes and extensive livestock grazing fragmented landscapes, disrupted **ecosystem processes**, changed species composition, and reduced **ecosystem resilience** to wildland fire. In addition, these new settlers constructed combustible structures across the landscape, prompting rudimentary fire suppression efforts that would eventually become highly effective and sophisticated.

This resultant fire exclusion promoted aging forests and shrublands, insect and disease outbreaks, an over-accumulation of fuel (especially in the West where decomposition rates are extremely slow), and a consequent increase in **fire severity** and intensity. The disruption of natural fire cycles in **fire-adapted ecosystems** became the dominant agent of change that initiated an increased unwanted wildland fire risk.

Changes in Fire Severity Resulting from Exclusion of Fire in Frequent Fire Return Interval Fire Regimes

Artwork Jim Dawson, © National Geographic Society, 1996

TOP PANEL depicts a ponderosa pine stand that has experienced frequent, low-severity fire. Stand structure, species composition, and fire behavior is characteristic of ponderosa pine plant communities prior to Euro-American settlement. (No disruption to the "natural" fire regime.)

BOTTOM PANEL portrays a ponderosa pine stand in which fire has been excluded, thereby disrupting the "natural" fire regime. Stand structure, species composition, and fire behavior, have changed dramatically.

Figure 3

Rangeland Decline

Most rangelands have experienced significant changes in fire regimes during the past 150 years. Prior to fire suppression efforts, wildland fire had maintained grasslands by rejuvenating decadent grasses and killing young woody species that might have seeded between fire occurrences.

Fire suppression allowed an invasion of woody species onto these grasslands, causing reductions in herbaceous cover and increased density of woodlands and shrublands. Many rangeland sites lost much of their herbaceous ground cover. On some sites, this loss of ground cover resulted in increased wind and water erosion. Erosion further reduced herbaceous cover, perpetuating the cycle of degradation.

When fire eventually burns these sites, it is generally more severe due to hotter fires burning for longer periods of time caused by larger amounts of fuel.

"The Country's 90 year-old policy of fire suppression has played a significant role in transforming our…ecosystems to their current condition with their heavy fuel loads. With the severity of fires that we are seeing, and the number of threatened and endangered species that we are trying to save, it's clear that things are out of balance"

Governor John Kitzhaber, Oregon

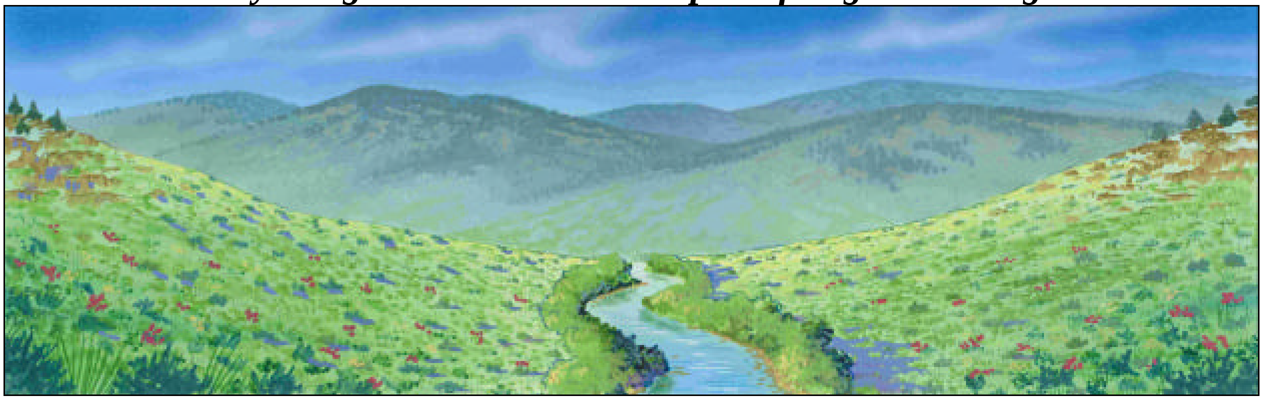
Western Governor's Association
Position Paper 1-01, December, 2000

Degradation by Non-Native Species

In addition, many rangelands became havens for non-native species establishment. Herbaceous non-native species invasion affects rangeland fire regimes much differently than woody species invasions. Some rangelands have experienced shorter fire return intervals due primarily to wildland fire disturbances that created conditions favorable for exotic species' invasions.

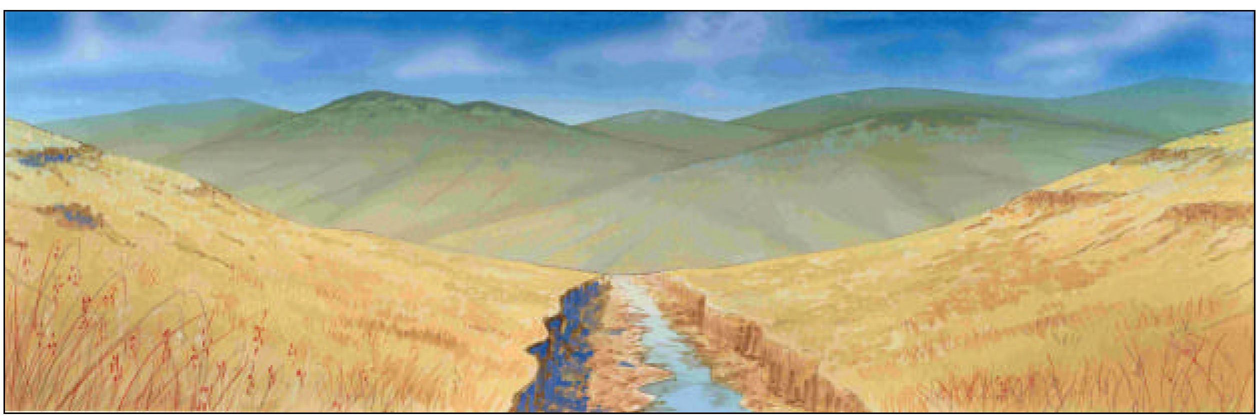
Many non-native annual plant species dry out earlier than native perennials. This prompts a longer annual flammable period. The longer flammable season—coupled with denser ground cover typical of these non-native species—triggers much more frequent fire. In many cases, each time a fire occurs, additional opportunities for non-native species establishment ensue. The result: a cycle of ecosystem degradation and costly, unwanted wildland fires.

A Healthy Rangeland and Two Examples of Degraded Rangelands



HEALTHY RANGELAND -- Native rangeland ecosystem with an abundant diversity of grasses, forbs, and shrubs. Juniper trees occupy rocky outcrops on the upland. The riparian ecosystem along the stream is dominated by willows and herbaceous riparian species. The entire landscape is maintained by fire at a moderate frequency. Figure 4

DEGRADED RANGELAND -- Due to disruptions in its fire regime, this rangeland ecosystem has experienced a decrease in diversity of grasses, forbs, and shrubs. In this case, fire exclusion has allowed juniper trees to expand downslope, covering an increasing portion of the landscape. As juniper increases in density and extent, herbaceous cover decreases. This decrease in surface fuel (herbaceous vegetative cover) results in decreased fire frequency, enabling the spread of juniper. Because of this reduction in herbaceous cover, the riparian area has received an increased overland flow during high rainfall events. This, in turn, has contributed to channel down-cutting. Down-cutting and grazing has also caused the disappearance of willow from the riparian area. Figure 5



DEGRADED RANGELAND – This rangeland ecosystem contains very little plant species diversity. Cheatgrass invasion has fueled an increased frequency of wildland fire that has reduced shrubs and small trees. While juniper trees, sagebrush, and other shrubs occupy small portions of the distant landscape, the majority is dominated by cheatgrass. Cheatgrass promotes an increased fire frequency, causing invasive species to become increasingly dominant over time. Reduction in native perennial forbs, shrubs, and small trees contribute to overland flow of water during high rainfall events. Overland flow of water, in turn, contributes to down-cutting in stream channels. Down-cutting and grazing has also caused the disappearance of willow from the riparian area. Figure 6

Forest Decline

Fire exclusion and historical logging practices altered forest structure, species composition, and associated fire regimes. Fire suppression efforts began influencing forest structure and composition more than 100 years ago. In the absence of fire, understory trees became much more dense. In many areas, understories shifted to species that were more shade-tolerant and less resistant to fire and drought cycles. As these forests aged, resistance further declined and they became increasingly susceptible to insect and disease outbreaks. As a result, wildland fires in these degraded forests burned more severely and became more difficult to control.

Commodity-driven logging has also been associated with increased fire hazard. For instance, in the Lake States during the late 19th Century, logging removed the large, fire-resistant trees and left behind only small diameter trees and **slash**. These hazardous fuel conditions led to wildland fires that, in some cases, destroyed entire communities and killed hundreds of people.

As these adverse impacts were recognized and understood, timber-harvesting practices were improved and became less detrimental. Timber harvesting on Federal lands greatly increased from the 1950s through the 1980s. Within some forest ecosystems during these decades, many of the larger, fire-resistant trees were harvested. An understory of younger, faster growing, shade resistant—yet fire and drought intolerant—trees became the predominant vegetation.

Where forests comprised of large trees once existed, natural reseeding and well-intentioned, aggressive planting programs also helped create dense stands of smaller trees and brush. Although mechanical thinning and slash treatment programs were planned for many of these plantations, funding for these activities has not kept pace with the need to reduce stand density.

Today, forest structure on significant portions of Federal lands has shifted to a dominance of these small, more closely-spaced trees. As these lightly-managed stands age, they become susceptible to—and provide fuel for—intense unwanted wildland fire.

Changes in Species Composition and Forest Structure

BEFORE – Bitterroot National Forest 1895 photo. ***Figure 7***

Before

The 1895 photo serves as the baseline reference for forest stand conditions that evolved from regularly occurring, low-intensity, surface burning. The forest was open and dominated by fire-tolerant, fire-adapted ponderosa pine.

TRANSITION – Bitterroot National Forest 1980 photo. ***Figure 8***

Transition

The 1980 photo (from same place) shows how the forest has changed dramatically since 1895. Over this 85-year period, small trees have established into dense thickets. These fire-intolerant tree species now crowd the forest. During drought periods the overabundance of vegetation stresses the site, pre-disposing it to insect infestations, disease outbreaks, and severe unwanted wildland fire.

AFTER – Bitterroot National Forest 2001 photo. ***Figure 9***

After

The 2000 fire season brought catastrophic changes to much of the Bitterroot National Forest. In this 2001 photo (again, from same place) no "forest" and only a few trees survived the severe fire. Note the beginning of erosion in the stream channel. The house, had been move prior to the firestorm, however, this is seldom an option for residents.

Severe Wildland Fires Increase Non-Native Species

In some forests and woodlands, logging, grazing, and unnaturally severe fires, have also contributed to increases in non-native species of invasive plants, insects, and pathogens. This invasion of non-native plants has negatively affected ecosystems in various ways, including native species displacement and endangerment, reduced site productivity, and degraded water quality.

Non-native species have also greatly increased fuel loadings in some areas, resulting—once again—in more frequent and more severe unwanted wildland fire.

INVASIVE SPECIES – Tamarisk (in inset and background) is one of many invasive species that can cause unwanted wildland fire to increase in severity—threatening and damaging both communities and natural resources.

Figure 10

Throughout the United States, non-native invasions have significantly altered fire regimes. (Alaska's fire regimes, on the other hand, have not been significantly altered by these influences.) Specifically, the following non-native invasions have resulted in more frequent and more damaging unwanted wildland fires:

- Melaleuca in the southeast United States.
- Phragmites along the Atlantic coast.
- Cheatgrass in the Great Basin.
- Tamarisk in riparian areas of the southwest United States.
- Non-native grasses in Hawaii.

In addition, pathogens such as American chestnut blight and white pine blister rust have changed many eastern forests by eliminating these large, dominant, fire-resistant trees. This, in turn, has increased fire hazard in areas not traditionally considered at high-risk from wildland fire. Similarly, emerging forest health maladies like "oak decline" are also increasing fire hazard in known fire-risk areas on the West coast.

