The National Cohesive Wildland Fire Management Strategy and Risk Analysis – Phase III Report

Report of the Cohesive Strategy Subcommittee

Draft Version: August 2, 2013

Resilient Landscapes

Fire Adapted Communities

Wildfire Response

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EXECUTIVE SUMMARY

NOTE: The CSSC plans to complete this section after WFEC review and comments. Thoughts for this section include a synopsis of next steps and conclusions, a focus on the policy option areas of emphasis, and ongoing efforts to address barriers and critical success factors.

SECTION A: INTRODUCTION

Purpose

The National Risk Analysis Report is the third national report of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy). This Phase III report, in conjunction with the National Action Plan to be released in early 2014, represents the culmination of more than three years of effort in developing an innovative national approach to address the increasingly complex reality of wildland fire management in the United States. The intent of this report is to develop a comprehensive, science-based cohesive strategy which addresses the significant, long-standing challenges to managing the ever-growing wildfire situation facing this Nation.

These major challenges include:

- **Threats to Healthy Landscapes:** Declining forest and rangeland health associated with the exclusion of periodic fires due to decades of aggressive wildfire suppression, and lack of active management of wildland fuels across the national landscape, have significantly contributed to a decline in fire resilient ecosystems, an increase in wildfire burn severity, and the increasing risk of destructive wildfires which damage landscapes and threaten associated communities. This threat is further exacerbated by climatic changes, insect and disease outbreaks, and the expansion of invasive species.

- **Threat of Wildfire to Communities:** Prevention and suppression of all wildfires is not always possible. Much of the public, especially those living in or near fire-prone communities, generally have not recognized or accepted the need to assume primary responsibility for making their individual properties fire-resistant.

- **Risk to Public and Firefighter Safety:** Public and firefighter safety must always take precedence over property and resource loss. Increasing trends in the size of large wildfires, their intensity, and the growth and complexity of the wildland-urban interface and intermix continue to present obstacles to protecting life and property.

The purpose of this report is to provide stakeholders across the nation a platform for devising a shared strategy that will guide decision-making to best use ecological, social and economic resources to prepare for, respond to, and recover from inevitable wildland fires.

The Cohesive Strategy is unprecedented in its focus on initiating dialogue and collaboration on a national scale. The Cohesive Strategy differs from previous fire strategies by taking an

"all lands" view of wildland fire management. Wildfire recognizes no boundaries – neither ownership lines, nor jurisdictional borders. Policymakers must take a landscape-level approach and work across boundaries to implement effective management techniques. And interested stakeholders must be involved, including those who own the land, those who use the land, and those who manage the land.

National wildfire challenges or issues play out in the areas of policy, decision, science, and collaboration. Issues in any one of these areas might create a challenge to successful resolution. A successful national strategy will need to consider current policies, decision-making and collaboration processes, and available science information and proven professional practices. Understanding policy options that facilitate actions to reduce wildfire risk and overcome barriers that prevent effective actions is an important part of developing a national strategy. Understanding roles, responsibilities, and decision-making from national levels to on-the-ground decisions need to be considered. It is also important that all stakeholders collaborate to understand risks and contribute to implementing actions at all levels.

The facilitated decision making process and powerful data-driven modeling system being developed to support the Cohesive Strategy utilizes stakeholder and expert input to demonstrate impacts and tradeoffs around implementation strategy. The information generated as part of this process can be utilized to inform decisions and suggest management options tailored to meet identified needs. The modeling system for landscape, social and fire analysis will continue to be used into the future.

Background

The Cohesive Strategy was developed in response to growing concern over mounting annual costs of fighting wildfires and devastating wildland fire losses to communities and values at risk. As early as 1999, and in published documents since that time, the U.S. General Accountability Office (GAO) called for the development of a cohesive strategy to address destructive wildfire threats. In 2009, Congress passed the Federal Land Assistance and Enhancement Act (FLAME Act), which authorized a supplemental funding source for federal emergency wildland fire suppression.

In addition, the FLAME Act directs the U.S. Department of Agriculture (USDA) and the Department of the Interior (DOI) to develop a national cohesive wildland fire management strategy to comprehensively address wildland fire management in the United States. Specifically, the Act describes seven needs for the future of fire management: identification of the most cost-effective way to allocate the fire management budget; reinvestment in non-fire programs; appropriate management response to wildfires; assessing communities

level of risk; hazardous fuels monies allocated on a priority basis; impact of climate change on frequency and severity of wildfires; and effects of invasive species on wildfire risk. All three phases of the Cohesive Strategy and the analysis conducted as part of Phase III support each element of the FLAME Act and help to illuminate issues and complexities involved in wildland fire management using a wealth of methods, data and analytical techniques.

The Cohesive Strategy acknowledges the reality that fire is a natural process necessary for the maintenance of many ecosystems, and focuses on attempting to reduce the conflict between fire-prone landscapes and people. By simultaneously considering the role of fire in the landscape, the ability of humans to plan for and adapt to living with fire, and the need to be prepared to respond to fire when it occurs, the Cohesive Strategy takes a holistic approach to wildland fire.

The Cohesive Strategy has been developed in three phases. It is important to understand that the completion of each phase of the Cohesive Strategy is a separate milestone, but the Cohesive Strategy is a national, iterative process that will continue into the future. In Phase I the Wildland Fire Leadership Council (WFLC) adopted a vision for the next century:

> *To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a nation, live with wildland fire.*

Also during Phase I, stakeholders met to collaboratively develop national goals, identify broad performance measures, and establish the guiding principles of the Cohesive Strategy. Three primary factors were identified as presenting the greatest challenges and the greatest opportunities for making a positive difference in addressing wildland fire problems in order to achieve the vision stated above. These three primary factors have become the goals of the Cohesive Strategy:

> **Restore and maintain landscapes**: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
>
> **Fire adapted communities**: Human populations and infrastructure can withstand a wildfire without loss of life and property.
>
> **Wildfire response**: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

The policy options, strategies, and recommendations presented in this report are consistent with the following Guiding Principles of the National Cohesive Wildland Fire Management Strategy which were developed during Phase I:

- Reducing risk to firefighters and the public is the first priority in every fire management activity.
- Sound risk management is the foundation for all management activities.
- Actively manage the land to make it more resilient to disturbance, in accordance with management objectives.
- Improve and sustain both community and individual responsibilities to prepare for, respond to and recover from wildfire through capacity-building activities.
- Rigorous wildfire prevention programs are supported across all jurisdictions.
- Wildland fire, as an essential ecological process and natural change agent, may be incorporated into the planning process and wildfire response.
- Fire management decisions are based on the best available science, knowledge and experience, and used to evaluate risk versus gain.
- Local, state, tribal and federal agencies support one another with wildfire response, including engagement in collaborative planning and the decision-making processes that take into account all lands and recognize the interdependence and statutory responsibilities among jurisdictions.
- Where land and resource management objectives differ, prudent and safe actions must be taken through collaborative fire planning and suppression response to keep unwanted wildfires from spreading to adjacent jurisdictions.
- Safe aggressive initial attack is often the best suppression strategy to keep unwanted wildfires small and costs down.
- Fire management programs and activities are economically viable and commensurate with values to be protected, land and resource management objectives, and social and environmental quality considerations.

The Cohesive Strategy is unique compared to previous national wildfire policies and strategies, because it takes a more comprehensive approach to stakeholder involvement, integrates over 100 layers of information from applicable national data sources, uses an empirical analysis of all available data layers, and incorporates the three geographic regional perspectives, issues, and solutions early in its development. Work at this regional level began in Phase II of the strategy with the creation of the regional strategy committees (RSC). Each RSC – Northeast, Southeast and West – is comprised of a diverse group of

stakeholders, including wildland fire management agencies and organizations, land managers, and policy-making officials, representing all levels of government and non-governmental organizations. The RSCs conducted assessments, prioritized actions that were responsive to regional goals and identified regional challenges and opportunities for improved land and fire management, consistent with the stated goals of the strategy, and having a foundation in science.

Phase III serves as the conclusion of the development stage of the Cohesive Strategy. During the first part of Phase III, the National Science and Analysis Team (NSAT) worked with the regions to bring together data describing the wildland fire situation in each region. Using this information, the regions developed Regional Risk Analysis reports containing recommendations for moving toward the three Cohesive Strategy goals. This work was further refined in Regional Action Plans which describe the actions and tasks envisioned to implement the recommendations, including recommendations for agencies and other stakeholders to be involved in each action. These regional reports and action plans have been examined in this report to gain additional insights that contribute to a more comprehensive national perspective.

The second part of the Phase III process involves the analysis of data and the development of models useful to understand trade-offs at the national level. The work of the regions informs the analysis at the national level, which also includes an in-depth analysis of wildland fire issues and interrelationships among biophysical and socio-economic drivers, and the identification of broad policy options and mapping of areas of greatest potential.

More information on the Cohesive Strategy can be found on the website www.ForestsAndRangelands.gov, including the foundational national documents, Phase I and Phase II national and regional reports, and the Phase III Regional Risk Analysis Reports and Action Plans.

Expectations for the Future

The Cohesive Strategy brings together federal, tribal, state and local government agencies and non-governmental organizations, treating all as partners working toward agreed upon goals, with a new joint and holistic approach to decision-making. This new strategy considers the dynamic nature of national challenges, provides models that help determine priorities, and considers landscape-scale solutions that include all stakeholders. Therefore, the publication of the Phase III report is not the end of the Cohesive Strategy process; it is only the end of the planning phase of the strategy development. Implementation of the Cohesive Strategy by the diverse partners will continue through the decisions that are

made, informed by a scientific method, to effectively prepare for, utilize, and respond to wildland fire.

Success in achieving the three broad goals of the Cohesive Strategy is a long-term proposition – no single decision by policymakers or management action by land managers will solve the nation's complex wildland fire issues. The analysis conducted at the national level, as well as the National Action Plan that is in development, may impact the regional action plans. New information and methods of utilizing the information presented in this document will be combined with stakeholder feedback to update the regional plans, and an on-going process of adaptive management will be used to ensure that the regions employ policies that are working to reduce the risk of wildfire to landscapes and communities across the nation.

Implications for Policy

Through an iterative and collaborative process among stakeholders, the RSCs have assembled a comprehensive list of risks, issues, and recommendations for action within the Regional Risk Analysis Reports that help to inform this National Risk Analysis Report. As current levels of resources and funding likely are insufficient to fully implement all recommendations, the National Science and Analysis Team (NSAT) was asked to explore various potential national policy options for achieving the national goals of the Cohesive Strategy and to identify the trade-offs and risks inherent in each option. In conducting the national level trade-off analysis, the NSAT broadly interprets "policy options" as being strategic direction that would lead to greater or less emphasis on various mixes of management actions in different contexts and locations. The national analysis helps prioritize potential actions across the landscape, based on improved understanding of relevant environmental and social conditions. The analysis of each policy option and underlying data will be useful further deliberations among stakeholders, partners, agencies, and policy makers as decision processes move forward.

SECTION B. NATIONAL COMMUNICATIONS AND STAKEHOLDER ENGAGEMENT

Cohesive Strategy Communication

The development of the Cohesive Strategy forged a new path forward by building on successes of the past and incorporating a new collaborative approach to managing the complex national fire problem. This new approach includes all the partners involved in fire management and gives each a voice in addressing a collective problem. A true Cohesive Strategy must be inclusive and shaped by a shared vision. Relationships need to be strengthened and new ones built. Issues of trust and skepticism need to be recognized and overcome. It is important that stakeholder values and concerns are understood and reflected.

It was recognized early on that the human dimension must have equal weight with the physical, biological, and ecological dimensions of wildfire. Collaboration is the fundamental process used to build local, regional and national shared understandings, goals, and mutual trust necessary to undertake joint actions.

The National Communications Working Group developed a National Communication Framework to support development of the Cohesive Strategy. It provides communication guidance and support to agencies, organizations, stakeholders, and interested individuals involved in the Cohesive Strategy communications effort. The goals of the Framework include keeping people informed about the Cohesive Strategy, implementing communication processes that enhance and sustain collaboration among stakeholders, and guiding future communication efforts during Cohesive Strategy implementation.

During the Cohesive Strategy development process, the emphasis was on large-scale regional and national collaboration, engaging a highly diverse population of stakeholders. Regional and national dialog was promoted among stakeholders to help develop shared wildland fire understandings and goals, develop mutual trust agreement, and encourage commitment to work together toward implementation. Every attempt was made to engage a broad spectrum of stakeholders in Cohesive Strategy development and increase awareness and understanding of the Cohesive Strategy.

Regional Communication Plans to Implement the Cohesive Strategy

Cohesive Strategy Regional Action Plans of the three regions were analyzed by the National Communication Working Group to identify overarching themes, commonalities, and differences among the planned communication actions. Communication, Collaboration, Education, and Evidence-Based Implementation are the broad, common action themes identified by the regions. These themes are elaborated in greater detail in the three Regional Action Plans.

Communication

- All Regions will maintain a focus on continued stakeholder communications and outreach. Regions recognize the need to have a communication structure in place and to commit resources for this effort.

- Public and professional interests in wildland fire are highly diverse. A variety of communications are required to meet their needs.

Collaboration

All regions recognize the importance of expanding collaborative partnerships to facilitate action toward the regional goals. This requires the development of strategic partnerships to achieve the goals, as well as shared accountability for outcomes. Communities engaged in comprehensive wildfire risk reduction efforts must address a number of interrelated challenges in the areas of landscape resiliency, fire adapted communities, and wildfire response. Collaboration requires significant communication and negotiation among multiple public and private entities.

Education

Education is the third common element identified by the regions. Because many different stakeholders will implement the Cohesive Strategy, fire education is essential. The more collaborators know about fire, the more successful their efforts at collaboration will be. Although North American communities are famous for coming together to solve local problems, better understanding of the collaboration process will make those efforts more successful. Education programs, materials, and teachers need to be developed to deliver fire and collaboration education in the different regions.

Evidence-Based Implementation

The Cohesive Strategy is science-based and driven by data. Building and managing data systems, and securing and sustaining the needed data and information for use by local decision-makers, is a key component of Cohesive Strategy communications.