Using Land Condition to Assess Wildfire Risk to Ecosystems

Fire Condition Class and Fire Regime Groups

In April 2001, a national course-scale assessment (*Course-Scale Spatial Data for Wildland Fire and Fuels Management: Version 2000, Schmidt et. al. [published 2001])* was completed that quantifies land condition in the conterminous United States. The analysis describes the degree of fire regime departure from historical fire cycles due to fire exclusion and other influences previously discussed in this chapter (selective timber harvesting, grazing, insects and disease, the introduction and establishment of non-native plants).

This coarse-scale analysis identifies changes to key ecosystem components such as species composition, structural stage, tree or shrub stand age, and canopy closure. It characterizes the landscape by five "**Fire Regime Groups**" and three "**Fire Condition Classes**" (see next page). In this analysis, wildfire risk conditions are identified by the Fire Regime Groups and are measured by the Fire Condition Classes. Specifically, the natural historical frequency and severity of fire within an ecosystem is the identified Fire Regime, and Fire Condition Class identifies the departure of current conditions from the historical reference condition.

Fire Regime Groups

Fire Regime Group	Fire Frequency	Fire Severity	Percent of (Conterminous) Federal Lands
I	0-35 years	Low severity	31%
II	0-35 years	Stand replacement severity	13%
III	35-100+ years	Mixed severity	36%
IV	35-100+ years	Stand replacement severity	14%
V	> 200 years	Stand replacement severity	6%

A fire regime is a generalized description of fire's role within an ecosystem—characterized by fire frequency, predictability, seasonality, intensity, duration and scale. Five combinations of fire frequency—based on fire return interval and fire severity—are the basis for the coarse-scale assessment's five Fire Regime Groups.

Table 1

Relative Ranking of Wildfire Risk to Ecosystems by Fire Condition Class

The three Fire Condition Classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. Based on the coarse-scale national data, they serve as generalized wildfire risk rankings. The risk of loss of key ecosystem components from unwanted wildland fire increases from Fire Condition Class 1 (lowest risk) to Fire Condition Class 3 (highest risk).

At historically characteristic fire intensities, fire:

- Is ecologically beneficial because nutrients are cycled.
- The soil's organic layer is not completely consumed because the remaining organic material stabilizes the soil surface and helps prevent erosion.

Fire Condition Class 1

Fires burning in Fire Condition Class 1 areas generally leave the soil intact and functioning normally. These fires usually pose little risk to the ecosystem. They have positive effects to biodiversity, soil productivity, and water quality. Many species require fire for their existence and regeneration; other species have developed adaptations to withstand periodic fires.

Fire Condition Class 2

Fire Condition Class 2 develops as:

1) Fire return intervals are missed, while understory vegetation continues to grow, becoming denser;

2) Or when highly flammable non-native species are established and their ranges are expanded by increased fire occurrence.

Fire Condition Class 3 is classified as high risk because of the danger it poses to people and the widespread, long-lasting damage likely to result to species and watersheds when wildland fires burn on these lands—even during non-drought water years.

If the accumulating vegetation or the invasion of woody or non-native species is not treated, fires begin to burn more intensely, making them even more difficult to suppress. Therefore, the impact of these fires to biodiversity, soil productivity, and water quality become more pronounced.

Fire Condition Class 2 is classified as moderate risk because of the increasing danger it poses to people and the damage that can result to species habitats and soils when a fire burns on these lands—particularly during drought years.

Fire Condition Class 3

In Fire Condition Class 3 areas within these same ecosystems, fires are relatively high risk. During drought years, small trees, brush, and other vegetation dry out and burn with the dead material—fueling severe, high intensity wildland fires. At these intensities, wildland fires kill all vegetation, even the large trees that—at lower fire intensities—would normally survive.

Fire frequency is further increased in Fire Condition Class 3 areas dominated by highly flammable non-native species. Within these areas, a fire cycle establishes that leads to the exclusion of native species and further expansion and domination by non-native species.

Within Fire Condition Class 3 in Fire Regimes I, II, and III, high-intensity fires consume the soil's organic layer and burn off or volatilize nutrients. When all small twigs, dead leaves and needles, and other organic litter are consumed, water runs unimpeded over the soil surface. Under these circumstances, the soil becomes more susceptible to erosion. At extreme fire intensities, the soil's capacity to absorb water is often lost. The fine, powder-like ash that follows a severe wildland fire on these sites produces a water beading process on the surface. These so-called “hydrophobic conditions” result in highly erodable soils.

Fire Condition Class 3 is classified as high risk because of the danger it poses to people and the widespread, long-lasting damage likely to result to species and watersheds when wildland fires burn on these lands—even during non-drought water years. Firefighters are especially cognizant of the hazards in Fire Condition Class 3 situations.

In a 1996 national survey (Wildland Firefighter Safety Awareness Study, Tri-Data), nearly 83% of all firefighters identified fuel reduction as the single-most important factor for improving their margin of safety on wildland fires.

Fire-Prone Areas Targeted

The cohesive strategy places a greater emphasis on restoration and fuel maintenance treatments within those areas most prone to fire occurrence, specifically within Fire Regime Groups I, II, and III. These areas have experienced the greatest change from historical conditions due to fire exclusion.

Thus, they are most likely to respond favorably to treatments designed to reduce hazardous fuel, thereby improving ecosystem resiliency to wildland fire.

Coarse-Scale Assessment Limitations

While the coarse-scale assessment of Fire Condition Classes provides a useful first-approximation of national level risk, its analysis scale and resolution of data are not sufficient to estimate local and regional-levels of risk. Consequently, many complex patterns of vegetation important in evaluating Fire Condition Class for other uses, cannot be detected by the technology and methods used in the coarse-scale analysis.

Similarly, because emergent problems associated with invasive, non-native plants and the expansion of coniferous species into adjacent shrublands and grasslands were not analyzed in the Fire Condition Class assessment, it does not accurately differentiate among some shrub and grass types.

Additionally, due to this insufficient detail, the coarse-scale assessment’s Fire Condition Class data cannot be used to establish priorities in the funding allocation process. Nonetheless, the Fire Condition Class concept must be applied at the local level as a measure of departure from—or return to—desired vegetation and fuel conditions.

Therefore, because of these coarse-scale data limitations, local units must map Fire Condition Class on a finer scale. This will enable changes in local Fire Condition Class to be used as a measure of the cohesive strategy’s effectiveness.

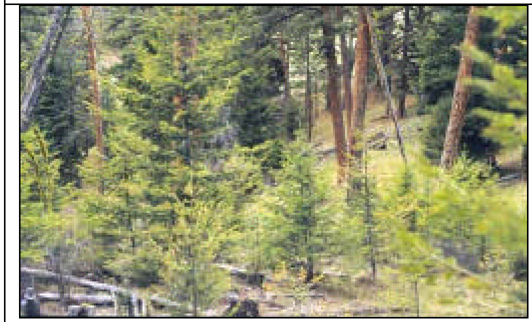
***Open ponderosa pine stand maintained by frequent low-severity fire, is dominated by large trees. Stand is resilient to disturbances such as insects and disease outbreaks. (CC1)* Figure 11**

¬ Fire Condition Class 1 ®

For the most part, fire regimes in this Fire Condition Class (CC1) are within historical ranges. Thus, the risk of losing key ecosystem components from the occurrence of fire remains relatively low. Maintenance management such as **prescribed fire**, mechanical treatments, or preventing the invasion of non-native weeds, is required to prevent these lands from becoming degraded.

¬ ®

***Wyoming big sagebrush type with considerable diversity is generally more resilient to disturbance and provides habitat for a great number of species. (CC1)* Figure 12**



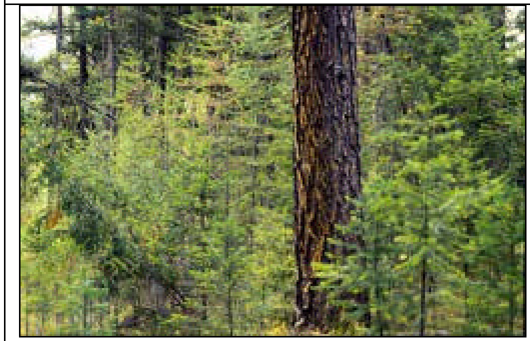
***Selective logging in ponderosa pine stands progressively removed the larger trees. Without periodic fire, forest openings filled with thickets of smaller understory trees. (CC2)* Figure 13**

¬ Fire Condition Class 2 ®

Fire regimes on these lands (CC2) have been moderately altered from their historical range by either increased or decreased fire frequency. A moderate risk of losing key ecosystem components has been identified in these lands. To restore their historical fire regimes, these lands may require some level of restoration through prescribed fire, mechanical or chemical treatments, and the subsequent reintroduction of native plants.

¬ ®

***Wyoming big sagebrush type where fire has been excluded for an extended period has reduced diversity and provides habitat for fewer species. The site is also vulnerable to future cheatgrass invasion and to wildland fire. (CC2)* Figure 14**



***The dense thickets of understory trees eventually become sufficiently large enough to allow fire spread into the ponderosa pine crowns. These thickets are also highly drought-prone. (CC3)* Figure 15**

¬ Fire Condition Class 3 ®

These lands (CC3) have been significantly altered from their historical range. Because fire regimes have been extensively altered, risk of losing key ecosystem components from fire is high. Consequently, these lands verge on the greatest risk of ecological collapse. To restore their historical fire regimes—before prescribed fire can be utilized to manage fuel or obtain other desired benefits—these lands may require multiple mechanical or chemical restoration treatments, or reseeding.

¬ ®

***Rangeland sites entirely dominated by cheatgrass—unlike the native vegetation that formerly occupied this site— are highly vulnerable to fast-moving, higher-intensity wildfires. (CC3)* Figure 16**

Finer-Scale Risk Mapping Underway

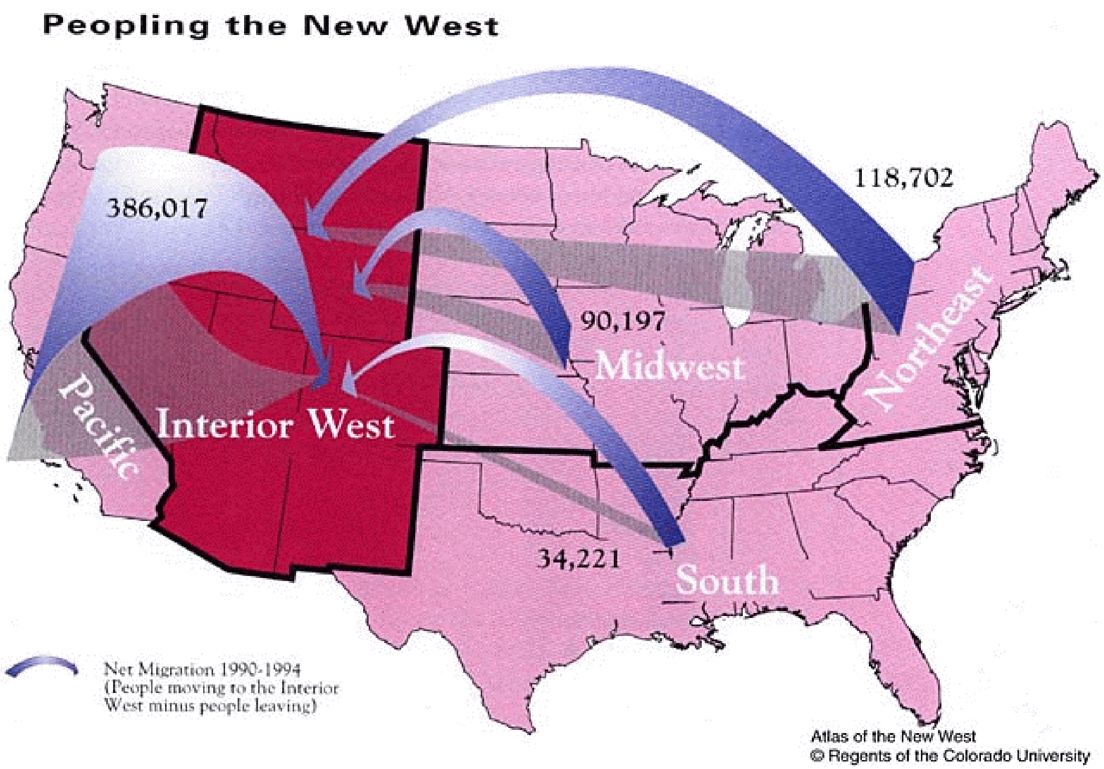
To improve the resolution of Fire Condition Class data and to expand its use, the USDA Forest Service and the Department of the Interior are undertaking a finer-scale risk mapping assessment of fire regime, ecosystem, and fuel. The definitions of condition classes may be revised in this undertaking to more clearly reflect changes caused by exotic and woody species invasions, as well as changes caused by high-severity fire resulting in long-term site degradation.