Distributed Communication and Education

The National Communications Working Group recognizes that the vast majority of communications about the Cohesive Strategy will originate with the many different stakeholder agencies and organizations. By contrast, a relatively small part will originate with the Cohesive Strategy communication organizations at the regional and national level. The regional and national communication organizations will succeed by supporting stakeholder communication and informing and joining in the formal and informal communication networks where the Cohesive Strategy is discussed.

Nationally, we are looking to collaboratives and other entities to support education and to disseminate information about the fundamentals of wildland fire knowledge and to spread shared understandings of what can and cannot be done to reduce wildfire risk. Stakeholders can provide learning opportunities where the different publics can explore the fundamentals of wildland fire, fire's ecological and social effects, and fire management. Educational institutions and others can deliver adult education in collaboration.

SECTION C - REGIONAL CONTEXT

In Phase III of the Cohesive Strategy, the three regions worked with practitioners and the NSAT to describe the wildfire situation in each region using bio-physical and socio-economic data. The overall findings from the three regional risk analysis reports will be briefly described here. For the full analyses, see the Phase III Regional Risk Analysis Reports posted in the reports library at www.forestsandrangelands.gov. The Risk Analysis Reports led to recommendations by the three regions for actions that should be taken at both the regional and national levels to effect the needed improvements to landscapes, communities, and fire response. All of the actions were vetted through regional practitioners and stakeholders, and are presented in the Action Plans with the full support of the Regional Strategy Committees. Actions were further refined, with specific tasks developed in the Regional Action Plans, and posted in the reports library at www.forestsandrangelands.gov.

The section below presents a brief synopsis of the wildland fire issues in each of the three regions. Each region is unique in its environments and its experience with wildland fire. Yet, there are issues that are common to the regions. Following the regional context descriptions, this section sets out the issues that are noted by two or more regions in their reports, making the issues national in scope, and barriers and critical success factors identified and prioritized by all three regions in Phase II.

Northeast Regional Context

The Northeast Region is comprised of diverse ecosystems; from prairie to pine, hardwoods to boreal forests, from coastal wetlands to mountains, displaying the full range of fire regimes across the region. Some of the most critically endangered ecosystems include grasslands, savannas, and pine barrens.

In the Northeast, the vast majority of land is in private ownership. Land uses and ownership patterns are complex, with many small holdings, and a diverse range of owner objectives. Public lands are often isolated among other land uses, including private and industrial forests and agricultural lands. Many public lands are managed for multiple uses.

The Northeast can be described in risk management terms as having a large number of small, mostly human-caused, wildfires with a low occurrence of large wildfires, but all these present a high risk to life and property when they do occur. The larger fires tend to occur in areas that contain more contiguous and undeveloped forested tracts of land. Many wildland fires can be fast moving, but are often contained within a single day. Most wildfires are human-caused; accidental fires and arson are the primary causes of fires in

the region. During the five year period, 2008-2012, the Northeast had an average of 21,083 wildfires reported per year, which burned an average of 135,591 acres each year (National Interagency Coordination Center, 2013).

The risk of wildfire increases as a result of natural events. Wind, ice, disease and insects can create large areas of downed timber and increased fuels (vegetation), leading to exacerbated wildfire conditions. All ecosystems can experience short and long-term wildfire hazards if these event fuels remain in place. The removal of event fuels before a wildfire is crucial as population continues to grow in forested areas, with homes and infrastructure in proximity to wildland fuels. These event fuels may also represent an economic opportunity to supply forest product needs, ranging from biomass to higher valued products.

In the Northeast Region, wildland fire management responsibilities are characterized by a patchwork of jurisdictions and ownership, and often more than one agency may be involved in the management of wildland fire incidents. Firefighter and public safety is of utmost concern at every level. Wildland fire management is the result of collaboration, partnerships, and cooperation among states, (interstate forest fire compacts), federal fire management agencies (e.g. The Forest Service (FS), Bureau of Indian Affairs (BIA), National Park Service (NPS), United States Fish and Wildlife Service (USFWS), tribal governments, and many local fire departments). State forestry agencies are typically the lead agency in wildfire suppression and have been mandated to suppress all wildfires. Maintaining or increasing the capacity of local fire departments to respond to wildfires is vital to augment state, federal, and tribal response needs. Most of the fire community is also vital to all hazard response in the Northeast. Effective integration of wildfire response training into all-hazard response trainings is critical to maintaining local response capability in the Northeast.

Homes and infrastructure are involved in a high percentage of wildfires in the region. Due to the heavy population and large proportion of landscape in the WUI/intermix, even small wildfires threaten structures, which increases the risk and complexity for firefighters. A proactive, collaborative approach to identifying risks in the WUI, combined with developing Community Wildfire Protection Plans (CWPPs), reducing hazardous fuels, treating event fuels, and educating the public in the context of managing fuels across a multi-jurisdictional, fragmented landscape will prepare communities for wildfire. The Northeast believes that focusing on preventing unwanted fires and increasing homeowner-shared responsibility will reduce firefighter risk and decrease the need for firefighting responses.

Southeast Regional Context

The Southeast region is comprised of thirteen states, stretching from the Atlantic seaboard west through Texas, including Puerto Rico and the U.S. Virgin Islands. The Southeast has many diverse fire-dependent ecosystems including: the Florida Everglades, coastal pine forests, Appalachian montane forests, and the grasslands of Texas. The Southeast wildfire problem is characterized by a year-round fire season, highly fragmented land ownership, an expansive WUI throughout much of the South and high population growth in WUI areas, high fuel loading, and a high number of unplanned ignitions. The majority of unplanned ignitions in the Southeast are human-caused. For the five year period of 2008-2012, the Southeast had an average of 38,582 wildfires reported each year, burning an average of 1,733,496 acres (National Interagency Coordination Center, 2013).

Approximately 89% of the burnable acres in the Southeast are privately owned by people with differing land use objectives. Landscape management requires a focus on collaboration between government and non-government agencies, individuals, and other interests.

Wildland fire is a key process in southern ecosystems to maintain resiliency, ecosystem health, wildlife habitat, and ecosystem services, as such as timber products and stable carbon storage. Southeast forest ecosystems have a frequent fire return interval due to the long growing season. Prescribed burning is a common practice to prevent the build-up of excessive fuel loads and manage for other benefits, such as wildlife habitat. In the past, the Southeastern fire and land management community has relied on cultural and historical acceptance of land management activities, including prescribed fire, to facilitate their implementation of appropriate management activities. New residents, however, are often unfamiliar with the use of fire as a valuable management tool. This population and an accompanying significant urbanized demographic shift, along with other factors, are creating new challenges for the fire management community.

The Southeast is experiencing rapid urbanization, leading to the development of many dense human communities located in landscapes that require frequent burning for hazardous fuel reduction and ecosystem maintenance. As the extent of the WUI increases, so does the potential for impacts from prescribed burning and wildfires. The mosaic of urban and wildlands compounds issues related to smoke, emissions release, liability, and the acceptance of fire by the general public. New residents need to be educated with respect to wildland fire, the use of prescribed burning, and effective land management of their own property to reduce wildland fire risk.

The diversity of ecosystems, land management goals, and landscapes across the Southeast means that a single solution will not work for everyone. Additionally, with nearly 90 percent of Southeastern land owned privately, decisions cannot be made at the state or regional level for the vast majority of landholdings. Instead, partners in the Cohesive Strategy may, moving forward, work collectively with land managers and landowners, using the best available information, to encourage and inform their decision-making process to help address issues and challenges related to wildland fire.

Western Regional Context

The West is comprised of diverse landscapes stretching from the great plains of Nebraska and Kansas to the Rocky Mountains to the Pacific coast and beyond, from the deserts of Arizona and New Mexico to the arctic tundra of Alaska, and including the state of Hawaii and the Pacific Island territories. Wildland fire management in the West is challenging due to a variety of factors including: steepness of terrain, access limitations, changing climate conditions, and invasive species. Many parts of the West are experiencing extended drought for more than a decade. Drought is one stressor that leads to increased wildfire threats. A stressed system or forest is more susceptible to infestations of insects, pathogens, and disease, which can kill vegetation, and in some areas of the West has left millions of acres of dead, standing trees. In the past five years, 2008-2012, the West had an average of 23, 091 reported wildfires, burning an annual average of 4,666,030 acres (National Interagency Coordination Center, 2013).

A century of widespread fire exclusion and the more recent severe reduction of active forest management have resulted in a build-up of surface fuels (downed wood, litter and duff) and the overstocking of forests with trees and ladder fuels. Large areas of western grasslands and fire-adapted forests are in need of restoration. The forest and rangeland health problems in the West are widespread and increasing, affecting wildlife habitat, water quality and quantity and long-term soil productivity, while providing conditions for uncharacteristically large, severe, and costly wildfires, with increasing threats to human life and property. Residents suffer from smoke in the air through much of the summer months, leading to health effects such as emphysema and heart disease. These environmental conditions, along with the effects of an expanding wildland urban interface (WUI) underlie four broad areas of risk: risk to firefighters and civilian safety, ecological risks, social risks, and economic risks.

Large blocks of publicly owned land characterize the West. Public lands comprise more than half the total land area. Fires that start on public lands and move out onto private land, threatening communities, are a major problem in the West. This is compounded by the scarce location of fire protection resources. Vast expanses of the West have less than one

fire station per 100 square miles. This leads to extended response times in rural areas - areas often characterized by federal ownership, steep slopes, beetle-killed trees, and poor road access.

Western stakeholders identified protection of the "middle ground", areas between communities and the more distant wildlands, as an important regional value. While they expressed concern over community protection, they also want middle ground areas protected from extreme wildfire events. The West needs large landscape scale changes in vegetative structure and fuel loadings to significantly alter wildfire behavior, reduce wildfire losses, ensure firefighter and public safety, and improve landscape resiliency. Active management of public and private land holdings is needed, with emphasis on federal forest management/harvesting and thinning operations to reduce hazardous fuels in and around communities and in the middle ground.

The West envisions expanding fire adapted communities work to speed up the development of fire adapted communities and to link them into a sub-regional communication and learning network. Fire adaptation is viewed as a continuum, with communities moving toward fire adaptation through concerted collaborative effort including: CWPPs, firewise communities, fuels treatments, the ready, set, go program, and many more activities at the community level. Fire adaptation is a continuous process that requires annual renewal of efforts to be prepared and to keep fuels at reduced levels. Communities need technical and financial support to continue to move closer to a fire adapted status.

Barriers and Critical Success Factors and Issues of National Concern

Representatives of the three regional strategy committees came together in Phase II to identify national priority barriers and critical success factors for improved landscape resiliency, fire adapted communities and improved fire response. Initially, there was a list of over 40 barriers/critical success factors. Through discussions between the regions, the CSSC, and the WFEC, a list of 11 were selected as being common to all regions and of significant importance to be addressed first.

The terms as used in this process are defined as:

Barriers – Must be removed in order for the Cohesive Strategy to be successful.

Critical Success Factors – Must be present for the Cohesive Strategy to be successful.

Each of the 11 barriers and critical success factors (CSF) that follow was selected by the RSCs as being the highest priority barriers/CSFs to be addressed in order to contribute to the successful implementation of the Cohesive Strategy.

1. **Increase Fuels Management on Private Land –** There is a need to increase private land management assistance to complement and implement broader fuel reduction management objectives across fire prone landscapes. Incentives for private landowners are needed to increase the fuels management on private lands. There is a need to integrate federal and state level fuels and prevention programs and provide fuels management incentives to mitigate undesired fire effects and property loss.

2. **Increase Fuels Management on Federal Land –** Need revised standardized guidance and direction for fuels treatments on federal land to enhance fire adapted communities and landscapes. Landscape scale restoration is often difficult to achieve due to the complex process requirements of federal laws, rules and policies. New interpretation and engagement with key partners can take advantage of flexibility that currently exists, but may not be exercised for fear of litigation.

3. **Growth Management, Land Development and Zoning Laws –** Reducing the risk to firefighters and homeowners, reduced suppression costs, and lower insurance rates is a top priority. There is a need for growth management, land development, and zoning laws that require defensible space and wildland fire risk reduction actions as communities develop; and the maintenance of wildland fire risk reduction practices, e.g., defensible space, fire resistant construction, hazard reduction, etc.

4. **Inefficiencies in the National Qualification Standards –** Inefficiencies in the national qualification standards and procedures must be addressed to increase response capabilities. Develop one wildland fire qualification standard for the federal, state, tribal, and local wildfire community. Currently NWCG PMS 310-1 provides qualifications for national mobilization and recognizes the ability to accept qualifications of local jurisdictions while in those jurisdictions. These standards are in sync with FEMA NIC efforts to bridge the gap with local government.

5. **Remove Policy Barriers and Process Complexities for Sharing Resources –** There is a need to remove policy barriers and process complexities, which affect the ability to effectively and efficiently share resources, not only for wildfire, but for fuels and prescribed fire work. The statutory authority for the USFS to pay for state resources responding to another state's incident, even though the receiving state reimburses the USFS for those responding resources, has been questioned. If not resolved, this issue is

likely to restrict mobilization of key resources for the protection of private, state and local government lands.

6. **Enforceable Fire Prevention State/Local Ordinances –** There is a need to develop adequate state and local ordinances related to wildfire prevention, which are enforceable. There is clear evidence that small investments in fire prevention help reduce the high cost of fire suppression.

7. **FEMA Pre-Disaster Mitigation Program** – There is a desire to enhance the FEMA pre-disaster mitigation program to maximize fuels reduction across the landscape with emphasis on private lands. Currently FEMA has pre-disaster mitigation grants available, but less than 1% of those funds go towards wildland fire mitigation. If those funds could be significantly increased, much more investment could go towards private lands.

8. **Assisting Communities at Risk –** Assist communities with evaluating their risk from wildfire, and provide communities with information and tools on how to mitigate risk from wildfire, create and conduct activities to become fire adapted, and track their progress. Education and outreach will include communications promoting self-assessment and identifying local expertise to sustain mitigation efforts.

9. **Investment in Firefighting Workforce –** There is a need to invest in the firefighting workforce at the field level. Budget cuts are reducing the number and quality of the on-the-ground firefighting workforce. Budget cuts always seem to land at the field more than at the national level. Continued and increased investment in the firefighting workforce is necessary in order to maintain capacity to respond to wildfire as well as mitigate fire hazards. A lack of investment in the firefighting workforce will lead to fewer firefighters on the ground, reduced safety, reduced capability at accomplishing local projects, and reduced initial attack success. In the long term we face a generation gap in the fire workforce available for future leadership of the program.

10. **Improve Fire Data –** The accuracy of various aspects of the LANDFIRE data is questionable, even when used at intended scale. LANDFIRE data is being used nationally to depict existing vegetation, surface and canopy fuels, fire regime condition class, and estimates of national fire hazard/risk. Without accurate data, many assumptions and actions based on this data will be compromised. There is a need for more realistic and accurate depiction of where wildland fire hazard/risk actually occurs across the country, which can be used to base decisions upon.

11. **Intergovernmental Wildland Fire Governance –** There is a need for an intergovernmental wildland fire governance structure to serve the needs of all jurisdictions in both wildland fire and all-risk incidents.

Additional information on barriers and critical success factors, including actions to address each, are included in the Next Steps section.

In addition to the priority barriers and critical success factors, the three regions identified additional issues or areas of concern that are of national significance. These include:

1. **Prescribed fire and smoke management –** Recognize the importance of prescribed fire as a landscape management tool, and increase public acceptance of smoke by educating the public about the benefits of prescribed fire.

2. **Rehabilitation of damaged lands –** Lands damaged by events such as severe storm activity, pests and drought-related effects, and previous wildfires often are at increased risk of wildfire.

3. **Biomass utilization –** Encourage more biomass utilization as a cost effective means to reduce built-up fuels

4. **Increasing collaboration with stakeholders and regulatory agencies –** Increase collaboration with stakeholders and regulatory agencies, place emphasis on expanding collaborative land management opportunities, and plan across landscape boundaries. Work together to improve sharing of resources, such as heavy equipment, aircraft, and prescribed burning crews.

5. **Expand fire adapted communities programs –** Place emphasis on community protection program activities to increase the number of fire adapted communities, and improve the level of wildfire awareness and readiness.

6. **Protection from unwanted fires for all lands –** Utilize appropriate suppression and detection responsibilities to insure all lands are protected, regardless of land ownership, using agreements or contracts.

7. **Implement actions from the three regional action plans –** Emphasize and maintain collaboration with stakeholders, and coordinate among all Cohesive Strategy partners to integrate applicable actions into federal land management plans and state forest action plans.

Regional Context Summary

The regions agree on many of the issues and the actions to be done to improve landscape resiliency, fire adapted communities, and fire response. They support expansion of fuels treatments on public and private lands, active management of public forest lands, support for and expansion of programs and tools to increase fire adapted communities, a reduction of structural ignitability, improved coordination and training among fire responders with a larger workforce, and more. They envision a comprehensive, coordinated response to wildland fire that begins long before the fire starts, and continues through the fire, and supports rehabilitation of damaged lands and communities after the fire.

Through experience, the regions have developed ways to deal with wildfire risk. To prepare landscapes and communities for wildland fire, fuels treatments are an essential tool in the toolbox. Fuels treatment effectiveness studies over the past eight years have shown that in 90% of cases where fire burned into treated areas, the treatments changed the fire's behavior by reducing torching, and 86% of the time, the treatment helped in controlling the wildfire (USDA Forest Service, 2013). But treating fuels is not enough. Community knowledge, preparation, and increased suppression ability are all tools in the toolbox for readying fire-prone lands and communities for wildfire. CWPPs have proven their value as an effective tool for raising awareness of wildfire risk, and motivating communities and individuals to prepare by reducing fuels around homes and communities, and replacing flammable building materials, such as wood shingle roofs. CWPPs have also played a role in strategically locating fuels treatments. The regional action plans call for fuels treatments, CWPPs, and many other actions as tools to reduce wildfire risk. The task is enormous, and a national commitment to address wildland fire, in a comprehensive, coordinated and cohesive way, is needed at the national level.

It is anticipated the National Action Plan will be derived from: actions to address the barriers and critical success factors; actions in relation to policy options derived from the tradeoff analysis; and actions from regional action plans that are national in scope, or common to multiple regions.

The scientific analysis is Section D examines the potential for the application of different policy options in the varied landscapes across the nation. This analysis will provide guidance for what actions might be effective in different regional environments. The time to prepare for wildfire is before the fire starts. Knowing what actions to employ, and where to do them, is a critical element of the Cohesive Strategy. Land and fire managers will work together with community members to prepare for fire so that the threats to landscapes and threats to communities can be diminished. The national analysis and strategy considers these issues at multiple scales. National support and a will to commit to a longterm effort to

work at the national, regional, and local levels to address wildfire before the fire, during the fire and after the fire is essential to dealing with the many wildland fire issues across the country, and a true Cohesive Strategy.

SECTION D: NATIONAL ANALYSIS

The preceding section identifies various actions and activities identified by the Regional Strategy Committees and collaborators that are designed to advance the goals of the Cohesive Strategy. The recommended actions span multiple issues, ranging from vegetation management, response coordination and training, community preparedness, wildfire prevention, and other related activities. All recommendations have been vetted in regional forums and are based upon practical understanding of the issues involved. The unfortunate reality is that resources and funding are likely insufficient to fully implement all recommendations, making further analysis and prioritization essential.

The next logical step in the development of the Cohesive Strategy is a spatial prioritization of actions and activities based upon a rigorous analysis of available information. Analysis can revel opportunities for greater success, as well as possible barriers (other than resource constraints) that could hinder or prevent some recommendations from being followed. Relatively few actions are likely to work well in all locations; most will vary substantially in effectiveness or efficiency depending upon local conditions. Additional analysis to explore temporal prioritization could further assist entities and decision-makers.

In late 2012, the National Science and Analysis Team (NSAT) was asked to explore potential options for achieving the national goals of the Cohesive Strategy and to identify the challenges, opportunities, and trade-offs inherent in each option. The purpose of this national analysis is to provide a broad strategic overview that could inform subsequent decision-making processes. For example, options explored here can help inform choices among more detailed activities described within regional action plans or suggest where actions could be focused from a national program management perspective. This section briefly summarizes the findings of the NSAT in relation to potential policy options that could be considered for national implementation. Here, "policy options" are broadly defined as strategic national direction that would lead to achieving the goals of the Cohesive Strategy. The policy options support intergovernmental decisions regarding whether we should maintain, emphasize, or de-emphasize the various mixes of management actions in different contexts and locations.

The key to building national policy options is to understand the underlying relationships among biophysical landscapes, the people that inhabit them, and wildland fire. Gaining a national perspective also requires an approach that essentially dissolves or ignores regional boundaries in order to more clearly see national patterns of similarities and differences.

Understanding Fire Regimes

Wildland fire from both natural and human causes has played a prominent role in shaping the landscapes of North America for millennia. There is a rich literature on the ecological role of fire in North American ecosystems and widespread appreciation of the historical role that human settlement patterns have had in changing the frequency, extent, and location of fire. There are several recent and accessible summaries of this literature, including Stein and others' (2013) report, *Wildfire, wildlands, and people: Understanding and preparing for wildfire in the wildland-urban interface—a Forests on the Edge report*[1] and references therein.

One universally accepted point is nearly all of the natural vegetation communities across North America historically burned—many quite frequently. The intensity with which they burned was a function of both the biophysical environment and the frequency of ignition, both natural and human-caused. In general, more frequent burning is associated with less intense or severe wildfires. Conversely, biomes that burned infrequently generally experienced higher severity fires that often consumed much of the aboveground biomass. This pattern arises naturally from the accumulation of biomass (fuel) between fire events, absent of any other disturbance or activity that would remove the standing fuel. Ecologists use the concept of historical fire regime and fire regime groups (FRG) to characterize the relationship between fire frequency and fire severity and their ecological implications (Table D.1, from Barrett and others [2013][2]).

Of note is the relatively high frequency of fires in FRG I and II, which historically averaged 35 years or less between fire events. These fire regime groups includes many of the fire-adapted forest and rangeland types in the US and account for nearly half of the undeveloped natural vegetation within the conterminous 48 states (Figure D.1), comprising about 1.1 million square miles. If one presumes that this area experienced a fire return interval of 35 years (the upper bound), then a lower bound estimate of roughly 31,000 square miles (>20 million ac) would have burned on average each year within these two FRG areas alone. Such estimates are rough, but they provide a sense of perspective

[1] Stein, S.M.; Menakis, J.; Carr, M.A.; Comas, S.J.; Stewart, S.I.; Cleveland, H.; Bramwell, L.; Radeloff, V.C. 2013. Wildfire, wildlands, and people: understanding and preparing for wildfire in the wildland-urban interface—a Forests on the Edge report. Gen. Tech. Rep. RMRS-GTR-299. Fort Collins, CO. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p.

[2] Barrett, S.; Havlina, D.; Jones, J.; Hann, W.; Frame, C.; Hamilton, D.; Schon, K.; Demeo, T.; Hutter, L.; and Menakis, J. 2010. Interagency Fire Regime Condition Class Guidebook. Version 3.0 [Homepage of the Interagency Fire Regime Condition Class website, USDA Forest Service, US Department of the Interior, and The Nature Conservancy]. [Online], Available: http://www.frcc.gov/.

when compared to the annual acres burned in the recent decade, 2002-2011. The best estimate of annual area burned in counties dominated by FRG I and II within the conterminous 48 states is roughly 7,800 square miles, or one fourth of the historical lower bound for this area. Another way of stating this is that the average time between wildfires has more than quadrupled across much of the landscape. The changes in area burned are less important that the subsequent changes in wildfire severity that accompanies them. It is not surprising that many fires that occur now are of higher severity than in the past or that substantive shifts in vegetation away from fire-adapted species are occurring. The issue may not be quite so severe in areas under active prescribed fire regimes. These include some actively managed forest of the Southeast, for example; a recent survey reported 6.5 million acres of prescribed fire activity there for silvicultural purposes in 2011[3]. There also are areas within larger national parks and designated wilderness areas nationwide where natural fire regimes have been successfully reintroduced and maintained for decades.

Table D.1. Fire regime groups and descriptions. Source: Barrett and others (2010)

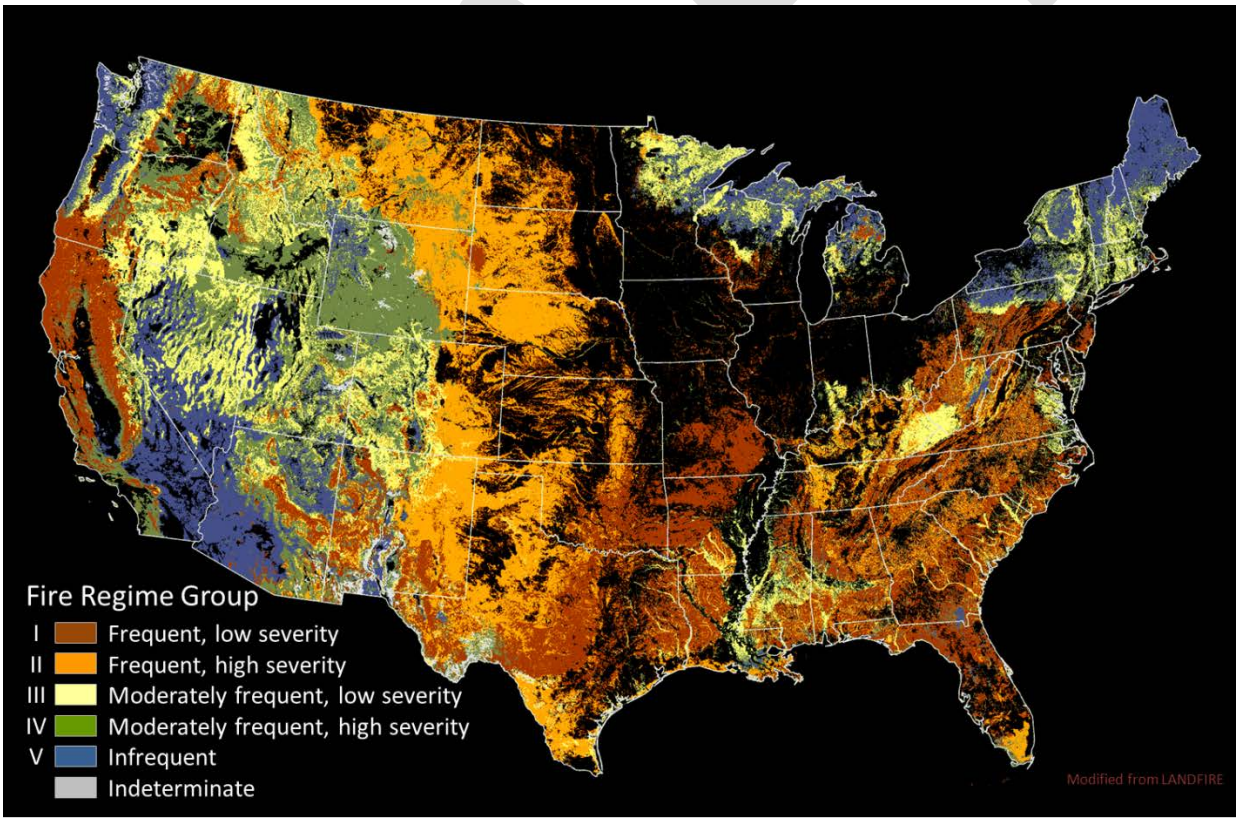
Group	Frequency	Severity	Severity description
I	0 – 35 years	Low / mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0 – 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35 – 200 years	Mixed / low	Generally mixed-severity; can also include low severity fires
IV	35 – 200 years	Replacement	High-severity fires

[3] Melvin, Mark A. 2012. 2012 National Prescribed Fire Use Survey Report. Technical Report 01-12. Coalition of Prescribed Fire Councils, Inc. 19 p. Available at http://www.prescribedfire.net

V	200+ years	Replacement / any severity	Generally replacement severity; can include any severity type in this frequency range

The changes in fire return intervals are not limited to just FRG I and II. Estimates of the areas burned historically in FRG III, IV, and V are problematic due to the wide range in fire return intervals. A previous analysis suggested increased fire return intervals throughout the US except for some areas of the Southwest and Great Basin (Cohesive Strategy Phase I report, Appendix A). Further evidence is suggested by the relative distribution of fire historically and more recently. Figure D.2 depicts the percentage of area burned by wildfire (2002-2011) that has occurred within counties associated with each fire regime group (relative to total area burned nationally), as compared to the percentage land area within those same counties that is dominated by natural vegetation (relative to the national total).