Until a finer-scale national assessment of Fire Condition Class is completed, the cohesive strategy will rely on Fire Regime Groups as a criteria for prioritizing national and regional fuel treatment funding.

Increasing Fire Risk in Wildland-Urban Interface Areas

Urban and suburban community expansion into rural areas placed valuable human improvements across a landscape that now burns much more severely than historically. Today, destructive fires in the wildland-urban interface—the ever-increasing areas where people have interspersed with wild lands—occur in fire-prone areas across the nation.

During the 1970s and 80s, the interior West's population increased more rapidly than the country at large. This demographic trend quickened in the 1990s. As human populations continue to grow and demographics shift—concentrating more people inside or adjacent to wildlands throughout the United States—even more private property will be at risk to unwanted wildland fires. During dry years or under adverse weather conditions—because they occur in high-risk fuel—many wildland-urban interface fires exceed firefighting capabilities.



MORE PEOPLE MORE HOMES MORE RISK – Population surge into the interior West.

Figure 17

Wildland-Urban Interface Lands Evolved with Fire

The vegetation in many of these interface areas—where wildland fire now poses the greatest threat to human lives and values—evolved with fire. Thus, in the absence of fire, treatments are necessary to reduce fuel accumulation. Continued fire exclusion will allow wildland fire hazard to increase and will contribute to ecosystem degradation.

While not all natural fires can be allowed to burn freely, prescribed burning and other treatments can be used to reduce these threats to communities. Some of these treatments may have a collateral benefit of restoring and maintaining ecosystem health. Treatments on Federal lands alone, however, will not solve the problem. They must also occur on adjacent State, Tribal, local, and private lands.

While Federal agencies and their partners will never completely remove the risk of unwanted wildland fire, the funding provided by Congress—beginning with the 2001 budget—coupled with the actions outlined in this strategy and the *10-Year Comprehensive Strategy*, can begin to arrest the trend of increasing risk from unwanted wildland fire in high risk areas.

Suppression Costs Increase Near Communities

Fires become more costly when homes are involved. Throughout much of the interior West, short interval fire-adapted ecosystems are typically located in valley-bottoms where homes and human development are most concentrated. Just as constructing homes in floodplains exposes homeowners to risk of floods, development in fire-adapted ecosystems poses a tangible wildland fire risk to communities.

The 2000 wildland fire season demonstrated the increased costs of firefighting near people and homes. The Skalkaho Fire on the Bitterroot National Forest covered 64,000 acres of forest interspersed with homes. It employed 755 firefighting personnel at a cost of $7.2 million. Meanwhile, on the same National Forest within the Selway-Bitterroot Wilderness Area, a fire that burned the same approximate acreage (63,0000 acres) required only 25 firefighters at a cost of approximately $709,999.

Certainly, the wildland-urban interface dilemma represents a crucial land management challenge to reduce the risk of unwanted wildland fire to protect lives, property, and natural and historic resources. Therefore, efforts to reduce hazardous fuel on Federal lands must be coupled with efforts to assist private landowners to take preventive action in their own communities.

Creating defensible perimeters around homes, improving building codes, and employing fire resistant landscaping will help reduce wildland fire risk to communities. These and similar actions can help prevent wildland fires from burning homes and reduce insurance premiums and suppression costs.

To attain these fire-safe attributes, public outreach and education is critical.

Fire Risk to Communities

Not all structures and communities in urban-wildland interface areas are at significant risk from wildland fire. A combination of factors determines the relative risk to a community, including:

- The composition and density of vegetative fuel within and around the community.
- Fire occurrence.
- Occurrence of extreme weather conditions.
- Topography.
- Fire protection capability.
- Type of construction material and design of structures.
- Density of structures.
- Community infrastructure including road access and water sources. (Determining community risk to unwanted wildland fire should consider local variations to these factors as well as community-specific fire protection measures, planning codes, and zoning regulations.)

Using Land Condition When Prioritizing Areas for Fuel Treatment Near Communities

When prioritizing areas for fuel treatment needs, consideration should first be given to the importance of the area requiring protection. These areas are often adjacent to Fire Condition Class 2 and 3 lands.

While the ecological difference between Fire Condition Class 2 and Fire Condition Class 3 lands may be significant, from a tactical fire protection standpoint the difference in potential fire behavior may only be marginal. Both Fire Condition Class 2 and Fire Condition Class 3 lands, however, can produce severe burning conditions that, under extreme fire weather conditions, overwhelm the best fire suppression technology.

Because they have more accumulated vegetation to remove, Fire Condition Class 3 lands are generally more expensive to treat than Fire Condition Class 2 lands. Furthermore, areas within Fire Condition Class 2 continue to degrade into Fire Condition Class 3 over time. Therefore, treating only Fire Condition Class 3 lands may not always provide the best payoff for the investment.

Thus, some Fire Condition Class 2 lands could be locally ranked as a higher priority for treatment than the nearby Fire Condition Class 3 lands.

III A FRAMEWORK FOR SUCCESS
ENSURING CLEAN AIR, CLEAN WATER, AND BIODIVERSITY THROUGH ADAPTIVE MANAGEMENT

This cohesive strategy will evolve as planning decisions are made, actions are implemented, and results are evaluated. While some uncertainties exist, implementing this strategy will help to avoid serious consequences that would occur should fuel reduction treatments be deferred or never implemented.

Guiding Legislation in Resource and Fire Management

A host of laws and regulations guide Federal agencies as they manage lands under their stewardship. Some laws affect the work of all Federal wildland agencies. They include: the Endangered Species Act, the National Environmental Policy Act, the National Historic Preservation Act, the Clean Water Act, and the Clean Air Act. Other regulations are more specific to the individual agencies.

Developing Strategies to Improve Performance and Accountability

With an umbrella of guidance and the passage of the *Government Performance and Results Act* (GPRA) in 1993, the agencies have each developed overall management strategies. The GPRA directs the USDA Forest Service and the Department of the Interior land management bureaus to develop strategic plans for their activities and create objectives to conserve natural resources, water, or wildlife; and to preserve air quality, cultural and historic sites. These objectives are designed to help align resource and fire programs to reduce risks to communities and to restore and maintain fire-adapted ecosystems.

Land Management Planning and Fire Management Plans

Land Management Plans

All Federal land management agencies are required to have a strategic plan that establishes standards and guidelines for implementing the agency mission at the local administrative unit. In general, land management plans identify: desired resource conditions, suitable land uses, and monitoring and evaluation requirements.

It is critical that fire management issues are fully integrated within these plans. Specifically, the land management plan should include an analysis of wildland fire's interaction—exclusion or application—with natural and cultural resources and other ecological processes. Some of these resources, processes, as well as human actions, include:

- Risk of wildland fire to people and their communities.
- Role of wildland fire as part of ecosystem function.
- Wildland fire history and behavior.
- Land-use history and landscape change.
- Past and current management actions.
- Soil and watershed processes.
- Plant and animal species/habitat requirements response to fire.
- Laws and regulations.

Fire Management Plan

The fire management plan provides programmatic direction for implementing wildland fire-related actions in support of the land management plan. Thus, it serves as the manager's guide for implementing fire-related direction on the ground.

Agency land management plans and fire management plans reflect priorities based on the collaboration of participating stakeholders. Until these plans are updated, local agency administrators will establish priorities consistent with land management plan direction through collaboration with the appropriate representatives of Federal, State, and Tribal governments, as well as other stakeholders.

Public outreach and collaboration is vital to successful land management planning and the development and implementation of effective fire management plans that serve to restore fire-adapted ecosystems and reduce risk from unwanted wildfire. This community-based collaboration is an interaction and alliance between land managers and the public/stakeholders to improve fire management effectiveness.

The Importance of Adaptive Management

Adaptive management can be used to design, monitor, evaluate, and adjust management activities. Assumptions associated with management approaches for entire watersheds and the sequence of hazardous fuel treatments need to be clearly identified and articulated as part of the adaptive management process. Collaboration with stakeholders is also essential to adaptive management.

> ***Adaptive Management***
>
> *An approach to managing complex natural systems that builds on common sense and learning from experience. It includes experimenting, monitoring, and adjusting practices based on what is learned. This management approach should focus on: accelerating learning and adapting through new partnerships; structured learning; and by changing relationships between and within management and research institutions.*

The type, intensity and frequency of management activity in fire-adapted ecosystems will influence the ability to provide for clean air, clean water, and biodiversity over the long term. Managers must vary the type, intensity, and frequency of management activities in accordance with local resource conditions, as well as to achieve local land management goals. While a considerable amount of science supports an understanding of fire-adapted ecosystems, the following are examples of topics that are not yet completely understood: effectiveness evaluations, remote sensing of fuel conditions, some effects of hazard reduction treatments in specific ecosystems.

Prioritization and Scale of Treatment Considerations

Although the need is too great to wait for the complete scientific analyses of every ecosystem and species, immediate fuel treatment implementation should be encouraged only where there is reasonable justification to believe that long-term sustainability will not be degraded. The uncertainty in ecosystem response should be considered in the prioritization of areas and the scale of treatments.

In addition, strategic treatment patterns on a landscape may provide benefits that extend beyond the physical boundaries of the treatment area. For example, research conducted in Sierra Nevada forest ecosystems by Dr. Mark Finney of the Rocky Mountain Research Station, USDA Forest Service, reveals that strategic treatment patterns can greatly reduce the spread and final size of unwanted fires. On the other hand, randomly placed or haphazard treatments may have little effect on wildfire acres burned.

Similar research on wildland fire effects in non-forest ecosystems within strategic treatment patterns, however, has not yet been conducted. Additionally, the landscape effects of such treatments have not yet been fully observed nor scientifically documented during unwanted wildland fire events (Omi and Martinson, 2002). Thus, the most effective placement of treatments to mitigate the undesirable effects of wildland fires is not fully understood.

The Joint Fire Sciences Program (including both the Department of the Interior and the USDA Forest Service) is an ongoing effort to improve knowledge and skills in reducing fire hazard through applied research. The program is intended to prioritize research needs and share the results of research to improve adaptive management efforts.

Validating Assumptions

It is essential that short- and long-term monitoring be conducted to validate assumptions, reduce uncertainties, and measure effectiveness and cumulative progress. During program effectiveness and efficiency management review, it will be determined whether to:

- Continue pursuing ongoing management,
- Modify management approaches (treatment types, intensity, and scheduling), or
- Propose new actions in response to what was learned through monitoring and evaluation.

This cohesive strategy will evolve as planning decisions are made, actions are implemented, and results are evaluated. While some uncertainties exist, implementing this strategy will help to avoid serious consequences that would occur should fuel reduction treatments be deferred or never implemented.

The Complexities of Managing Fuel in Fire-Adapted Ecosystems

The benefits of reducing hazardous fuel in the vicinity of human communities are widely understood and accepted. But the management of fuel in fire-adapted ecosystems has many complexities—not all of which are well understood.