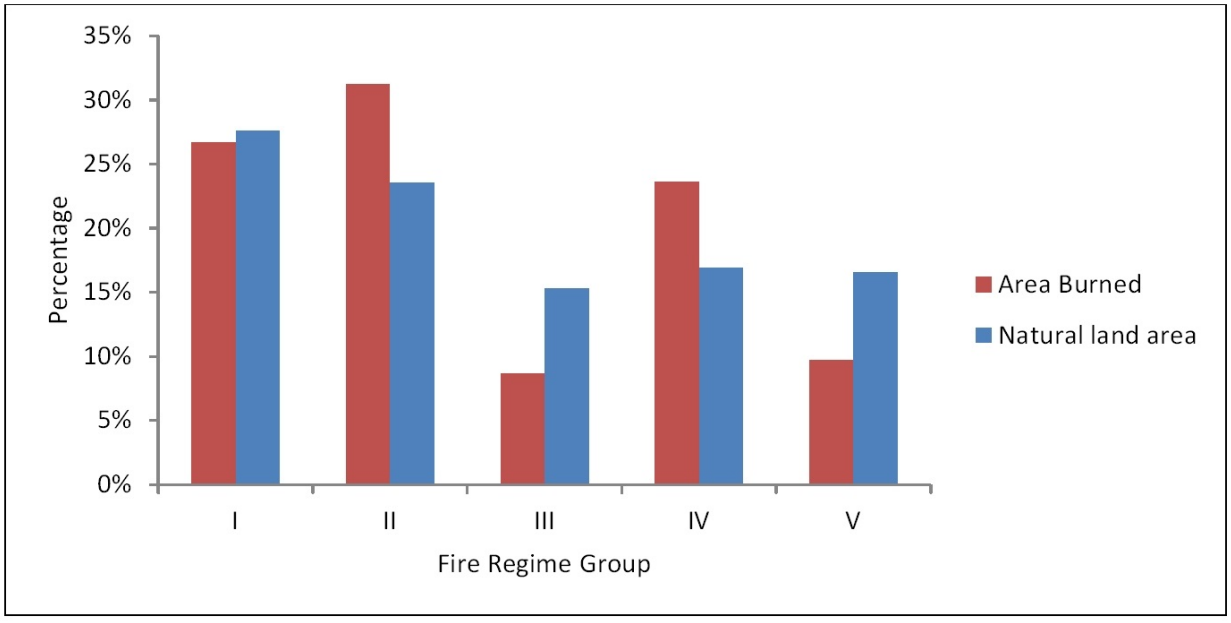
Figure D.1 – Historical fire regime group values in areas of current natural vegetation. Fire regime group data provided by LANDFIRE



Given the expected fire return intervals in each of the groups, one would expect a considerably higher percentage of area burned in FRG I and II relative to their landmass; roughly equal ratios in FRG III and IV; and a smaller percentage of area burned in FRG V.

The actual pattern is quite different than expected. FRG I burned roughly proportional to its landmass, which is consistent with the observation above concerning reduction in the area burned. FRG II shows a higher percentage of area burned than land area, which is more consistent with historical patterns, but not enough to suggest no change in fire return intervals. FRG III has burned in roughly the same proportion as FRG V, but less than FRG IV, which suggests that fire return intervals have increased in FRG III (less area burned). Perhaps the most interesting observation concerns FRG IV and V. The proportion of the total area burned in FRG IV exceeds its land base, suggesting a disproportionate chance of large, high-severity fires occurring in areas of FRG IV. Similarly, the proportion of area burned in FRG V is higher than expected. Both observations suggest that decreases in area burned are less prominent in FRG IV and V than others, although the finer-scale spatial pattern of these fires likely has changed due to land conversion and the cumulative effects of development.

Figure D.2 – Bar chart showing the relative percentage of land area dominated by natural vegetation (Natural land area) occurring in counties with modal FRG I – V, versus the relative percentage of area burned in those same counties (2002-2011). Both red bars and blue bars individually sum to 100%



Understanding these broad-scale changes in fire regimes is essential to crafting an effective Cohesive Strategy. Fire regimes are intrinsically and fundamentally connected to fuel accumulation, vegetation composition, and subsequent fire behavior when wildfires inevitably occur. More extreme fire conditions can be expected in areas where the time between fires has been extended unless fuels have been reduced by other means. Human

development and suppression can postpone wildfires, but they do not exclude them except in unusual circumstances. Moreover, the confluence of climate factors and the fuel accumulations that result from sustained, vigorous suppression in some locations make exclusion increasingly difficult. The basic biophysical environment remains conducive to wildfire and is unlikely to change in a way that would mitigate wildfire occurrence[4]. In nearly all cases, fuels do not simply disappear in the absence of wildfire in fire-adapted ecosystems. Either they accumulate and wait for the next fire to occur, or some form of active fuels management such as prescribed fire or mechanical treatment is required. Conversely, in those rare ecosystems where fires have become more frequent, fuels management may be required to protect remaining unburned areas or to alter species composition or structure.

The importance of historical perspective is that it provides a benchmark for areas where returning natural vegetation to near-historical or desired conditions is a primary objective. However, a fundamental challenge in wildland fire management is that restoring historical conditions is neither practical nor desirable in many locations. The degree to which wildfires or fuels management can be tolerated within a given landscape depends upon community values and land management objectives. Where fuels cannot be managed to match historical levels, then adjustments must be made within human communities to accommodate a new normal in fire occurrence and extent. For forested systems, this likely means a progressive transition from historical FRG I or III to a new FRG IV and less frequent, higher intensity fires. Higher intensity fires lead to higher suppression difficulty, higher risks to firefighter and public safety, and more severe social or ecological damage when they occur. Changes in rangeland and shrubland systems can lead to increased, more continuous fire extent, often with greatly increased rates of spread, which also increase suppression difficulty and risk to firefighters. Additionally, changes in fire frequency can lead to an undesirable mix of new species that move into these systems (e.g., invasive grasses such as cheat grass or encroachment by woody species such as juniper).

The aforementioned changes in fire regime are just one component of the overall historical changes that have occurred across the United States. Much has been written about the growth of the wildland urban interface and the concomitant risks from wildfire that it brings. Again, readers are referred to the Stein and others (2013) report for an overview of this issue. Many of the data sets referenced by Stein and others (2013) are incorporated in the analyses described below.

[4] Some northern hardwood forests of the East may be the exception to this general rule. As human burning has decreased, compositional and structural changes within these forests have caused them to become more fire resistant.

Much also has been written about how future fire regimes may change due to changing climatic conditions, accelerated human development, invasive species, changes in resource utilization (food, fuel, and fiber), and other agents of landscape change. All are potentially important; all remain uncertain; all are active areas of research. Current conditions provide the best predictor of the immediate future until greater clarity is achieved. Fire regimes of today will inevitably change. When, where, and to what degree remains speculative, but the changes will likely exacerbate the challenges of managing wildland fire, not diminish them. Our collective ability to meet the challenges of tomorrow will depend greatly on how well we meet the challenges of today.

Conclusion: *Historical patterns of natural fire regimes suggest that considerably more area burned nationally each year than is burning today. The net effect is a gradual change in vegetation structure and composition that can lead to higher intensity fires than occurred historically, especially in areas that previously burned more frequently.*

Natural versus Anthropogenic Fire

The historical fire regimes discussed above are a function of the underlying biophysical environment, natural ignitions, and burning patterns of Native American tribes prior to European settlement for hunting, gathering, and agricultural purposes. Present day regimes are also strongly affected by the biophysical influences of vegetation, climate, and natural ignitions, but the human footprint and its effect on fire regimes is radically different than before. For simplicity, one can broadly divide wildland fire into two principal regimes—natural and anthropogenic. In the natural regime, fire occurrence and extent is primarily driven by environmental variables including vegetation and weather, and natural ignitions sources (primarily lightning). The anthropogenic or human-driven regime reflects the primary influence of human-caused ignitions and the influence of suppression activities. Much like the historical fire regimes, the effects of humans and nature cannot be spatially disaggregated cleanly. That is, both operate within the same geographical landscape. At any particular point on a landscape (or point in time), one or the other may be dominant but not exclusive. The implications of the differences between human and natural causes are important, which will become clearer in the discussion of policy options later in this report.

The difference between the natural and anthropogenic regimes can be illustrated by looking at seasonal patterns of wildfire occurrence and the area burned by fires of different causes. Figure D.3 depicts the bi-weekly pattern of fire occurrence attributed to three different causes: accidental (ACC), incendiary (INC), and natural (NAT), compiled from a combination of federal, state, and local data sets. The most commonly reported causes are accidental, which include debris burning, fireworks, equipment, campfires, and others.

Incendiary fires include malicious arson events or other incidents where fires were set intentionally using incendiary devices. Figure D.3 also indicates the close agreement in time between accidental and incendiary ignitions, both anthropogenic. In contrast, natural ignitions have a very strong and consistent seasonal pattern that rises in the spring, peaks in the summer, and declines in the fall. The seasonal pattern in area burned as a result of these different causes displays an interesting periodicity in which the area burned due to natural ignitions exceeds that from other causes through late spring and the summer season (Figure D.4).

Figure D.3 – Smoothed time trace of wildfire incidents reported and attributed to different causes throughout the United States, 2002-2011

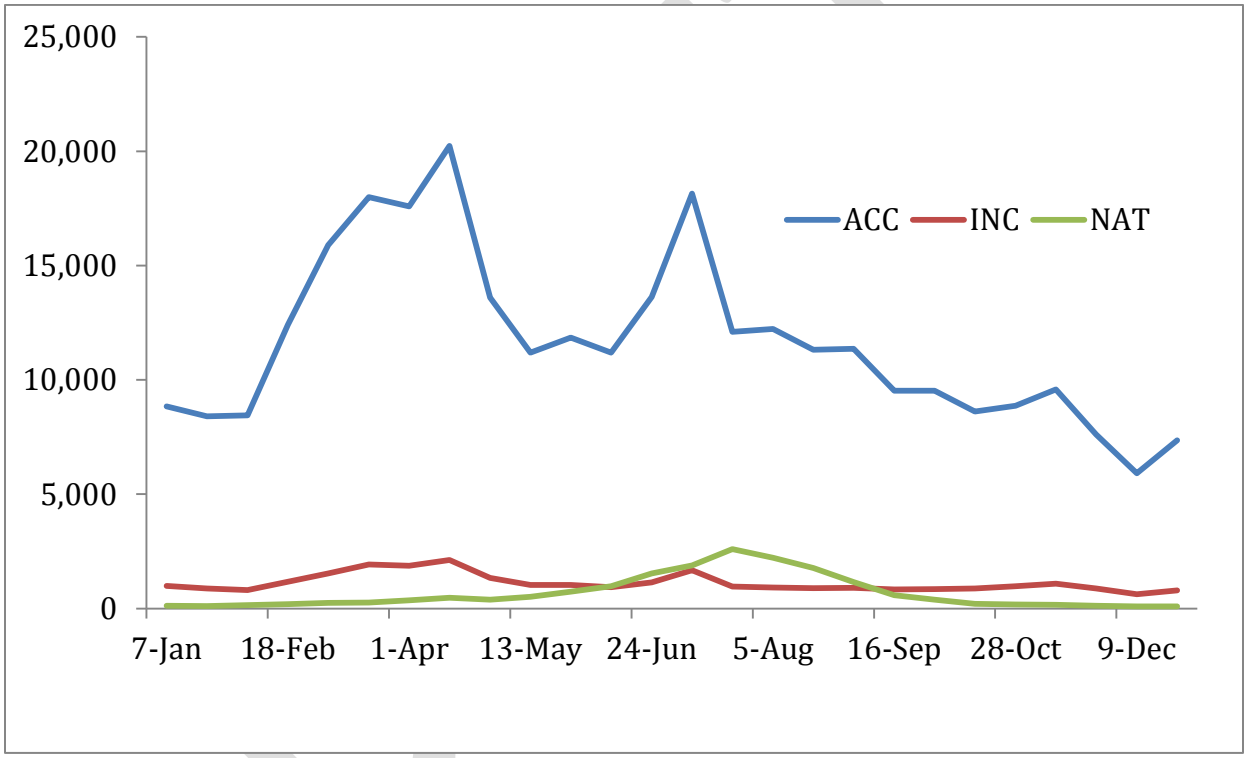
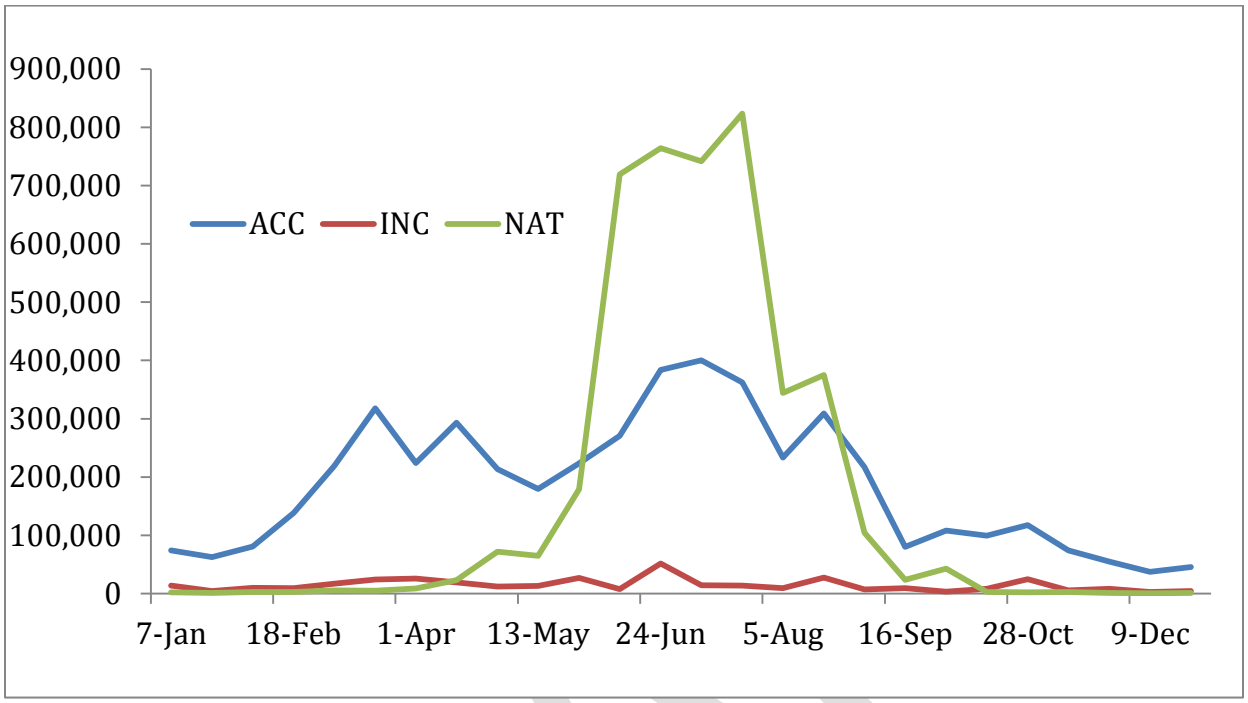


Figure D.4 – Smoothed time trace of area burned from incidents attributed to different causes throughout the United States, 2002-2011



The fact that relatively few natural ignitions disproportionately account for total area burned is consistent with the more general trend that much of the area burned across the nation can be attributed to relatively few fires regardless of cause. For example, the summary of available data used shows that the top 3% of fires in terms of individual[5] fire size account for over 90% of the total area burned nationwide. Another way of viewing this is that if an additional 1% of the fires in the US were to reach the size of the current top 3%, the total area burned would increase by 30%.