Successful resource management in fire-adapted ecosystems should be based on four fundamental principles (Brown, James K. 2000):

1. *Fire will occur with an irregular pattern.*
2. *Diversity of species and vegetation pattern depends on fire diversity.*
3. *Fire initiates and influences ecological processes such as regeneration, growth and mortality, decomposition, nutrient cycles, hydrology, and wildlife activity.*
4. *Humans exert a commanding influence on ecosystems by igniting and suppressing fire.*

Research reveals that active management can improve habitat quality for some species dependent on fire-adapted ecosystems such as Kirtland's warbler and the red cockaded woodpecker. In the South's fire-adapted forests, for example, the relationship between fire and bobwhite quail populations serve as an important factor in initiating prescribed burning programs.

Most research involving relationships between fire and wildlife has focused on mammals and birds, emphasizing habitat rather than populations. The cause and effect relationships between fire and wildlife are correctly understood only in the context of specific ecosystems.

Much attention has been directed toward avoiding impacts to individual species. In fire-adapted ecosystems, to avoid listing species under the Endangered Species Act, proactive management of watersheds and landscapes—accompanied by an appropriate level of monitoring and evaluation—may be critical. Because of degraded habitat in landscapes where fire frequency has been significantly increased or reduced, vegetation conditions are more likely to present risks to species.

Landscape Patterns and Processes – Key for Species

The effectiveness of ecosystem restoration contributing to species conservation depends on landscape patterns and processes. Sage grouse population dynamics, for example, are dependent on landscape and temporal habitat disturbance patterns, as well as on long-term vegetation change such as movement of conifers into sagebrush grass communities where fire has been excluded.

Fire Effects on Habitat

"Fires affect animals mainly through effects on their habitat . . .The extent of fire effects on animal communities generally depends on the extent of change in habitat structure and species composition caused by fire. . . Animal species are adapted to survive the pattern of fire frequency, season, size, severity, and uniformity that characterized their habitat in pre-settlement times. When fire frequency increases or decreases substantially, or fire severity changes from pre-settlement patterns, habitat for many animal species declines."

Smith, Kapler

After the occurrence of wildland fire in dry sagebrush communities, many other factors—such as the expansion of cheatgrass—affect the integrity of sage grouse habitat.
The restoration of sage grouse habitat requires the reestablishment of native rangeland grasses, shrubs, and forbs. To accomplish this, **fire frequency** must be reduced in landscapes that have become dominated by cheatgrass, and increased where tree encroachment has replaced sagebrush grass communities.

Habitat Management Requires Multi-Level, Landscape-Scale Coordination

Due to the extent of habitat alteration that has occurred over the past century, management for species conservation in fire-adapted ecosystems is complicated.

- Habitat is currently at risk of long-term loss from severe wildland fires in many areas.
- Further reduction of habitat due to severe wildland fire may threaten species viability.
- Significant areas of habitat for individual species have been lost due to changes in plant species and cover that have resulted from fire exclusion.

Thus, successful habitat management is dependent on coordination of all wildland fire management activities across jurisdictional lines, including coordination of ecosystem restoration and maintenance activities across broad landscapes.

Balancing Short- and Long-Term Effects

All management actions and ecosystem processes have both favorable effects on some species and unfavorable effects on others. Some of these effects are short-lived and others are enduring. The implementation of this cohesive strategy will often require balancing the short-term versus long-term effects.

Single-species management often results in land managers considering solely short-term effects, especially when managing threatened, endangered, or other special status plant and animal species habitat. An over reliance on managing for short-term effects for single species benefits can compromise long-term habitat sustainability.

For example, emphasis on mitigation against short-term effects on fish species could preclude watershed-level management that would protect the **ecological integrity** of the entire watershed.

> *"There are a number of tools that can be used to [reduce hazardous fuels] – selective thinning, prescribed burns, and commercial cuts, to cite a few. But the primary goal must be forest health – something on which all of us involved in this debate should be able to agree."*
>
> Governor Dirk Kempthorne, Idaho
> Testimony delivered to the Subcommittee on Forests and Public Lands Management, Senate Energy and Natural Resources Committee, September 23, 2000,

Unwanted Wildland Fire Effects

These photos of Colorado's Buffalo Creek Fire aftermath, illustrate soil severely burned and left exposed to rain and runoff. This produced the subsequent 1996 flash flood event that claimed two lives. The ensuing erosion also washed topsoil off the hillsides, clogging downstream watercourses. This erosion reduced future storage capacity of reservoirs and silted over the river's gravel beds—significantly reducing spawning habitat.

Figure 18

"Climate change is also likely to increase fire frequency. As long as year-to-year variation in precipitation remains high, fire risk is likely to increase whether the region gets wetter or drier. This is because fuel loads tend to increase in wet years as a result of increased plant productivity and are consumed by fire in dry years."

Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change
National Assessment Synthesis Team
U.S. Global Change Research Program

Air Quality and Fuel Management Programs

Air quality provides an example of short- and long-term trade-offs in implementing fuel management programs. There is a risk of short-term human health impacts from **prescribed fire** to Clean Air Act health standards. These emissions from prescribed fires, however, can be managed by carefully distributing fire over time and space, as well as under appropriate weather conditions.

Wildland fires, on the other hand, often occur when atmospheric conditions are least capable of dispersing smoke. This often results in large, dense smoke concentrations in populated areas. Additionally, mechanical thinning and forest products and **biomass** removal will further reduce potential negative impacts of smoke. Without fuel treatment, wildfires will have greater impacts on air quality over the long term.

Use of Biomass Residues in Fuel Management Programs

The National Energy Policy encourages increased development of renewable energy sources such as biomass. Wood residues produced in hazardous fuel treatments are a potential significant source of biomass. This cohesive strategy and its underlying analyses provide inputs for assessing biomass energy opportunities on public lands.

> *"Utilization of biomass for energy production is consistent with a National Energy Policy objective to increase America's use of renewable and alternative energy sources. Biomass utilization is also consistent with the goals and objectives of the National Fire Plan to reduce accumulations of woody material that create a fire hazard—threatening communities and forests and rangelands."*
>
> Department of the Interior Secretary Gale Norton
> Testimony before the House Committee
> on Resources, June 6, 2001

Woody fuels are a necessary component for many healthy functioning ecosystems. They provide long-term site productivity, watershed and soil protection, and habitat. In addition, numerous opportunities—consistent with management objectives in agency land management plans—exist for the use of biomass residue. Additional opportunities could be made available as land management plans are revised. Specific sources of residue for biomass energy production include the restoration of lands that have been degraded by expansion in the distribution of woody species (such as Western juniper), and by the accumulation of shade tolerant species within the Intermountain west. An interagency task group on biomass energy opportunities on Public Lands estimates that the Bureau of Land Management alone has the available biomass equivalent of approximately 100,000 tons of coal on lands suitable for biomass production.

Global Climate Change

Much attention has been focused on issues related to changes in the Earth's climate. Despite controversy on this topic, consensus exists that a considerable amount of annual and decadal variability in weather and climate occurs and will continue.

These climate change influences are forecasted in the 2000 report *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. The report was produced by a national assessment synthesis team comprised of experts from government, universities, industry, and non-governmental organizations. Requested by the U.S. President's Science Advisor, it predicts these climate change effects and vulnerabilities at the regional scale. Specifically, the report foresees an increase in unwanted wildland fire risk that will result in escalating peril to both ecosystems and communities.

Therefore, as climates become more variable, the need to implement an aggressive fuel treatment program that will mitigate this risk becomes even more important.

IV REDUCING RISKS TO PEOPLE AND NATURAL RESOURCES

"The truth is that current forest conditions are so far out of sync with inherent disturbance regimes that we lack the technological capability to manage fire disturbance. The public is just beginning to understand that the forests they grew up with may not be sustainable into the future."

Dr. John Lehmkuhl
Research Wildlife Biologist
Pacific Northwest Research Station
USDA Forest Service

Areas at Risk

Management Challenge: Determine Optimum Fuel Treatment Mix to Restore and Maintain Ecosystems and Protect People and Communities

Ecosystem conditions are constantly changing. Under any fuel treatment program, vegetation will continue to grow, mortality from insect and disease outbreaks will persist, fuel will accumulate, and wildland fires will occur.

Disruption of fire regimes over several decades has greatly increased the risk of unwanted wildland fire in the United States. This has resulted in increased fatalities, property losses, local economic disruptions, and fire-damaged landscapes. Because of the magnitude and extent of fuel condition changes, it is not possible to restore and maintain all ecosystems within the next few decades.

The management challenge is to determine the optimum mix of ecosystem restoration and maintenance treatments and the appropriate fuel treatment methods. Under the appropriate mix of treatments, while unwanted wildland fires will continue to occur, they will become more manageable and less likely to be destructive to communities and ecosystems.

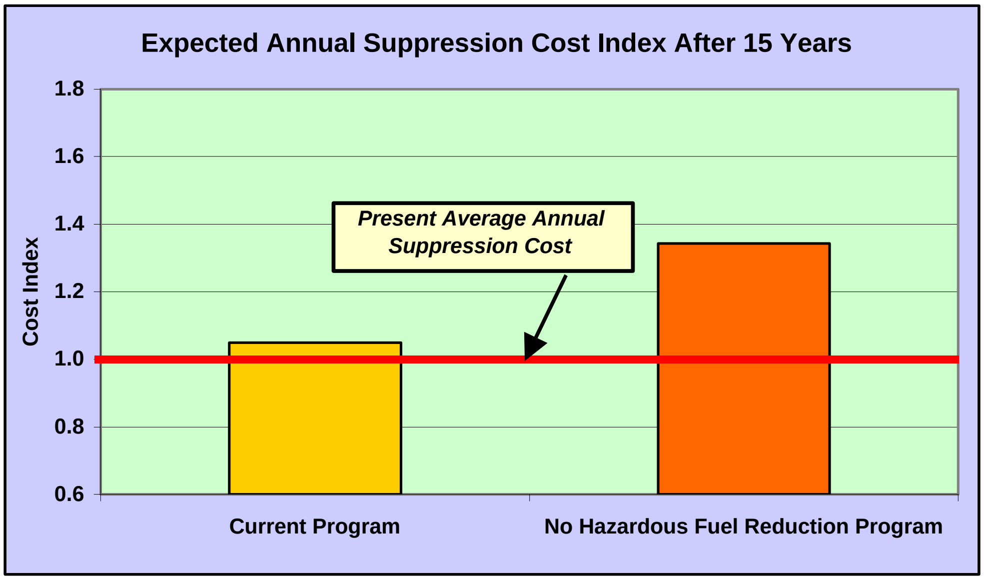
Wildland fire effects on watersheds, air quality, species, and long-term site degradation, often adversely impact communities—even when flames do not directly threaten people's structures and their immediate infrastructure. While it is imperative that fuel conditions directly adjacent to communities are properly managed, landscape-scale and cross boundary treatments will result in increased treatment efficiency and protect the multitude of diverse resources vital to a community's health and well being.

The Costs of Unwanted Wildland Fire

Suppression costs and wildland fire acres-burned have increased due to over-accumulation of fuel and a corresponding increase in high-risk acreage and drought conditions. In recent years, large fires have become more damaging and more costly (Figure 19). Unless the rate of restoration is increased, greater burned acreages and higher wildland fire suppression costs will continue.

Wildland fire that occurs on Fire Condition Class 1 lands typically requires minimal, if any, rehabilitation treatments. Wildland fire that burns under extreme conditions in Fire Condition Classes 2 and 3 lands often requires extensive site rehabilitation treatments to protect resources and nearby communities.

These treatments significantly increase wildland fire costs. In fact, some fires that burn in Fire Condition Class 2 and 3 lands cause long-term site degradation that compromises ecosystem integrity and productivity for decades or even longer. (See Figure 20.)