Conclusion: *Natural and anthropogenic fire regimes are distinctly different, but equally important. Natural ignitions account for a smaller proportion of the incidents, but a disproportionate amount of the area burned. Anthropogenic ignitions account for the bulk of the reported incidents and occur throughout the nation.*

ANALYTICAL APPROACH

The preceding discussion of fire regimes is necessarily broad and ignores the considerable variation that exists throughout the nation. Indeed, every state, county, management unit,

[5] Includes multiple fires managed as a single complex.

or community can claim its own unique fire regime, history, and special circumstances. Such differences are important when planning at the local level but overwhelm a national analysis designed to inform a national, intergovernmental strategy. On the other hand, generalities are useful only to certain extents; at some point the specifics of a location must be fully considered. One of the challenges within the national analysis is finding an adequate level of both generalization and specification that highlights important differences while also recognizing commonalities.

Data spanning a broad spectrum of environmental, socioeconomic, and fire related statistics have been assembled in order to support development of the Cohesive Strategy. These data have been summarized and consolidated to the county level in order to provide a comparable unit of analysis across data sets. Where appropriate, they also have been normalized in various ways to allow equitable comparisons across counties of different sizes. This allowed data from multiple sources and of various forms to be used to discern relationships among driving factors and influential variables. It also allows creation of national maps that highlight many of the intra- and inter-regional or state similarities and differences.

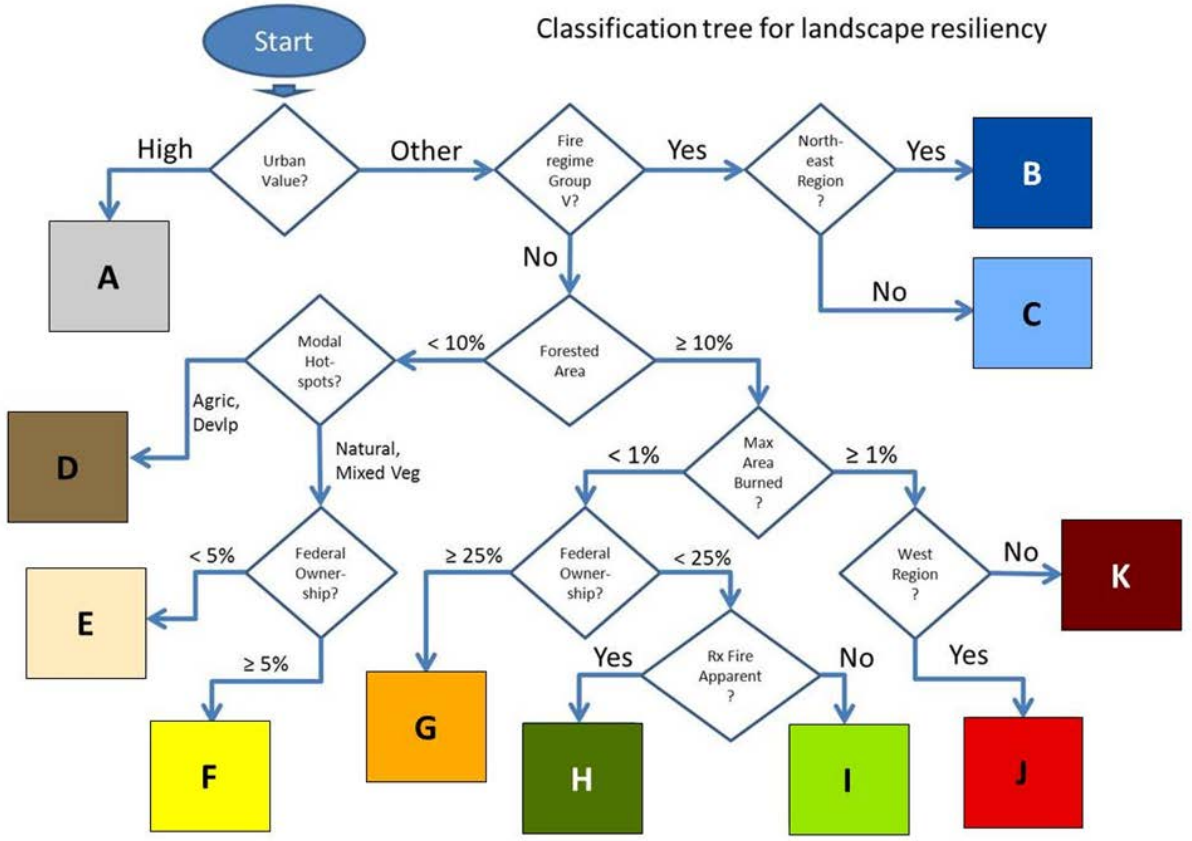
Even county-level metrics pose challenges, however, to completing a national analysis. There are 3109 counties in the conterminous United States and each one has its own unique story. This analysis is not directed at telling those unique stories, but rather highlights the pattern of similarities and differences found among the counties and uses those common attributes to develop a manageable set of narratives that can be linked to nationwide policy options. To that end, grouping counties along two principal themes of landscape resilience and risk to communities provides a serviceable classification system. Counties are grouped together based upon the similarities among them with respect to key variables that are relevant to the principal themes. Two different techniques were used to better match the nature of the themes and patterns within the data.

Landscape Resiliency Classes

Landscape resiliency has been defined in various ways, but at its core is about resistance to and recovery from disturbance. Given that landscapes themselves are complex intersections of natural, built, and human components, creating a simple metric of landscape resiliency is of little value. A more useful approach is to recognize that discussions about resiliency are contextual, that is, they vary from location to location and depend upon a host of local considerations including both ecological and human dimensions. The classification system designed here was intended to divide counties into classes where similar conversations about resiliency might occur, using county-level attributes. Counties were assigned to different landscape resiliency classes using a

classification tree. A classification tree begins with all counties in a single group and then progressively divides them into more similar subgroups based on key variables. Each junction in the classification tree involves a dichotomous division based on a single variable. The classification tree used the relative urban landcover within a county, the modal fire regime, geographical region, area forested, area of public lands, and various measures of fire occurrence to assign counties to one of eleven classes labeled A through K (Figure D.5). The classes tend to have strong geographical associations due to the influence of regional similarities in landcover and fire regimes; a notable exception is the urban class (Class A), which follows the general pattern of population density and urban development.

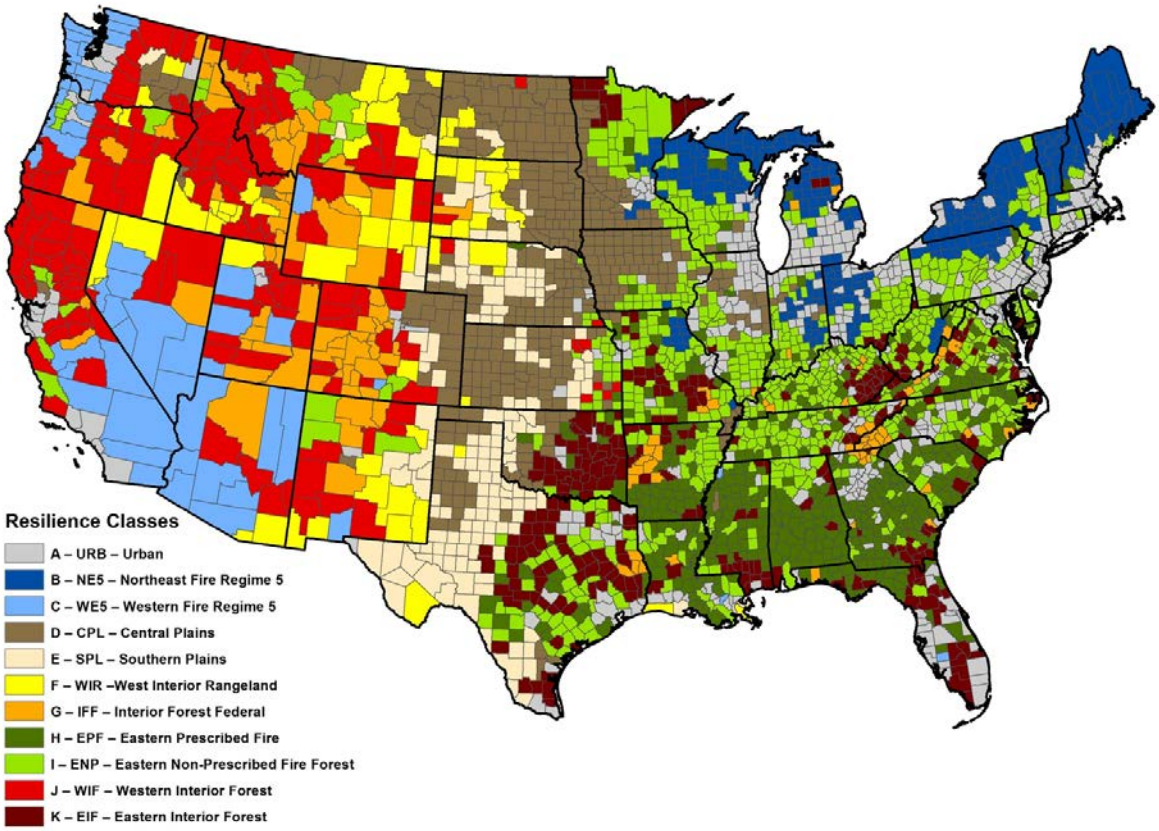
Figure D.5 – Classification tree used to subdivide counties based on variables relevant to the topic of landscape resiliency



The nature of each class is revealed by looking at both the variables used in the classification tree and the broader range of descriptive variables for each county. From this perspective, one can develop an informative, general narrative that applies to the counties within each class. Furthermore, the narratives help point to possible management options or policies that would advance the goal of landscape resiliency within each class, recognizing that each class could connote a unique interpretation of "landscape resiliency"

that is specific to the conditions found therein. Thus, resiliency classes are used to promote a context-specific discussion of policy options that matches actions to landscapes.

Figure D.6 – Map of the geographical distribution of the eleven resiliency classes across the conterminous United States



Conclusion: *Counties have been classified using a relatively small set of variables into various "resiliency classes" that share common attributes. Examining multiple variables reveal both similarities and differences among counties relative to the theme of landscape resiliency.*

Community Clusters

A central goal of the Cohesive Strategy is promoting fire-adapted communities. The wildfire risk to communities and values can be viewed as the intersection of three principal elements: wildfire occurrence and extent, homes and communities, and social and economic resources (Figure D.7). The first of these simply captures the magnitude of the

hazard posed by wildfire. The second and third reflect the principal values at stake. The values threatened include buildings, homes, infrastructure, public and firefighter safety, public health, and many of the benefits that communities derive from the landscapes around them.

Figure D.7 – Conceptual diagram of the intersection of three principal elements contributing to risk to communities

Quantifying all of the values that could be threatened by wildfire across the nation is impractical. The number and distribution of homes located within the wildland urban interface (WUI), composed of both the interface and intermix areas, is often used as a surrogate for many of the tangible values at risk, a convention followed here. Homes do not capture all of the values that are affected by wildfire, but losing a home is one of the most profound human experiences outside of loss of life. The number of homes lost in a wildfire is often equated by the public with the magnitude of the overall damage, even though other values are clearly impacted.

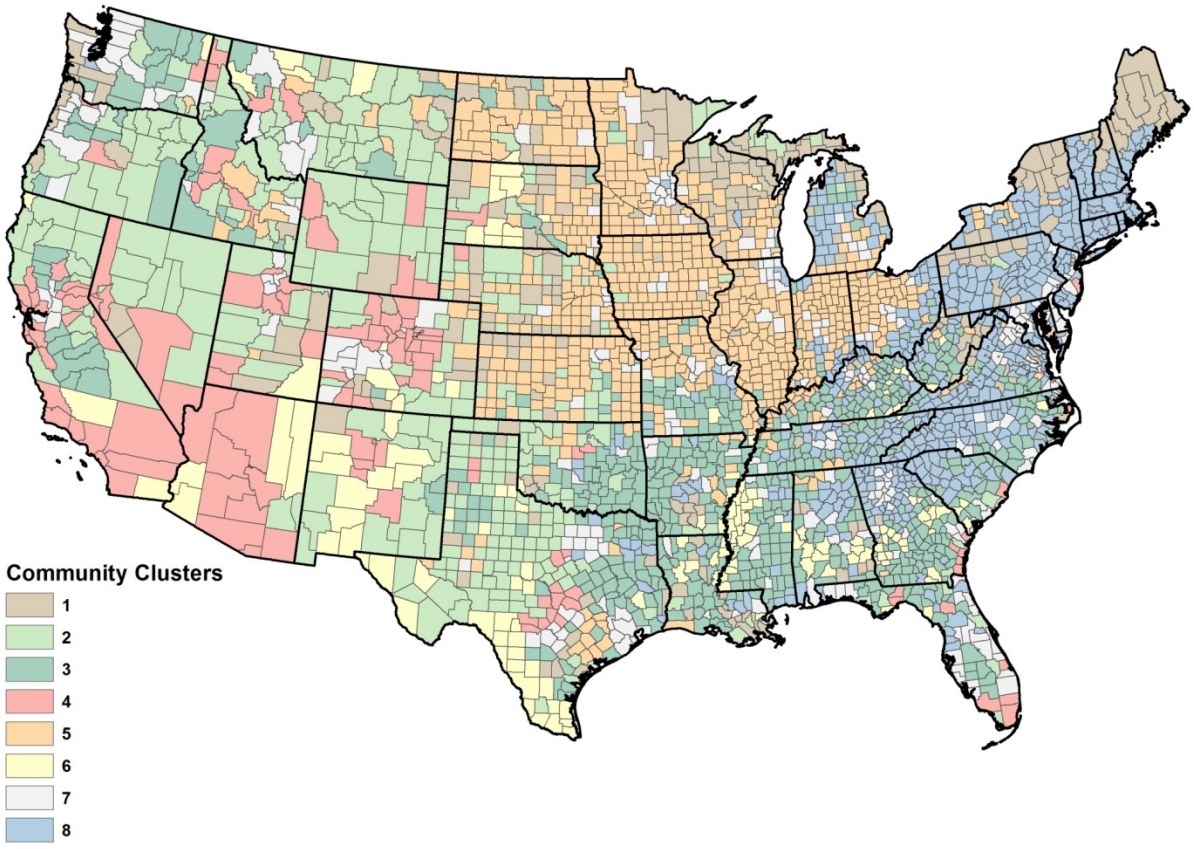
The capacity of a community to prepare for, respond to, and recover from a wildfire event is also a critical concern. There is an emerging literature on the concept of social vulnerability to catastrophic events. Researchers have generally looked at a combination of demographic and economic information in order to assess the vulnerability of individuals, families, and communities. Survey data on family incomes, education, and indicators of

household stress were used here to suggest relative vulnerability, while also considering metrics of economic activity within a county.

A statistical technique known as cluster analysis was used to group counties. Variables reflective of the amount of area in WUI and density of homes within it, demographic measures of household stress and economic advantage, and measures of area burned by wildfires and ignition density were used in the cluster analysis. Cluster analysis was used because it provided a cleaner separation of counties when considering all variables simultaneously, as opposed to sequentially as in a classification tree.

The result of the cluster analysis is a set of eight "community clusters" that are simply numbered 1 to 8 in no particular order. All community cluster types can be found in each of the three geographic regions, albeit in decidedly different proportions (Figure D.8). Geographical affinity of several clusters is apparent, but is not as strong as with the resiliency classes. This result highlights the fact that there are counties with similar fire histories, WUI patterns, and socioeconomic attributes scattered throughout the country. Community clusters were used to develop narratives that in turn are used in the discussion of policy options below, complementing the landscape resiliency classes.

Figure D.8 – Spatial distribution of community clusters



Conclusion: *Counties have been grouped using a relatively small set of variables into various "community clusters" that share common attributes. Examining multiple variables reveals both similarities and differences in community wildfire risk among counties.*

Intersecting Landscape Resiliency Classes and Community Clusters

The most vexing problems in wildland fire management cannot be solved by looking solely at landscape conditions, nor is a community perspective adequate by itself. It is the combination of the two that sheds light on the most difficult issues. Placing the community clusters in juxtaposition with the landscape resiliency classes creates a combination class that provides greater environmental context to the community clusters, while simultaneously enhancing the socioeconomic dimensions of the landscape classes.

The intersection of the community clusters with the landscape resiliency classes and the number of counties in each combination class is shown in Table D.2. Note that blank spaces in the table indicate that no counties fell within the intersection. The table indicates the number of counties, not the spatial extent covered by each combination class; differences in county size across the country affect the distribution of area.

Table D.2 – The number of counties within the conterminous 48 states that fall within each combination of community cluster and resiliency class

Resiliency Classes	Community Clusters								
	1	2	3	4	5	6	7	8	Grand Total
A	8	3	31	30	71	4	129	194	**470**
B	68	5	6		78	1	6	56	**220**
C	15	5	6	12		9	7		**54**
D	56	38	29	2	265	5	14		**409**
E	22	76	7	3	28	22	1		**159**
F	2	32	6	8	12	7	1		**68**
G	18	24	28	12	4	8	20	17	**131**
H	29	8	189	8	30	54	42	99	**459**
I	62	18	145	7	207	24	60	192	**715**
J		69	24	38	7	4	8		**150**
K		40	135	13	15	16	17	38	**274**
Grand Total	**280**	**318**	**606**	**133**	**717**	**154**	**305**	**596**	**3109**

An interesting observation from this table is that almost all of the possible combinations have one or more counties fall within them. This spread across combinations is reflective of the considerable diversity that is found across the United States. It also highlights the challenges that arise when one tries to make generalizations. Fortunately, the total number of combinations (79) is manageable, and there are distinct patterns that suggest common narratives.

Although a resiliency class may be distributed across all community clusters (or vice versa), they are not independent. That is, there are distinct patterns of association between the two such that various combinations occur more frequently than they would by chance

alone, while others less frequently. For example, resiliency class A, which represents a landscape dominated by human development, is disproportionately associated with community clusters seven and eight, which are primarily urban and suburban communities, respectively. Similarly, resiliency class D has a strong association with community cluster five, both of which are often associated with counties dominated by agricultural development. The association between classes and clusters is a reflection of both the human footprint on landscapes, and conversely how biophysical landscapes have influenced human development. Many of the unique attributes of each combination are described in Appendix 6.

One can ask whether the combination of landscape and communities is sufficient to cover all the complexities and issues that are involved in wildland fire. For example, can you distinguish between areas with different levels of response capacity, the complexities of mixed land ownership, and overlapping jurisdictional responsibilities? Many of these issues were examined, and consideration was given to whether an additional classification system(s) might be necessary. In general, the two-dimensional system proved adequate for addressing the issues at hand. Those few issues that exhibit geographical patterns that cannot be explained with the combination classes can be examined using other means.

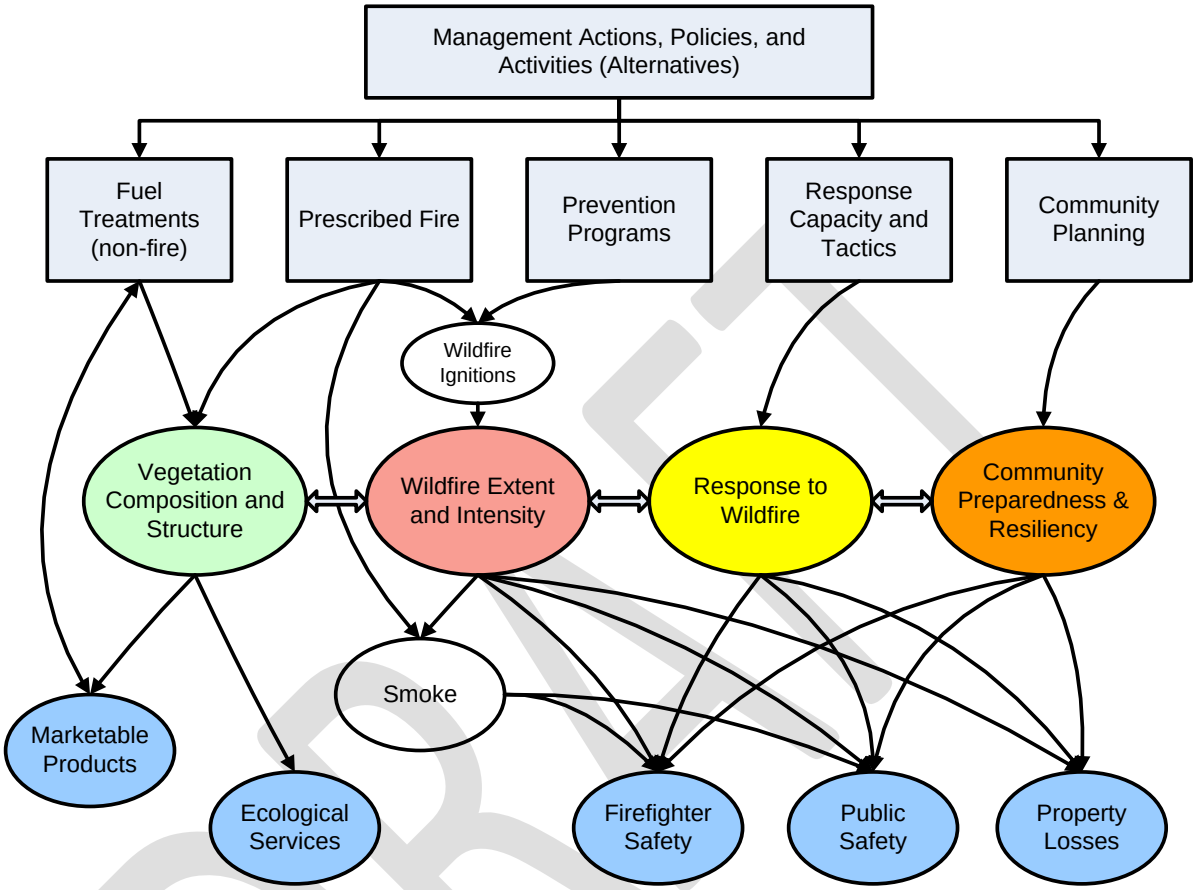
Conclusion: *The combination of landscape resiliency classes and community clusters provides a powerful mechanism to discern and relate both the environmental and socioeconomic dimensions of the landscape simultaneously.*

POLICY OPTIONS

Wildland fire encompasses numerous interacting and complex social, ecological, and physical factors. One conceptual view of the Cohesive Strategy is as a collection of policies and management actions activities that collectively influence: vegetation composition and structure, wildfire extent and intensity, response to wildfire, and community preparedness and resiliency (Figure D.9). These in turn influence the goods and services received from forests and rangelands, firefighter and public safety, and homes and property affected by fire.

This basic conceptual model can be applied at any scale. That is, the relationships hold whether the area of concern is a local land-management unit or community, or whether national policies are being considered. During the Phase III process, the regional strategy committees and others suggested a wide range of actions and activities, most of which conveniently fit within the major categories identified in the conceptual model.

Figure D.9 – Simple conceptual model of the major anthropogenic factors involved in wildland fire management (gray), principal interacting processes (various colors), and values affected by fire (blue)



For the purposes of the national analysis, the Wildland Fire Executive Council and other advisory groups helped identify a series of options that might be considered from a national perspective. These options are grouped into four management themes: broad-scale fuels management, managing human ignitions, home and community actions, and response to wildfire. In the discussions below, the objective of each option is described and information inherent in the landscape resiliency classes and community clusters is used to identify areas of the country where each option logically might be applied. The summaries here are intentionally terse; additional detail is available in the complete report of the NSAT[6]. Table 3 and Figure D.3 provide a quick reference to the options and maps of their spatial extent. Options are numbered for ease of reference only; the numbers have no bearing on priority or importance.

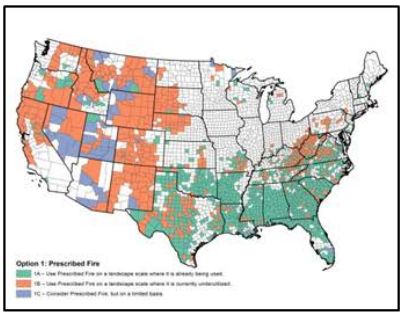
[6] The draft report of the national analysis completed by the NSAT is publically available at [link TBA.]. Final publication of the NSAT report is expected for late 2013.

Following the presentation of options, implications of implementing these options are discussed and the nature of trade-offs that are inherent in choices among them are highlighted.

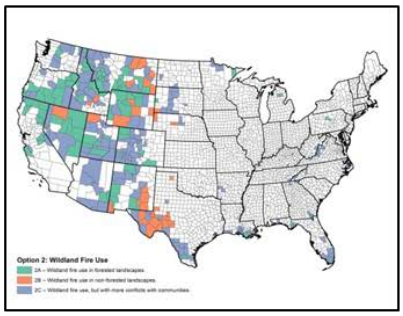
Table D.3 – Themes and policy options

Theme	Option	Description
Managing Fuels Across the Landscape	1.a	Prescribed Fire: Expand or maintain in areas of current use
	1.b	Prescribed Fire: Expand into areas of limited current use
	1.c	Prescribed Fire: Utilize on a limited basis
	2.a	Manage wildfires for resource objectives: In forested systems
	2.b	Manage wildfires for resource objectives: In non-forested systems
	2.c	Manage wildfires for resource objectives: In areas where increased awareness of community risk is necessary.
	3.a	Non-fire Treatments: Supported by forest products industry
	3.b	Non-fire Treatments: In non-forest areas
	3.c	Non-fire Treatment: In areas with limited economic markets
	4	Treatments as a precursor to prescribed fire or managed wildfire.
Managing Human Ignitions	5.a	Reduce accidental human-caused ignitions
	5.b	Reduce human-caused incendiary ignitions (e.g., arson)
Home and Community Actions	6.a	Focus on home defensive actions
	6.b	Focus on combination of home and community actions
	7.a	Adjust building and construction codes, municipal areas
	7.b	Adjust building and construction codes, non-municipal areas
Response to wildfires	8	Prepare for large, long-duration wildfires
	9	Protect structures and treat landscape fuels
	10	Protect structures and target prevention of ignitions

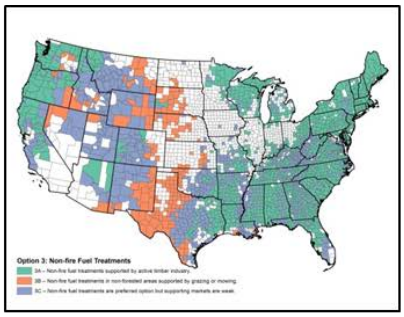
Figure D.10 – Thumbnail maps of the various options. Larger versions of the maps along with additional details can be found in the NSAT National Analysis Report (link to be provided).