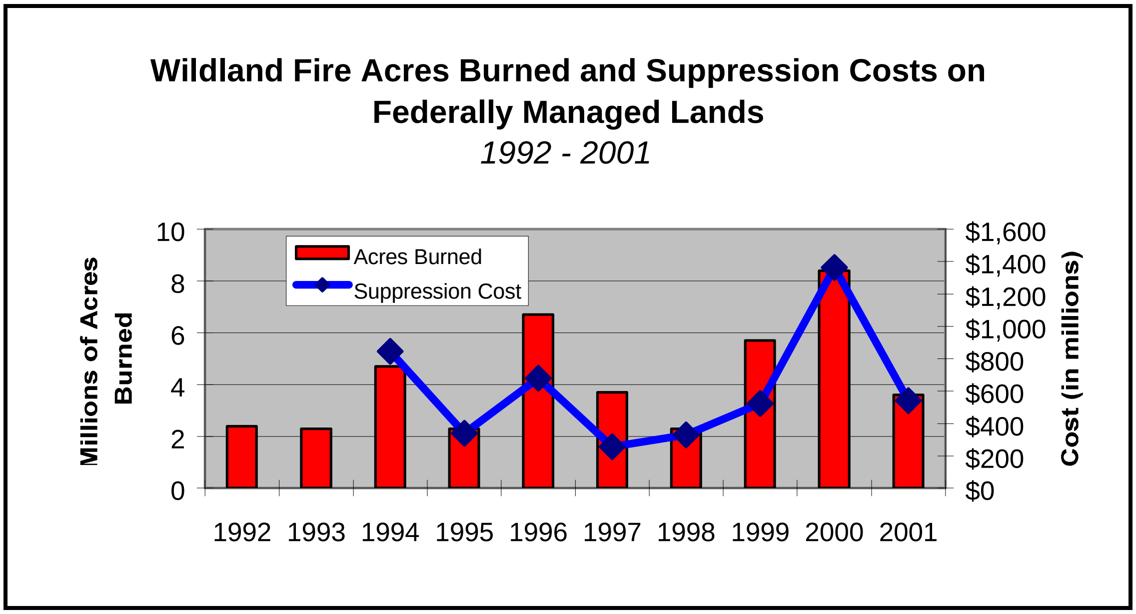
Annual Suppression Costs

Under the current program (illustrated above), costs would be relatively similar to current costs. With no hazardous fuel reduction program, wildfire suppression costs would increase by one-third over current costs. (The suppression cost is the sum of wildland suppression costs in and outside the wildland-urban interface.)

This index was calculated for a continuation of the current level of fuel treatment. Because of the tremendous—and unpredictable—annual variance in suppression costs, confidence in these cost index projections (outlined above) is lower than the with other indices presented in this strategy.[1]

Figure 19

[1] ***Analysis Process.*** *The risk indices on the bar charts in this chapter (Figures 18, 19, 21, 23-25) portray expected levels of risk after 15-years of program implementation. The current level of risk is indicated by the horizontal line at the Risk Index of 1.0 on the vertical-axis. Risk indices reflect the cumulative effects of unwanted wildland fire, the exclusion of fire in its natural role, hazardous fuel treatments, as well as present levels of other land management activities (such as timber management, range improvement, wildlife habitat restoration, and watershed restoration). (See Hann et al., In Prep.)*



Wildland Fire Suppression Costs from 1992 to 2001.

Figure 20

Managing Wildland Fire to Reduce Suppression Costs and Maintain Ecosystems

Managing wildland fires to maintain fire-adapted ecosystems is prudent in large expanses of undeveloped areas that are unlikely to threaten people or property. However, continuing expansion of development and the settlement of people into these wildland areas increase the probability that these fires will eventually threaten human values.

Whether or not a fire that is initially determined to be beneficial will eventually become a threat entails a substantial amount of uncertainty. For instance, the science of predicting long-range weather conditions for specific sites does not always have sufficient precision on which to base decisions with potentially significant consequences. When these wildland fires become large and threatening, they become very costly to suppress and may present significant risks.

Currently, in most areas, reliance on wildland fire as a primary strategy for reducing hazardous fuels is dangerous. The results would likely be 1) increasingly degraded wildlands on Condition Class 2 and 3 lands; 2) increased wildland fire risk to communities as these fires get large and encroach on developed areas; and, 3) exorbitant suppression costs to keep these large, unruly fires away from communities.

Wildland fires should, however, be considered a primary management option for maintaining Condition Class 1 fire-adapted ecosystems in backcountry lands where there is little chance they will threaten or otherwise negatively impact communities.

In the future, as strategically designed fuel treatments are completed and large expanses of continuous, high-hazard fuels are broken into a lower hazard matrix of treated and untreated areas, the risk that these fires will become threatening is greatly reduced. Efficiently managed wildland fires will then become more of the solution and less of the problem. Because of their lower fire intensity, slower spread rates, and limited fire line construction needs, the expense associated with managing these fires will be far less than current suppression expenditures for high intensity fires that constitute imminent threats to people and communities.

Lands Degraded By Wildland Fire Inflict a Myriad of Negative Impacts

Loss of Land Productivity

Severe wildland fire can incur a myriad of negative impacts. In addition to suppression and rehabilitation costs, there is another cost associated with loss of traditional uses of severely burned land (timber harvest, grazing, and subsistence activities). This loss of productivity can extend over centuries on forested ecosystems and over decades on rangelands.

*Under certain conditions, wildland fires can maintain, or even improve land conditions and reduce risks to communities and natural resources. Reliance solely on wildland fires for reducing hazardous fuel, however, can result in increasingly degraded wildlands. In some areas, this reliance has **increased** wildland fire risk.*

Damage to and potential loss of non-commodity resources (watershed health, air quality, wildlife habitat) represents another societal cost. For example, fisheries can be severely impacted by sedimentation and siltation following fire. Rehabilitation can reduce but cannot eliminate these impacts.

LANDS DEGRADED BY WILDLAND FIRE – Uncharacteristically severe wildland fire resulting from a combination of fuel accumulation and drought has resulted in the near total removal of live vegetation and surface organic matter that is necessary to protect underlying soils from erosion.

Figure 21

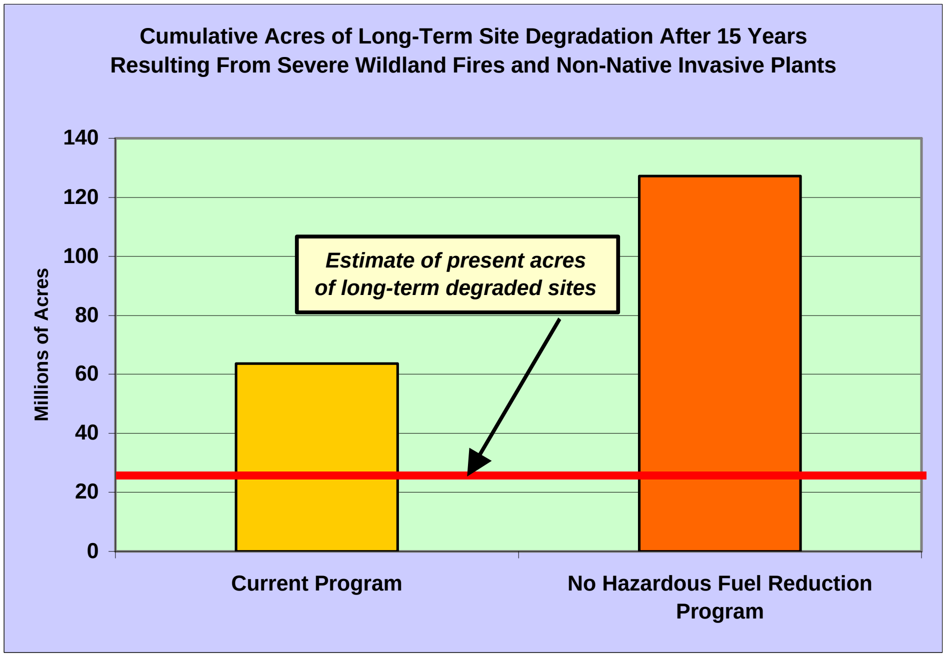
When lands in Fire Condition Class 2 and 3 burn—especially during drought conditions—the severity of wildland fire effects often supercedes the land's fire-adapted recovery mechanisms. In practically all of these events, the severely burned land does not return to Fire Condition Class 1, but becomes even more degraded. The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. When accelerated soil erosion occurs, productivity suffers, key ecosystem components are lost, and ecosystem processes function differently than prior to the fire occurrence. Severely burned sites are also highly vulnerable to invasion by non-native species.

Recovery to pre-fire conditions can take from decades to centuries.

Some management activities (such as mulching, installing water bars, and reseeding with native species) can accelerate recovery—but solely on a limited basis.

In spite of intensive rehabilitation efforts, native plant species may not flourish for decades due to reduced site productivity.

In addition, should invasive species become established, they may be extremely difficult to remove or control.



Site Degradation

Wildlands degraded by fire will continue to accumulate with or without treatment programs.

After 15 years of treating fuels at the current program level, degraded wildlands would total about 60 million acres. (This is three times as many acres as are currently degraded). If no hazard fuel reduction program was implemented, more than 120 million acres, (approximately one-quarter of all Federal wildlands) would be degraded by wildland fire.[2]

Figure 22

Furthermore, in areas invaded by non-native species (e.g., cheatgrass), wildland fire hazard is actually increased following successive fires.

[2] **Analysis Process.** *Change in long-term site degradation was calculated for the end of a 15-year period of national-scale fuel treatment implementation. An estimate of the current amount of long-term degraded sites is indicated by the horizontal line (at approximately 21 million acres on the vertical-axis). The expected amount of long-term site degradation is associated with the cumulative effects of unwanted wildland fire, the exclusion of fire in its natural role, the spread of invasive species, and hazardous fuel reduction treatment and other land management activities (such as timber management, range improvement, wildlife habitat restoration, and watershed restoration). (See Hann et al., In Prep.)*

HOMES DESTROYED – The June 2000 Bobcat Gulch Fire, east of Rocky Mountain National Park on the Front Range of Colorado, occurred in Fire Condition Class 3 lands. More than 20 homes were lost in this unwanted wildland fire.

Figure 23

Risk to People, Private Property, and Communities

Increased Suppression Forces Only Treat Symptom

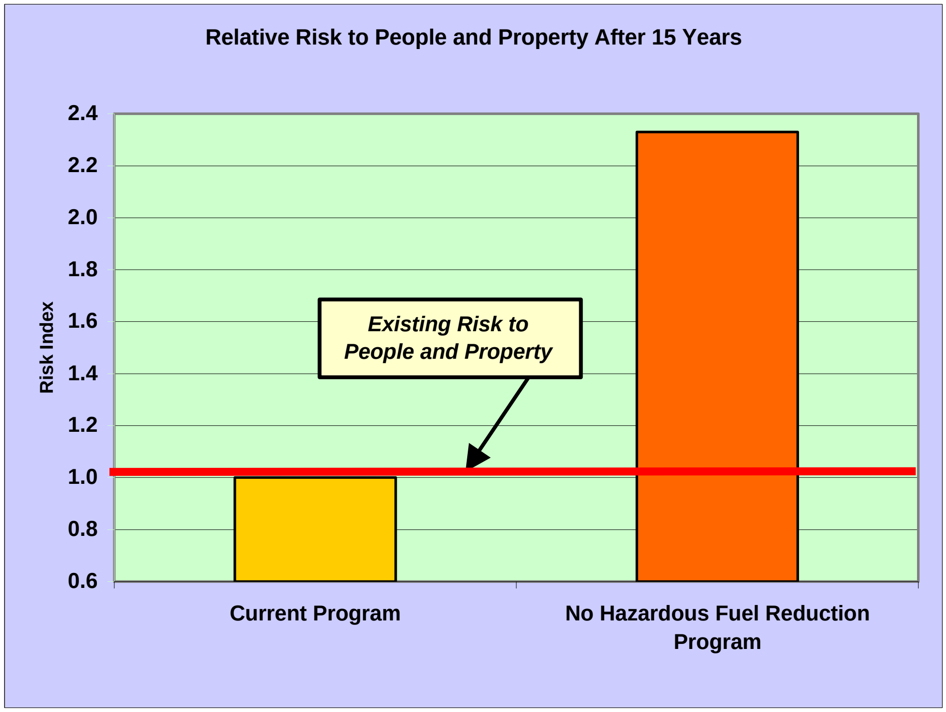
As human populations continue to expand into and adjacent to wildland ecosystems, they will have broad impacts, threatening: species viability, watershed health, historic properties, cultural landscapes, and overall **ecosystem integrity**. This situation is exacerbated by fuel accumulations when wildland fires are suppressed to protect homes, human development, and societal values.

While increased suppression forces may provide additional protection to high-value areas during the short term, they treat only the symptom, not the problem. Allowing fuel to accumulate presents an ever-increasing need for suppression forces. Furthermore, at very high fuel loadings, fire behavior overwhelms even the best fire suppression efforts. Under extreme conditions, control of wildland fire becomes solely dependent on relief in weather or on large fuel breaks. Therefore, regulating fuel to manageable levels that leave ecosystems intact provides the only viable, long-term solution.

Creating Defensible Space

Homes with high susceptibility to ignition characteristics—such as firewood stacked directly beside them, roofs made with wood-shakes, or pine needle accumulations on roofs and in yards—frequently incur more severe fire damage. Research suggests that removing hazardous fuel within 200 feet of structures can reduce their susceptibility to ignition and provide a measure of increased protection.

While such localized, intense treatment and protection measures provide "defensible space" and greatly reduce the potential for individual structures to ignite, fuel treatments are also needed to limit fire spread between communities and their adjacent wildlands.



Risk to People and Property

Under the current program, risk to people and property would no longer increase.

If the current program were terminated: the risk to people and property would become more than twice as high in 15 years; and catastrophic loss of homes and other community assets would be substantially higher than those incurred in recent years.

Figure 24

Both the Department of the Interior and the USDA Forest Service are providing funding through Rural Fire Assistance, State Fire Assistance, and Rural Fire Protection grant programs to increase community awareness, purchase fire equipment, and take local actions to reduce fire risks, including fuel treatment. The National Research Council and the Federal Emergency Management Agency (FEMA) recognized wildland fires in California (1993) and Florida (1998) as among the defining natural disasters of the 1990s. The magnitude of these catastrophic fires was compared with the Northridge earthquake, Hurricane Andrew, and flooding of the Mississippi and Red rivers.

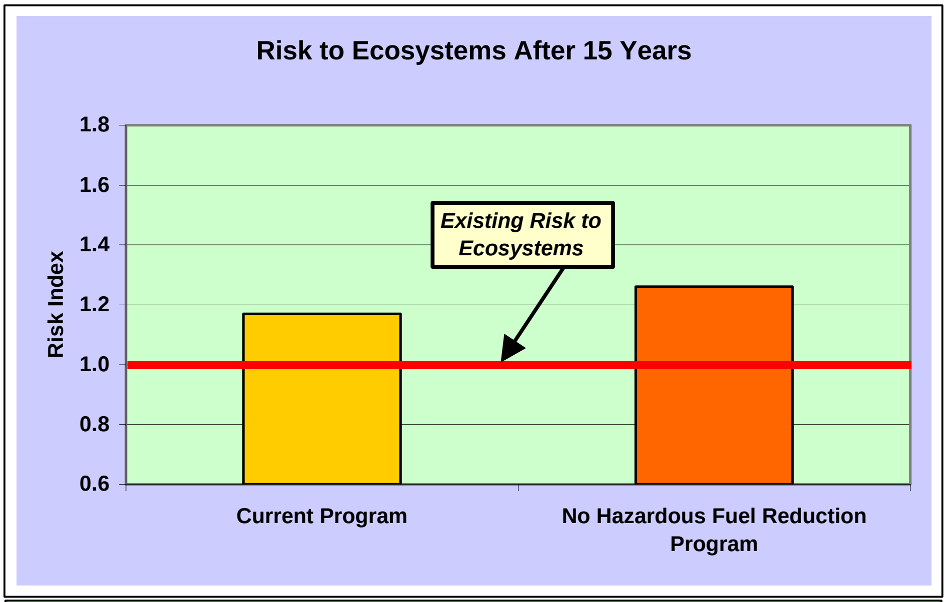
The 1991 Oakland, California fire was ranked by insurance claims as one of the ten most costly all-time national natural catastrophes. In the absence of a mitigation strategy, more wildland fire disasters of this scale can be expected. FEMA is emphasizing mitigation and prevention to State and local governments to address the growing losses from natural disasters such as hurricanes and flooding. The cohesive strategy complements the efforts to forestall these disaster-related costs and losses.

"Save the forest first. We can rebuild our houses."

Homeowners pleading with the Green Knoll Fire managers near Jackson, Wyoming in July 2001. These people wanted the inherent values outside their urban interface area to receive priority over their own—replaceable and rebuildable—houses.

Risk to Ecosystems

The Significance of Reducing Risks Outside the Wildland-Urban Interface



Risk to Ecosystems

Under the current program, risk to ecosystems would still be significantly greater than the current risk. Damage to key ecosystem components would continue to increase as efforts are focused to protect communities.

If the current program were eliminated, risk to ecosystems would increase to approximately 25% above current risk. Long-term damage to key ecosystem components such as water quality, soil, and habitat conditions would increase significantly over levels experienced in recent years.

Figure 25

The destruction of homes by wildland fire has swept through this country's headlines in recent years. At the same time, wildland fire-related damage to values outside the interface area can sometimes prove more vital to rural residents than their replaceable and rebuildable homes. Case in point: when the Green Knoll unwanted wildland fire threatened subdivisions near Jackson, Wyoming during the 2001 fire season, homeowners pled with fire managers to prioritize their suppression strategies to save the surrounding forests—rather than their homes. They said they could rebuild their homes, but not replace the value of the inherent wildland qualities.

These values that wildland-urban interface residents covet—as well as oftentimes depend on—include all the intrinsic, natural amenities and everything from timber and fisheries to wildlife and game animals (see *Fire-Sensitive Values Found Outside the Wildland-Urban Interface* on following page).

Most rural communities were located adjacent to natural resources and developed economies strongly based on these attributes. These communities' lifelines are buttressed by these natural resources, as well as by the perceived higher quality-of-life adjacent to these wildlands.

It is important to note that much of the natural resource base and the quality of life attributes actually exist *outside* the immediate vicinity of these communities (wildland-urban interface). Thus, unwanted wildland fire can adversely affect both natural resources and the non-commodity quality of life attributes associated with these communities. As echoed by the Jackson, Wyoming residents, allowing severe wildland fire to burn the resource base of these communities—their "quality of life setting"—can be as damaging to the existence of the community as the destruction of its buildings.

It is therefore important to develop and implement strategies that restore, maintain, and protect rural communities *and* their vitally significant adjacent ecosystems.

Fire-Sensitive Values Outside the Wildland-Urban Interface

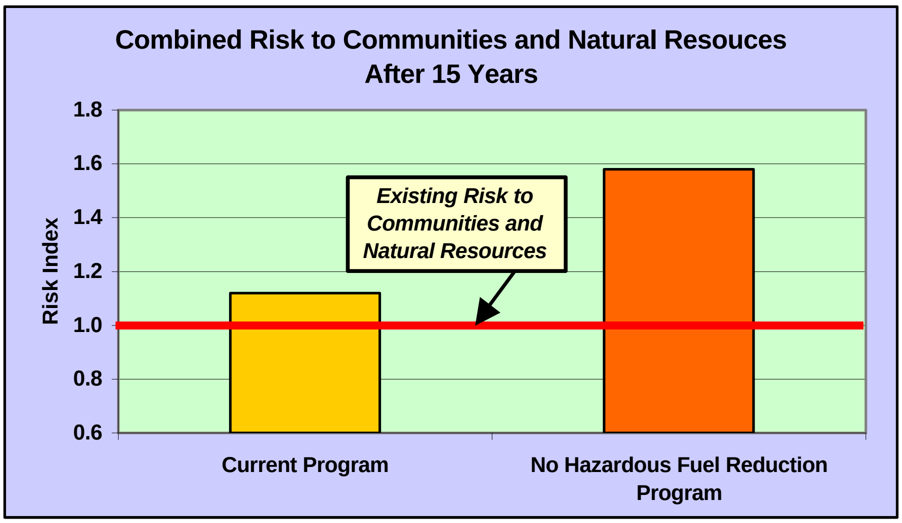
Economic

- Many rural communities require and rely on the natural resources of their surrounding wildlands. Many of these resources are direct commodities such as timber, mushrooms, nuts, berries, game animals, fisheries, and other harvestable products. Other resources are indirect such as livestock grazing of wildland grasses and shrubs that help produce beef and wool.

- It generally takes much less effort (greatly reduced cost) to suppress unwanted wildland fires in ecosystems maintained by prescribed fire or other treatments.

- The cost of restoring or maintaining an ecosystem through treatment activities is generally much less than the cost of suppressing a wildland fire and rehabilitating the land.

- Wildland fires disrupt rural community economies typically dependent on recreational values and other wildland amenities—especially when they occur during primary tourist seasons. In some cases, large, severe wildland fires can cause long-term economic disruption to recreation values.



Combined Risk to Communities and Natural Resources

Under the current program, the combined risk to communities and natural resources would still be greater than the current risk.

Without a hazardous fuels reduction program, the combined risk to communities and natural resources would increase to approximately 60% above current risk.

Losses of homes and other community assets and long-term damage to key ecosystem components such as water quality, soil, and habitat conditions would be significantly less than those experienced in recent years.

Figure 26

Quality-of-Life

- Many people live adjacent to rural areas because of the natural setting's amenities. These attributes include scenery, clean air, wildlife, and proximity to outdoor recreation sites (such as trails, campgrounds, ski areas).

- Critical communication infrastructure such as electronic sites and power transmission lines are often located outside the wildland-urban interface in areas vulnerable to unwanted wildland fire.

SENSE OF PLACE – Location serves as a prerequisite element associated with quality-of-life values—both within communities and for dwellings outside of defined communities.

Figure 27

Human Safety and Health

- Unwanted wildland fires can degrade water quality, decrease storage capacity, and jeopardize the physical structure of municipal watersheds.

- Dense smoke from unwanted wildland fire can create serious health problems in nearby communities and jeopardize highway safety.

- Large, severe wildland fires can create unsafe conditions for both firefighters and the public.

Cultural, Historical, and Tribal Resources

Unwanted wildland fires can damage or destroy:

- Irreplaceable cultural and historical resources, including prehistoric or historic districts, buildings, structures and sites listed—or eligible for inclusion—in the National Register of Historic Places.
- Tribal resources such as game habitat, ethnobotanical resources, sacred sites, and cultural districts.
- Native American artifacts such as petroglyphs, rock cairns, arrowheads, pottery and other objects.

Environmental

- Increased frequency of unwanted wildland fires can exacerbate the spread of non-native invasive plants.

  Unwanted wildland fires can damage or destroy:

    - Critical terrestrial habitat and species persistence, including threatened, endangered or other special status plant and animal species.
    - Watershed integrity, water quality, and riparian and aquatic habitat for threatened, endangered or other special status plant, animal, or other special status aquatic species.
    - Soils and site stability and productivity through erosion—oftentimes long-lasting and, within some ecosystems, irretrievable.
    - Severe, unwanted wildland fire can cause long-term site degradation that compromises site productivity and ecological integrity that can continue for decades.

Risk to Air Quality

Smoke and Public Safety

In fire-adapted ecosystems adjacent to human communities, concerns for public health often compete with concerns for public and firefighter safety. Stagnant atmospheric conditions during the late summer and early fall often inhibit smoke dispersal from wildland fires.

There is also a risk of prescribed fire impacting the human health standards of the Clean Air Act. Emissions from prescribed fires, however, can be managed by carefully distributing fire over time and space and aligned with appropriate weather conditions. Additionally, non-fire fuel reduction or spatial alteration may further reduce these potential negative impacts.