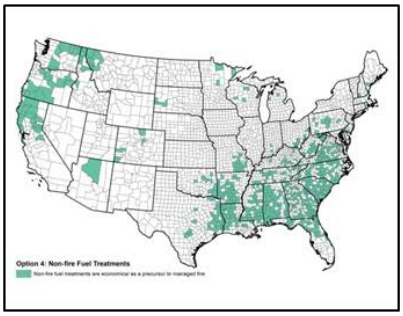
1. Prescribed Fire Use



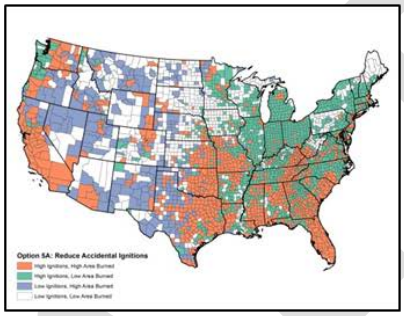
2. Wildfire for Multiple Benefits



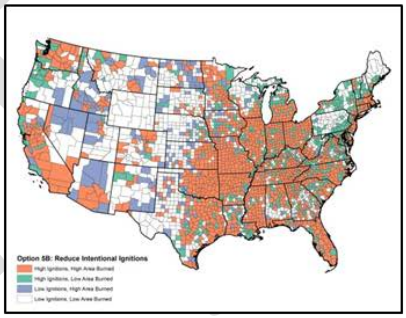
3. Non-fire Fuel Treatments



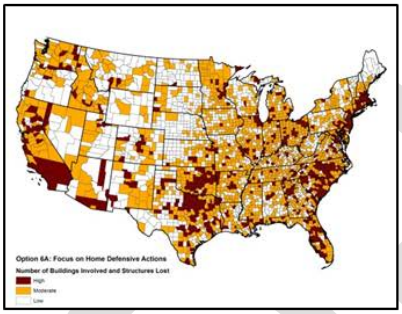
4. Non-fire as a Precursor to Fire



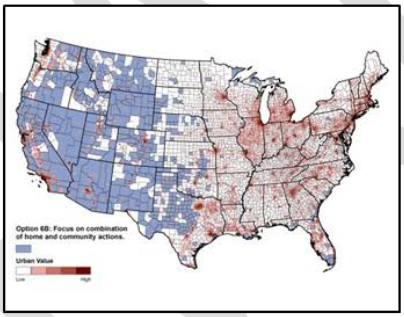
5a. Reduce Accidental Ignitions



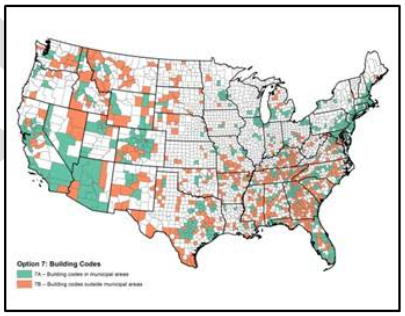
5b. Reduce Intentional Ignitions



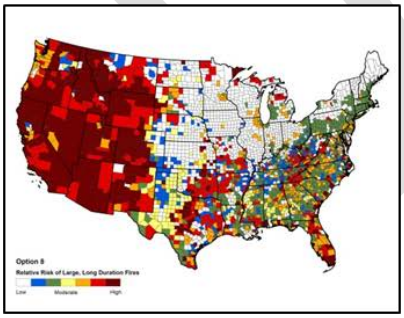
6a. Home Defensive Actions



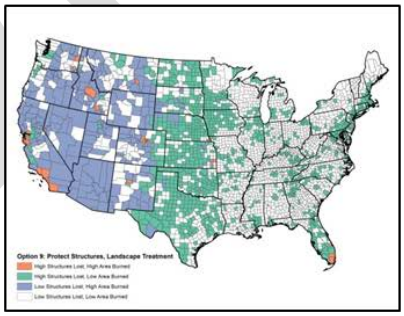
6b. Community and Home Actions



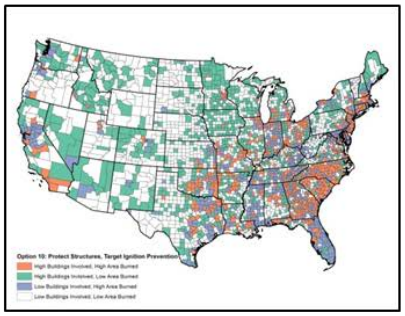
7. Building Codes



8. Preparedness for Large, Long Duration Fires



9. Protect Structures and Apply Landscape Treatments



10. Protect Structures and Target Ignition Prevention

1

Fuels Management

The primary purpose of hazardous fuels management is to reduce the intensity of wildfire if and when it encounters a treatment area during the lifespan of the treatments.[7] To be effective, fuel treatments must reduce fireline intensities under the conditions most likely to result in harm. That is, they have to work across a range of weather conditions likely to occur during a wildfire. Reducing wildfire intensity can have multiple benefits. Depending on landscape objectives, reduced intensity (fire behavior) can lead to reduced severity or extent (fire effects), which can lead to reduced or even beneficial ecological effects. For example, wildfires burning less intensely may more closely mimic historical fire effects and thus lead to the restoration or enhancement of native, fire-adapted vegetation. In addition, less intense fires are more likely to have less severe effects, such as reduced mortality of economically valuable tree species or reduced chance of soil erosion following fires. Strategically placed fuel treatments can have broader landscape effects that extend beyond the perimeter of the area physically treated, either through affecting fire behavior directly or by facilitating ecologically sensitive containment strategies. Such treatments can affect spatial distributions of fires, leading to more desirable vegetation composition and structure, reducing potential for invasive species, and preserving structure that is currently limited on the landscape (i.e. sagebrush).

Reduced intensity also means that suppression efforts are more likely to be effective and can be conducted more safely in areas where wildfires are unwanted or threaten communities. Fuel treatments in close proximity to homes and communities also are an effective, proactive way of reducing the likelihood of structure ignition and enhance the safety of firefighters and the public.

The three primary means of managing fuels are prescribed fire, managing wildfire for ecological purposes and resource objectives, and non-fire treatments involving mechanical, biological, or chemical methods, or a combination of all listed.

Prescribed Fire

Prescribed fire is one of the most effective and cost-efficient means of managing vegetation for multiple purposes, including hazard reduction, ecosystem restoration or maintenance, silviculture, and others. In general, prescribed fire is an effective tool in areas with fire-

[7] Here, treatments for the primary purpose of managing hazardous fuels are distinguished from treatments that reduce vegetative fuels as a secondary benefit. For example, prescribed fire can be used for the primary benefit of promoting desirable vegetation in areas devoid of significant wildfire hazard (e.g., native rice fields). Many silvicultural practices have secondary fuels benefits, but are not conducted for that primary reason.

adapted or fire-dependent vegetation (FRG I, II, III). Prescribed fire is also used to a lesser extent as site-preparation in rangelands (i.e., preparation of chemical application for invasive species eradication) or post-harvest clean-up in forested systems. Broad areas of the country have the potential for prescribed fire use based on their natural fire regime, vegetation, and level of human development. Maps of potential for prescribed fire use were developed in both forested and non-forested systems based on vegetation, FRG, and land cover. These maps provide a baseline from which further opportunities for use were explored. Emphasis is on broad-scale application of prescribed fire, focusing on counties where a significant portion of each county is suitable for prescribed fire use. It is recognized that prescribed fire can be applied nearly everywhere for very specific reasons; such local concerns are not captured here nor are smoke management concerns or other environmental impacts that might restrict its use.

An additional consideration is that prescribed fire carries inherent risk, as fires can escape the prescribed perimeter or produce hazardous smoke if not managed correctly. Implementing and maintaining a prescribed fire regime, therefore, requires properly trained personnel, resources, and the willingness on the part of the landowners and nearby communities to accept the potential disadvantages of prescribed fire in exchange for the potential benefits.

The suggested first option for prescribed fire is maintained or expanded use in areas where it is currently employed (Option 1.a). These areas logically have the necessary training and experience to implement a prescribed fire program and also suggest community acceptance and tolerance. The analysis of probable areas of prescribed fire use based on remotely sensed data and other reports indicate that many counties throughout the Southeast and scattered counties in the Northeast and West are substantively using prescribed fire.

The second option would be to expand into areas where prescribed fire has been identified as suitable, yet the evidence of current, widespread application is less compelling (Option 1.b). These include many areas in the West as well as counties in the central Appalachians. Implementing prescribed fire regimes in these regions likely will require additional training and resources, as well as outreach and coordination with the communities that are most likely to be affected.

The third option (Option 1.c) includes counties that have areas suitable for prescribed fire, but perhaps not to the extent as in 1.a or 1.b. As an example, these include counties where a smaller proportion of the total county area is suitable for prescribed fire, but it occurs in remote areas in large contiguous blocks. These include Western counties with areas of low road density and more than 25% of the total county area is suitable for prescribed fire.

All three options would involve combinations of regional recommendations 1.1, 1.2, 1.3, 1.4, 1.7, and 2.4 from the previous section.

Conclusion: *Prescribed fire is a very useful tool that has the potential for widespread increased application. Three areas were identified for prioritization, which in total comprise 55% of the land area of the conterminous 48 states.*

Managing Wildfire for Resource Objectives

Managing wildfire for resource objectives and ecological purposes refers to a strategic choice to utilize unplanned ignitions in order to achieve management objectives similar to those associated with prescribed fire. Federal fire policy is consistent between the agencies and has traditionally been restricted for used in federal wilderness areas, national parks, or other remote areas and only under specific conditions or circumstances. These restrictions are intended to reduce risk and avoid potentially negative impacts/consequences to non-federal lands. Guidance issued in 2009 regarding implementation of federal fire policy has led to expanded application of this method to manage wildland fuels. In contrast, most state and local jurisdictions are explicitly prohibited from implementing any strategy other than full suppression on wildfires. Like prescribed fire, allowing wildfires to burn for the purposes of ecosystem restoration or hazard reduction has inherent risk. These risks must be balanced with the potential benefits on an individual incident basis, which requires both pre-incident planning at the landscape scale and sophisticated incident management.

Areas were identified that might be suitable for managing wildfire for resource objectives by looking first at those areas where prescribed fire was deemed suitable. Counties were then highlighted where managing wildfire for multiple benefits in forested landscapes seems plausible (Option 2.a), separate from those counties dominated by non-forest vegetation where this tactic might also be applied (Option 2.b). Both Options 2.a and 2.b are associated with rural areas with few roads, low numbers of ignitions (mostly natural), moderate flame intensities, and large contiguous blocks of natural vegetation. The forested areas have a high percentage of federal ownership (primarily Forest Service, Bureau of Land Management, or National Park Service) and a mix of FRG I, II, and IV. Non-forested areas include counties with low federal ownership and FRG II and IV.

A third set of counties also were identified where the landscape characteristics might benefit from managing wildfire for resource objectives, but the community attributes would suggest potential conflict (Option 2.c). Community concerns would necessarily lead to greater restrictions and control on incident management objectives.

Managing wildfires for ecological benefits and resource objectives is notably absent from the list of recommendations identified in the section on regional context.

Conclusion: *Managing wildfire for resource objectives and ecological purposes is a useful tool for managing fire adapted ecosystems and achieving fire resilient landscapes, but it has limited potential for broad application across the landscape because of its inherent risk. This method of managing fuels is typically prohibited by state and local policies or statutes. Use of this method to manage fuels in wilderness, parks, and similar remote and wild areas has proven effective.*

Fuel treatments using mechanical, biological, or other non-fire methods

A variety of methods traditionally have been used for changing vegetation composition and structure and altering fuels to reduce hazard that do not involve fire directly. These include mechanical thinning and clearing debris in forests or mowing in rangelands, among others. Non-mechanical methods can involve livestock grazing to reduce fine fuels in rangeland systems, or the use of herbicides to change vegetation composition. These methods can be used wherever they are economically viable, especially where using fire as a management tool is undesirable or carries high risks. The advantages of such methods are that they do not create fire risk and can often be applied with a greater level of control over the location, timing, and desired outcome of the treatment. Mechanical treatments are particularly suited for fuels management following natural disturbances such as storms or insect outbreaks that radically change forest structure. An additional consideration is that mechanical treatments generally are not wholly adequate surrogates for fire in terms of ecological effects, which affects their suitability in many circumstances.

An added advantage of mechanical treatments in forested ecosystems is the potential to utilize the removed biomass for other purposes. For example, forest thinning might result in understory trees being utilized for wood chips or specialty products that can be made from small-diameter trees. If markets exist for the byproducts of the treatment, then there is a greater chance of being able to economically offset the cost of treatments. Areas where an active timber market might offset some of the cost of mechanical treatments in forests were identified by using data about timber jobs, mill production, and forested area available for mechanical treatment (Option 3.a). These counties occur throughout the Northeast and Southeast, within the Pacific Northwest, and scattered in the interior West.

Note that commercial timber harvest is not equivalent to fuels management. There are forested areas where intensive forest management for commercial products can lead to reduced fuel loadings, greater access, enhanced control over both wildfire and prescribed

fire, and generally reduced wildfire threat. There are also areas where selective harvest can leave behind abundant timber slash or debris, promote uncontrolled growth of the understory, encourage spread of invasive species, and generally exacerbate fuel conditions. Much depends on the strength of local markets and landowner incentives to leave conditions better following harvest than before.

A second option includes non-forested counties where combinations of mechanical (mowing), chemical herbicide use, or biological control (grazing) appear feasible (Option 3.b). These include the range and grasslands systems where frequent—even annual—control of vegetation might be advantageous or where it is desirable to alter vegetation composition and structure and limit fire extent. Economic costs and benefits will vary locally and depend on treatment type.

A third option includes counties where mechanical treatment in forests offers considerable benefit, but where evidence of economic value or markets to support such activities is weak (Option 3.c). These include major areas of the interior West, central Texas and Oklahoma, and scattered counties throughout the Southeast and Northeast.