To reduce particulate emissions, this cohesive strategy advocates mechanical thinning in the appropriate locations prior to, or in lieu of, prescribed burning. Current regulatory policies count prescribed fire emissions in measuring air quality. They do not, however, include wildland fire emissions. Constraining prescribed fire use in fire-adapted ecosystems to ensure public health may inadvertently increase risks to human health and safety from unwanted wildland fire.

In 1977 and 1987, southern Oregon and northern California experienced long term, unhealthy smoke concentrations. Similarly, the following wildland fires all caused prolonged exposure of unhealthy smoke levels to communities:

- The 2000 Valley Complex and other fires in western Montana and eastern Idaho that year.
- The 1999 Big Bar Fire Complex in northern California.
- The 1994 wildfires in Wenatchee, Washington.

This strategy would help reduce the likelihood of these prolonged smoke events.

V PRIORITIES AND IMPLEMENTATION ELEMENTS

"Treating all fuels across an entire landscape is practically impossible…With all the limitations on treatment location and continuity of treatments across a landscape, it is logical to address how the spatial arrangement of treatment units affects [their efficacy]."

Mark A. Finney, Research Forester
Rocky Mountain Research Station, USDA Forest Service

Priorities

The cohesive strategy does not propose to treat all acres, nor eliminate all risks. Strategic patterning and sequencing of treatments can substantially reduce risk to priority areas while minimizing environmental disturbance and treatment cost. The strategy establishes priorities that can be used to effectively distribute hazardous fuel treatment funds. The prioritization procedure is intended to ensure that areas with the greatest risk to communities and ecosystems receive the greatest amount of funding. Specific criteria will be adjusted as coarse-scale fire risk data and community risk criteria are refined.

The prioritization process utilizes a three-tiered system in which the criteria become more specific moving from the national to the local level. Only at the local level can treatment decisions be made regarding whether to maintain healthy ecosystems or to restore degraded ecosystems when reducing hazardous fuels. Competition for funding between restoration and maintenance treatments will be resolved at the local level through prioritizing a combination of values to be protected on landscape and **subbasin** scales.

National Funding Prioritization

National-level funding to state and regional (Federal administrative designations) offices is prioritized to areas with the greatest:

1. **Risk to Communities**
   Populated areas in close proximity to high risk Federal lands (those with significant fire history and fuel hazard) identified and ranked by the states and prioritized on an interagency basis—considering public support, partnerships, and other collaborations.

   Fire History Criteria
   On Federal lands, the sum of: acres burned by wildland fire, acres treated to reduce hazardous fuel, and acres of fire rehabilitation treatment.

   Fuel Hazard Criteria
   On Federal Lands, departure from both historical fuel conditions and fire occurrence in fire regimes I, II and III within each state or region. (*The concept of Fire Condition Class, while more appropriate, has not yet been sufficiently developed for this purpose. The cohesive strategy recommends a study to refine these data immediately.*)

2. **Risk to Ecosystems**
   High risk Federal lands (those with significant fire history and fuel hazard) as identified on an interagency basis.

   Fire History Criteria
   On Federal lands, the sum of: acres burned by wildland fire, acres treated to reduce hazardous fuel, and acres of fire rehabilitation treatment.

   Fuel Hazard Criteria
   On Federal Lands, departure from both historical fuel conditions and fire occurrence in fire regimes I, II and III within each state or region.

Regional Funding Prioritization

These priorities are the same as (previously listed) national priorities, with: additional considerations for quality interagency planning at the subbasin level, evidence of active community participation, and the development of partnerships and other collaborative efforts with stakeholders. Regional-level funding to local offices is based on:

1. **Risk to Communities**
   Populated areas in close proximity to high risk Federal lands (those with significant fire history and fuel hazard) identified and ranked by the states and prioritized on an interagency basis—considering public support, partnerships, and other collaborations.

   Fire History Criteria
   On Federal lands, the sum of: acres burned by wildland fire, acres treated to reduce hazardous fuel, and acres of fire rehabilitation treatment.

   Fuel Hazard Criteria
   On Federal Lands, departure from both historical fuel conditions and fire occurrence in fire regimes I, II and III within each field unit.

2. **Risk to Ecosystems**
   High risk Federal lands (those with significant fire history and fuel hazard) based on subbasin prioritization as identified on an interagency basis, considering public support, partnerships, and other collaborations.

   Fire History Criteria:
   On Federal lands, the sum of: acres burned by wildland fire, acres treated to reduce hazardous fuel, and acres of fire rehabilitation treatment.

   Fuel Hazard Criteria
   On Federal Lands, departure from both historical fuel conditions and fire occurrence in fire regimes I, II and III within each field unit.

Local Priority Considerations

Agency land use and fire management plans will reflect priorities based on collaboration with all affected stakeholders. Until these plans are updated, local agency administrators will establish priorities through collaboration with the appropriate representatives of Federal, State, and Tribal governments and other stakeholders.

These local priority considerations will include but not be limited to:

- Benefits that extend beyond treatment areas (strategic location and treatment patterns that provide benefits over a much larger area than just the acres actually treated).

- The potential for unwanted wildland fire to cause irreversible damage to ecosystems or historical and cultural resources.

- Projects that span multiple agency and ownership boundaries with broad interagency and public ownership and—to enable the leveraging of funds—include interagency and community participation.

Implementation Elements – Social, Institutional, Program Management

It is not enough to establish priorities. These priorities must also be woven into the social, institutional, and program management aspects of the Federal wildland management agencies.

Three key elements, Social, Institutional, and Program Management, support the strategy's implementation by strengthening Federal accountability and commitment to working with affected stakeholders at all levels. These elements also reiterate the ideals outlined in the *National Fire Plan* and the *Federal Wildland Fire Management Policy*.

I Social

These elements provide and enhance public understanding, acceptance, support, and participation of the implementation of this strategy.

- Expand interagency public education programs with emphasis on: the role of fire in ecosystem sustainability, wildland fire risks in rural communities, and collaborative strategies for reducing the risk to both people and communities living in fire-prone ecosystems.
- Promote firewise planning, zoning, and building requirements, and encourage local governments to reduce hazards on their lands and in their communites.
- Encourage landowners to redeem their responsibility for mitigating hazards on private lands.
- Strengthen rural economic sustainability and provide opportunities to diversify local economies through:
    - The use of local labor and contracting sources for fuel treatments, restoration, and rehabilitation work.
    - The development and expansion of local markets for traditionally underutilized wood, other **biomass** products, and other commodities, and the storage of native seeds and plant materials.

II Institutional

These elements ensure that the specific agencies embrace this cohesive strategy and elevate the significance of its implementation equally at all levels: local, national, and regional. They also ensure accountability.

- Establish consistent Federal agency monitoring, evaluation and reporting standards and measures for protection, restoration, maintenance, and rehabilitation actions and activities.
- Enhance the integration and cohesion of fire and resource management programs and initiatives both within and across the Department of the Interior bureaus, USDA Forest Service, and other appropriate Federal agencies (such as the Environmental Protection Agency).
- Ensure that all land management activities (forest and range management, wildlife habitat enhancement, watershed restoration, recreation development, etc.) are planned and implemented in a way that reduces hazardous fuel or, at a minimum, does not degrade fire condition class.
- Establish objective assessment procedures that integrate considerations of current ecosystem condition, the probability of degradation from disturbance events, and alternatives to reduce risk or to improve conditions.

III Program Management

Successful program management must include collaboration with State, Tribes, and local governments, other Federal agencies and stakeholders in planning and implementation of this cohesive strategy. In addition, integration of internal agency programs is critical to long-term success of the strategy. Collaboration and integration are critical for:

- Identification of community values and key ecosystem elements threatened by unwanted wildland fire.
- Prioritization of risk reduction and ecosystem restoration needs and establishing accountability measures.
- Project selection, implementation, monitoring, evaluation, and program review.
- Improvement of post-fire rehabilitation and restoration techniques.
- Identification of research needs related to hazard reduction and ecosystem restoration and maintenance.

Measuring Success

While National-scale success from the implementation of the cohesive strategy will take several years to be realized, localized benefits will begin to accrue as soon as hazardous fuel treatments are applied. Annual assessments of change in land condition (Fire Condition Class) from the previous year will determine to what degree the strategy's goal *"to coordinate a sound, collaborative approach for reducing wildland fire risk to communities, and to restore and maintain land health within fire-prone areas"* is achieved.

Specific goals, outcomes, and measures of success in managing hazardous fuels and restoring ecosystems were developed in *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan,* (May 2002). The following, excerpted from the *Implementation Plan*, will be applied to evaluate agency administrator performance and to measure the effectiveness of the cohesive strategy's implementation.

Reduce Hazardous Fuels

Implementation Outcome

Hazardous fuels are treated, using appropriate tools, to reduce the risk of unplanned and unwanted wildland fire to communities and to the environment.

Performance Measures

a) Number of acres treated that are 1) in the Wildland Urban Interface or 2) in condition classes 2 or 3 in fire regimes 1, 2, or 3 outside the wildland urban interface, and are identified as high priority through collaboration consistent with the Implementation Plan, in total, and as a percent of all acres treated.

b) Number of acres treated per million dollars gross investment in Performance Measures "a-1" and "a-2" (above) respectively.

c) Percent of prescribed fires conducted consistent with all Federal, State, Tribal and local smoke management requirements.

Restore Fire-adapted Ecosystems

Implementation Outcome

Fire-adapted ecosystems are restored, rehabilitated and maintained, using appropriate tools, in a manner that will provide sustainable environmental, social, and economic benefits.

Performance Measures

a) Number of acres in fire regimes 1, 2, or 3 move to a better condition class, that were identified as high priority through collaboration consistent with the Implementation Plan, in total, and as a percent of total acres treated.

b) Percent of areas degraded by wildland fire with post-fire treatments underway, completed, and monitored.

c) Number of acres in Performance Measure "a" (above) moved to a better condition class per million dollars of gross investment.

VI NEXT STEPS AND CONCLUSIONS

"Earth does have a fire problem, but it is one of maldistribution. There is too much of the wrong kind of fire in the wrong places at the wrong times, and not enough of the right kind of fire at the right places at the right times."

Dr. Stephen Pyne
World Fire: The Culture of Fire on Earth

An Ambitious Fuel Treatment Program is Needed

As part of land management stewardship responsibilities, a sound, permanent, long-term, ambitious fuel treatment program is needed to realistically achieve the goal of stopping the increase in unwanted wildland fire risk to both communities and the environment. This will be accomplished by fully coordinating fuel treatment program capabilities and active forest and rangeland management, including thinning that produces commercial or pre-commercial products, biomass removal and utilization, prescribed fire and other fuels reduction tools to simultaneously meet long-term ecological, economic, and community objectives.

Social, political, and economic forces have influenced wildland fire management in the past and will continue to do so in the future. The key to this cohesive strategy's success is ensuring that these same forces steer wildland fire management into a future in which healthy land reduces the risks of unwanted wildland fire.

Next Steps

This cohesive strategy provides the guidelines for a step-by-step, iterative approach to restoring ecosystems and protecting human values. The coarse-scale assessments currently available that establish the basis for the strategy will be refined as finer-scale data become available. More accurate assessments, integrated planning processes, public input, and collaboration with other agencies, are all included in the work ahead.

The support of the Joint Fire Sciences Program will influence the ability to manage these ecosystems and provide the appropriate research necessary to improve an enhanced understanding of economic benefits and consequences, social sciences, and ecological interactions.

Specific Actions to be Addressed

- Through funding priorities, encourage multi-agency (Federal, State, Tribal, local) fuel treatment program/project planning at the subbasin or watershed scale.
- Evaluate the cumulative effects of treating—or lack of treating—fuel across spatial scales appropriate to the management of key ecological and human resources.

- Treatments such as mechanical thinning must be considered prior to—or in lieu of—fire use when unacceptable risk is present, and to promote forest products and biomass utilization as encouraged by the National Energy Policy. Opportunities to increase biomass energy production should be considered as land management plans are revised.
- Explore options to sell forest products and biomass to offset the cost of fuel treatments.
- Complete and improve wildland fire risk assessments at the subbasin scale.
- Continue to refine criteria and acquire additional data to improve overall, interdisciplinary risk assessment. Incorporate outcomes to prioritize treatment areas at the local level. Seek funding for a uniform, national refinement of the fire regime condition class coarse-scale analysis.
- Develop organizational incentives for improving the integration of fire management and other resource management programs to ensure that all resource management planning will consider the impacts of management activities on condition classes.
- Accelerate a collaborative fuel treatment selection process to select projects in advance of the fiscal year in which they are funded.
- Utilize techniques that identify strategic patterns, arrangements, and sequencing of fuel treatments to most effectively achieve risk reduction while immediately mitigating the potential threat to human communities.
- Identify and strengthen technical assistance that federal, state, tribal and local governments can offer to conduct planning, assessments, environmental analyses, clearances, and consultation necessary to implement fire protection, restoration projects, and emergency rehabilitation.
- Sanction or contract for a third party cost benefit analysis of Federal agency fuel treatment programs to address short and long term economic, social, and ecosystem effects of fuel treatment investments. Include fuel treatment program, fire preparedness and suppression, emergency post-fire stabilization, and restoration costs, as well as natural resource, commodity, social and community, and ecosystem impacts.

What Happens If We Do Nothing?

The cohesive strategy provides a process for establishing a national fuel treatment program. In doing so, it promotes a framework of action for coordinating a collaborative approach for reducing wildland fire risk to communities, and for restoring and maintaining land health within fire-prone areas.

However, if no action for achieving the cohesive strategy's goals and objectives is implemented at this time, the impacts to the Country's ecosystems and human values—to the American people and their communities—could be devastating. There's no question that the cohesive strategy directly addresses the wise concerns voiced below.

> *"Letting nature take its course implies a willingness to accept the consequences of catastrophic fire. Are we willing to accept the ecological consequences of huge, unusually severe fires? We can't restore the* [ecosystems] *that were here 150 years ago, but we can restore the natural processes that created them."*
>
> Dr. Steve Arno, Retired Research Forester

> *"The real challenge for fire managers and fire ecologists is in designing the fire regimes of the future. We know that nature will define a fire regime for us. We also know that we will have a social demand placed on us to exclude* [catastrophic fire] *in many places…Fire will always be here."*
>
> R. Gordon Schmidt, Retired Fire Analyst

Conclusion –We Need to Take Action Now

Nationally, the scale and distribution of unwanted wildland fires will likely continue to escalate until hazardous fuel has been treated across considerable portions of the landscape.

By focusing efforts, measurable and noticeable results can be achieved at the local and subbasin levels, even though they might not be noticeable at the national scale. In addition, subbasin reviews and landscape-scale project planning can:

- More effectively identify fuel treatment priorities across ownerships and integrate multiple resource objectives within project areas.
- Establish a logical sequence of treatments that minimizes risks to adjacent resources and communities.

Fuel treatments should be strategically patterned to provide increased efficiency and effectiveness. Furthermore, to most effectively reduce risk to ecosystems at any budget level, a mix of both restorative and maintenance treatments are needed.

Because wildland fire often impacts the community and the larger ecosystem on which the community depends, management programs that include treatments in both of these areas will likely be more successful.

VII ACKNOWLEDGMENTS

The Cohesive Strategy Team is indebted to and would like to recognize the substantive efforts of the individuals on the two teams who prepared:

The USDA Forest Service's *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy* (October 2000).

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The Department of the Interior's *Integrating Fire and Natural Resource Management – A Cohesive Strategy for Protecting People By Restoring Land Health* (In Final Draft August 2001).

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Washington Office, USDA Forest Service

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X GLOSSARY

Adaptive Management
A type of natural resource management in which decisions are made as part of an ongoing process. Adaptive management combines planning, implementing, monitoring, research, evaluating, and incorporating new knowledge into management approaches based on scientific findings and the needs of society. Results are used to modify future management methods and policy.

Biodiversity
The variety of life forms and processes including complexity of species, communities, gene pools, and ecological functions.

Biomass (Biomass Residue)
Organic matter that can be used to provide heat, make fuel, and generate electricity. Wood, the largest source of biomass, has been used to provide heat for thousands of years. Other sources of biomass include plants and residue from forestry.

Ecosystem
A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and components of any part of the natural environment within its boundaries. An ecosystem can be of any size—a log, pond, field, forest, range or grassland, or even the earth's biosphere. *(Society of American Foresters, 1998.)*

Ecosystem Composition
The mix of different species that comprise plant and animal communities and their relative abundance in a given area.

Ecosystem Function
The process through which the constituent living and nonliving elements of ecosystems change and interact, including biogeochemical processes and succession.

Ecosystem Health
A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, allowing goals for uses, values, and services of the ecosystem to be met.

Ecosystem/Ecological Integrity
The completeness of an ecosystem that at multiple geographic and temporal scales maintains its characteristic diversity of biological and physical components, spatial patterns, structure, and functional processes within its approximate range of historic variability. These processes include: disturbance regimes, nutrient cycling, hydrologic functions, vegetation succession, and species adaptation and evolution. Ecosystems with integrity are resilient and sustainable.

Ecosystem Process
The actions or events that link organisms and their environment, such as predation, mutualism, successional development, nutrient cycling, carbon sequestration, primary productivity, and decay. Natural disturbance processes often occur with some periodicity *(From Webster's dictionary, adapted to ecology).*

Ecosystem Resilience
The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages.

Ecosystem Restoration
Comprehensive actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling the system to resume acting, or continue to act, following the effects of a disturbance. Restoration management activities can be active (such as control of invasive species or thinning of over-dense tree stands) or more passive (more restrictive, hands-off management direction that is primarily conservation oriented). Frequently, a combination or number of actions are used sequentially to achieve restoration goals.

Ecosystem Structure
Stage of vegetation community development that is classified on the dominant processes of growth, development, competition, and mortality.

Fire-Adapted Ecosystem
An ecosystem with the ability to survive and regenerate in a fire-prone environment.

Fire Condition Class
Fire Condition Classes categorize and describe vegetation composition and structure conditions that currently exist within the Fire Regime Groups, compared to natural potential vegetation types. These three classes serve as generalized wildfire risk rankings—based on the coarse-scale data. The risk components from unwanted wildland fire increases from Fire Condition Class 1 (lowest risk) to Fire Condition Class 3 (highest risk).

Fire Cycle
Length of time necessary for an area to burn.

Fire Frequency (Fire Return Interval)
How often fire burns a given area; often expressed in terms of fire return intervals (e.g., fire returns to a site every 5-15 years).

Fire Intensity
Expression commonly used to describe the power of wildland fires. As used in this cohesive strategy report, the rate of energy release per unit length of the fire-front.

Fire-Prone Ecosystem
Any ecosystem subject to wildland fire.

Fire Regime Group
A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration and scale (patch size), as well as regularity or variability.

Fire Severity
A qualitative measure of the fire's immediate effects on the ecosystem. Relates to the extent of mortality and survival of plant and animal life—both above and below ground—and to loss of organic matter.

Hazardous Fuel
Excessive live or dead wildland fuel accumulations that increase the potential for uncharacteristically intense wildland fire and decrease the capability to protect life, property, and natural resources.

Interagency Wildland Fire Policy
The Federal Wildland Fire Management Policy and Program Review was chartered by the Secretaries of the Interior and Agriculture to ensure that Federal policies are uniform and programs are cooperative and cohesive. For the first time, one set of Federal fire policies will enhance effective and efficient operations across administrative boundaries to improve the capability to meet challenges posed by current wildland fire conditions.

The policy review team reexamined the role of fire in ecological processes and the costs associated with fighting fire. An interagency product has resulted in changes in terminology, funding, agency policy, and analysis of ecological processes.

Landscape
An area composed of interacting and inter-connected patterns of habitats (ecosystems) that are repeated because of the geology, landform, soils, climate, biota, and human influences throughout the area. Landscape structure is formed by patches (tree stands or sites), connections (corridors and linkages), and the matrix. Landscape function is based on disturbance events, successional development of landscape structure, and flows of energy and nutrients through the structure of the landscape. A landscape is composed of watersheds and smaller ecosystems. It is the building block of biotic provinces and regions.

Landscape Level
A watershed or series of interacting watersheds or other natural biophysical (ecological) units, within the larger land management planning areas. This term is used for conservation planning and is not associated with visual landscape management and "viewscape" management.

Prescribed Fire
Any fire ignited by management actions to meet specific objectives. All prescribed fires are conducted in accordance with approved prescribed fire plans.

Restoration
In the context of this cohesive strategy, restoration means the return of an ecosystem or habitat toward: its original structure, natural complement of species, and natural functions or ecological processes.

Risk
The probability that potential harm or undesirable consequences will be realized.

Risk to Communities
The risk associated with adverse impacts to communities resulting from unwanted wildland fire.

Risk to Environment
The risk associated with loosing key ecosystem components from unwanted wildland fire.

Short Interval Fire-Adapted Ecosystems
Those plant and animal communities that depend on frequently occurring wildland fires to cycle nutrients, control pathogens, maintain species composition, population, and distribution in healthy resilient conditions across broad landscapes.

Slash
Concentrations of downed fuel (forest and other vegetation) resulting from natural events such as wind, fire, or snow breakage; or human activities such as logging and road construction.

Subbasin
A drainage area of approximately 800 thousand to one million acres, equivalent to a fourth-field Hydrologic Unit Code (HUC).

Sustainability
Meeting the needs of the current generation without compromising the ability of future generations to meet their needs. Ecological sustainability entails maintaining the composition, structure and processes of a system, as well as species diversity and ecological productivity. The core element of sustainability is that it is future-oriented. (*Committee of Scientists Report, 1999.*)

Uncharacteristic Wildfire Effects
An increase in wildfire size, severity and resistance to control, and the associated impact to people and property, compared to that which occurred in the native system.

Unwanted Wildland Fire
Any wildland fire in an undesirable location or season, or burning at an undesirable intensity, spread rate or direction. Also known as *catastrophic, severe, uncharacteristically severe,* or *damaging.*

Viewshed
The landscape that can be directly seen from one or more viewpoints or transportation corridor which has inherent scenic qualities or aesthetic values as determined by those who view it.

Watershed
1) The region draining into a river, river system, or body of water. 2) A watershed also refers specifically to a drainage area of approximately 50 to 100 thousand acres, equivalent to a fifth-field Hydrologic Unit Code (HUC). Watersheds are nested within subbasins.

Wildland Fire
Any fire burning in wildland fuels that is not a prescribed fire.

Wildland Fire Use or Wildland Fire for Resource Benefit.
The management of naturally ignited wildland fires to accomplish specific, pre-stated resource management objectives, in pre-defined geographic areas and conditions as approved in Fire Management Plans

Wildland-Urban Interface
The line, area, or zone, where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.

XI APPENDIX
LEGAL BASIS FOR SUSTAINABILITY

Legal Basis for Sustainability

A suite of laws and regulations guide Federal agencies as they manage lands under their stewardship. Some laws affect the work of all Federal wildland agencies.

Clean Air Act

"... to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population."

Clean Water Act

"...The objective…is to restore and maintain the chemical, physical, and biological integrity of the nation's waters."

Endangered Species Act

"The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved…"

Federal Land Policy and Management Act

"The Congress declares that it is the policy of the United States that ... The public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air, and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use."

National Environmental Policy Act

"Creation and maintenance of conditions under which man and nature can exist in productive harmony."

National Indian Forest Resources Management Act of 1990

"Indian forest land management activities undertaken by the Secretary of the Interior shall be designed to achieve... the development, maintenance, and enhancement of Indian forest land in a perpetually productive state in accordance with the principles of sustained yield and with the standards and objectives set forth in forest management plans..."

National Wildlife Refuge System Improvement Act of 1997

"The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

National Historic Preservation Act

"…The historical and cultural foundations of the nation should be preserved as a living part of our community life and development to give a sense of orientation to the American people."