A variant on the theme of non-fire fuel treatments is an option in which economically sustainable mechanical treatment is used as a precursor to and in combination with safer and more expanded use of prescribed fire or wildfire for resource objectives. The intent is to use mechanical treatments strategically to reduce the risks from fire use across a broader landscape. For example, mechanical treatments in pine plantations that are located between communities and wildland areas might facilitate prescribed fire use in the wildlands. Essentially, this involves an intersection of Options 1 and 3.a. The net result is Option 4, which includes many southeastern counties, the Pacific Northwest, and scattered interior counties.

Fuel management options 3 and 4 would involve combinations of regional recommendations 1.1, 1.2, 1.3, 1.6, 1.8, 2.3, 2.4, and 2.7 from the previous section.

Conclusion: *Fuel treatments involving mechanical, biological, or chemical methods offer many advantages in terms of greater control over the outcome and reduced risk of unintended consequences. The disadvantage is usually higher economic cost, which in some cases can be offset in some forested locations by active economic markets for the byproducts of the treatments.*

Managing Human Ignitions

Human ignitions are the predominant cause of wildfires throughout the United States. In the conterminous 48 states, more reported incidents began with human-caused ignitions

than from natural ignitions in 98% of the counties. The area burned from these human-caused fires exceeds that from natural ignitions in 94% of the counties. Only in the remote interior West is the pattern reversed. Thus, programs that target the prevention of human-caused ignitions have the potential to substantively affect wildfire occurrence and extent in essentially every county. Such programs are most effective when they focus on the underlying causes of these human-caused ignitions in each location and tailor the prevention programs to specific causal factors and community dynamics.

There are many different types of human-caused ignitions, but are lumped into two primary categories: accidental and incendiary. Accidental causes include debris burning, fireworks, equipment, campfires, and others. Incendiary fires include malicious arson events or other incidents where fires were set intentionally using incendiary devices. Counties were distinguished where there are higher-than-normal numbers of human-caused incidents (the median is used to define "normal"), versus those counties where the area burned by human-caused ignitions exceeds the national median.

The first option under this theme highlights counties where the intent or focus would be to substantively reduce the number of accidental ignitions (Option 5.a). The two classes of higher-than-normal ignition density and higher-than-normal area burned are used to create a four-color map with low-low, high-low, low-high, and high-high combinations. Counties falling into the high-high combination are found predominantly in the southeastern and south-central states and in the far West. The Northeast has a high percentage of the high-ignition-density, low-area-burned counties, while the interior West displays the bulk of the low-ignition-density, high-area-burned counties.

The second option under this theme similarly focuses on areas experiencing higher than normal incendiary ignitions or the area burned by such fires (Option 5.b). There is more congruence between ignition density and area burned with incendiary fires than with accidental fires. Thus, large portions of the East and more populated counties of the West exhibit a combination of both high incendiary ignitions and high area burned.

The data sets assembled by the NSAT include a broad set of community metrics and more detailed causal information that can be explored to target specific causal factors within the various community contexts. For example, debris burning is one of the principal causes of accidental fires; its occurrence varies considerably among community clusters.

Regional recommendation 2.6 focuses on fire prevention programs.

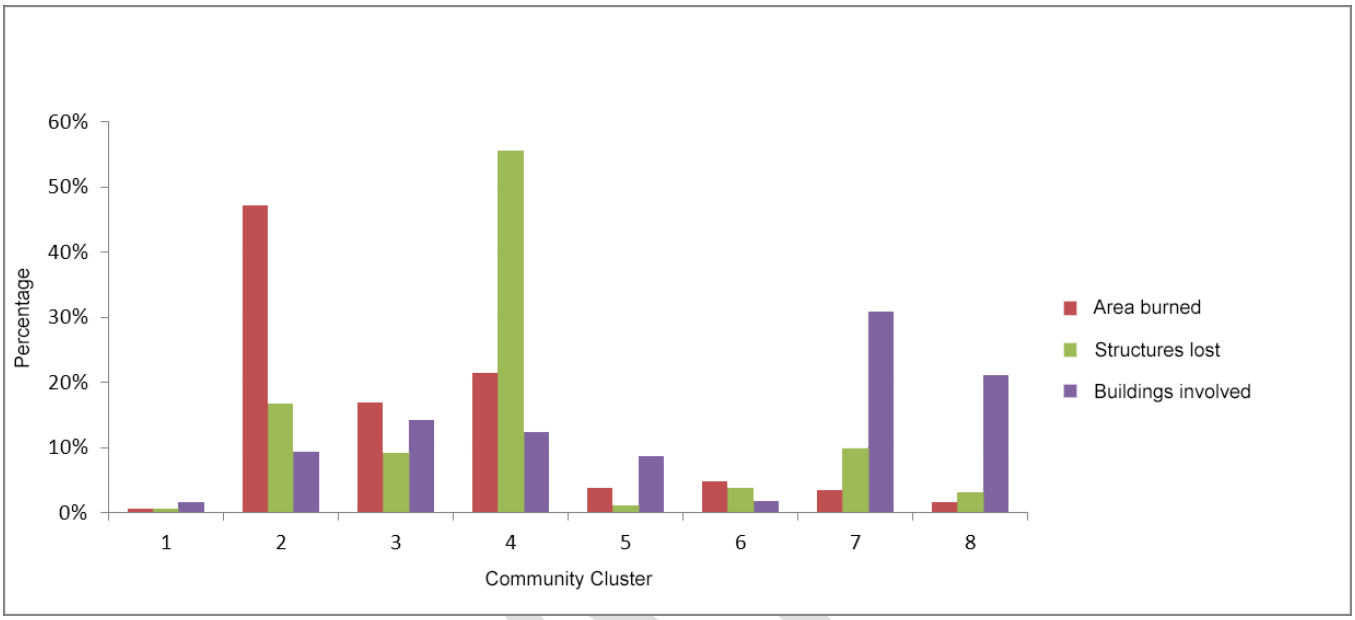
Conclusion: *Human caused ignitions, whether accidental or incendiary, are a universal problem that affects much of the United States. Targeting regions or counties with higher-than-normal levels of activity could prove productive, especially if targeted at specific causes.*

Home and Community Protection

Many programs that strive to reduce losses to homes and communities from wildfires focus on the immediate vicinity of the home or the surrounding community. Social science research also suggests that the public is increasingly concerned with the overall environmental health of the land, with fire representing one influencing and important factor. Reducing the likelihood that a wildfire burning in adjoining vegetation will ignite homes or other structures is one of the most effective avenues to reducing losses. Many actions can be taken by the individual homeowner, but others require concerted effort at the community level to be effective. Similarly, community efforts without commensurate attention by local home and business owners are unlikely to succeed. Therefore, actions by property owners to reduce the ignitability of homes and other structures are prudent wherever structures are in proximity to flammable vegetation. Data on the incidence of buildings involved in outdoor fires suggests that essentially all communities would benefit from more attention by property owners. Beyond that first step, there are areas of higher risk where additional emphasis on home or community efforts might be placed.

Recent patterns of structures lost or buildings involved in incidents help identify areas of possible prioritization. Figure D.11 presents a series of bar charts that show the relative area burned, proportion of structures lost, and proportion of buildings involved for each of the eight community clusters. The chart is scaled such that each set of bars sums to 100%. One can readily observe that the largest proportion of area burned and many of the structures lost occur in community cluster 2, while much of the area burned and the largest proportion of structures lost occur in community cluster 4. Thus, community clusters 2 and 4 are obvious candidates for greater focus on both community-level planning and individual structure protection. Community cluster 3 has the highest area burned among clusters common in the East and sizable numbers of structures involved. Community cluster 6 shares many of the same attributes with clusters 2 and 4 where it occurs in the West, and is similar to community cluster 3 in the East. Additional information on the configuration of the wildland urban interface in these four clusters reinforces the need for community level planning, given that fires that threaten homes often originate beyond the perimeter of the community itself.

Figure D.11 – Bar chart showing the relative area burned (red bars), proportion of structures lost (green bars), and proportion of buildings involved (purple bars) for each of the eight community clusters



Community clusters 7 and 8 are distinguished by very high numbers of buildings involved and structures lost relative to the area burned. This suggests that they would be good candidates for primary focus on the protection of individual homes and actions by individual property owners. Looking more broadly, the density of structures lost or buildings historically involved in wildfires highlights counties across the US where homes are affected by wildfire and could benefit from home protection (Option 6.a). Community clusters 2, 3, 4, and 6 are candidates for a focus on community planning and coordinated action in combination with encouraging individual actions by property owners (Option 6.b).

One approach to making homes and other buildings more resistant to ignition is to focus on building materials and construction standards. Such standards engage individual property owners and enhance the effectiveness of additional community-wide actions. Building standards and adjustments in infrastructure are more easily applied to new construction and development than to existing development, and communities can be designed or managed in ways that enhance response effectiveness or mitigate risk. Changes in building codes are more likely to be effective when targeted at areas of new construction in high-hazards areas, and consequently counties with increasing WUI area or increasing WUI home density growth—the latter being more closely aligned with increasing home construction overall—are places where such efforts are most likely to have a significant

effect. Because municipal and non-municipal areas tend to exhibit varying levels of ability to implement building standards, these are mapped separately (Options 7.a and 7.b).

Regional recommendations 2.1, 2.2, 2.3, 2.5, and 2.7 are applicable to these policy options.

Conclusion: *Protecting homes from ignition by wildfire is a practical step that is applicable anywhere homes can be found adjacent to natural vegetation. Similarly, coordinated action at the community level has practical advantages everywhere, but is essential when wildfires originate outside the perimeter of the community and threaten the entire community. New construction offers risk mitigation opportunities that may not be available elsewhere.*

Initial and Extended Response to Wildfires

The United States benefits from an extensive and sophisticated wildland fire response organization that comprises thousands of separate local, state, Tribal, and Federal entities. Each organization has a specific jurisdictional responsibility for initial response. They also coordinate and share resources and responsibilities as fires become larger and exceed the local capacity for response. Fortunately, local response capacity is generally adequate for controlling or extinguishing the majority of wildfires, though escalating risks due to changing conditions in and around communities may impact response effectiveness in the future. The relatively small percentage of fires that escape initial response are vitally important, however, as they account for a disproportionate percentage of the area burned, damage to homes and communities, and injuries and fatalities. They also account for a major portion of total suppression costs nationwide.

Coordinated response is a complex nationwide issue. Various institutional arrangements have been negotiated and developed across the country to meet the challenge of delivering the appropriate resources and personnel required on each incident. The Regional Strategy Committees and others examined various ways of improving coordination within their regions and have suggested actions for improvement (recommendations 3.1, 3.2, and 3.3). Implementing these recommendations will require working through the details among the various national, regional, and local governance organizations. Analyzing the implications of these various recommendations is beyond the scope of this national analysis. It is suggested, however, that some of the data sets that were accumulated by the NSAT could be useful within the more regional and local discussions of these issues.

At the national level, it is possible to highlight patterns that suggest areas of greater concern, or alternatively where a combination of response with other policy options might play out differentially. That is, response is essentially the last line of defense and action. It comes after fires have started and there is little else to be done except respond. As suggested previously, available evidence does not suggest that wildfires will suddenly

diminish in either occurrence or extent. An effective and safe response organization is essential. One way to ensure that collective response organization is also efficient (i.e., uses resources to maximum advantage) is to match it with other management options. For example, response personnel will find it easier to protect homes and communities when those same homeowners have proactively reduced hazards around their homes and prepared for wildfires.

Because most large wildfires typically cause significant challenges, the likelihood of observing a large, long-duration wildfire is mapped first. Normative terms like "large" and "long-duration" are context dependent. For example, a "large" fire in the intermountain west may imply thousands of acres, whereas a "large" fire in New England may only be a few 100 acres in size. Identifying a national standard that reflects these nuances is difficult. For analysis purposes, an index of fires of concern was defined as being greater than 1 square mile in extent and at least two weeks in duration (from report to containment). The two standards work in tandem. Larger western fires tend to be constrained by duration; fires lasting more than two weeks are generally much larger than 1 square mile. In the eastern US, the size constraint ensures that long-duration fires are of consequential size. The ten-year record of events provides a sample of where such fires occur nationally. Extrapolating that sample to all combinations of resiliency classes and community clusters generates a national map that reflects the relative likelihood of experiencing a large, long-duration wildfire within each county. Option 8 identifies counties where preparedness could be enhanced based on this likelihood. The resulting map indicates that much of the West, Southeast, and mid-Atlantic regions display areas of higher probability, as well as scattered counties of the upper Midwest.

A second option related to larger fires focuses on the relationship between area burned (as reported in federal and state records) and structures lost (as reported in the nationwide ICS-209 incident reporting system). An index of the rate at which structures are lost relative to the area burned was created and compared the rate of loss to the area burned itself. A four color map reflecting the intersection of those two indices revealed an interesting pattern. The combination of high rates of structure loss with low area burned is dominant in the Central Plains and Eastern regions. Conversely, the interior West exhibits most of the area with high rates of area burned, but relatively lower rates of structures lost per unit area burned. Counties exhibiting a combination of both high area burned and high structure loss rates are few in number, but highlight some of the most problematic counties in the country from a response perspective. Option 9 emphasizes structure protection in combination with efforts to reduce fire size based on these patterns.

The final response option is most relevant to initial response, which often is the responsibility of a local fire department or agency. Data from the National Fire Incident

Reporting System (NFIRS) was examined and indices computed of the numbers of buildings involved per incident and the relative frequency of reported accidental human-caused ignitions. The intersection of higher-than-normal values for these variables indicate that the number of buildings involved per reported incidents is one of the few variables lacking a strong geographical pattern. In contrast, the relative frequency of accidental ignitions tends to be higher in the East and more populous areas of the West. The intersection of these two variables has an interesting pattern that illustrates the widespread extent of the challenges in managing wildfire risk and offers a guide to matching structure protection with prevention efforts (Option 10). Reducing human caused ignitions should result in a commensurate reduction in the workload of local response organizations and considerably less risk to structures throughout much of the East and populous Western counties. Throughout much of the remainder of the country, there is an expectation that buildings will be involved in many local incidents, even if the number of responses is relatively low.

Recommendations for improving response to fire were presented under Goal 3 in the regional reports.

Conclusion: *Initial and extended responses is complex and difficult to analyze, particularly at a national scale. Examining data on area burned, structures lost, and patterns of accidental ignitions provides a backdrop for understanding some of the response challenges facing local, state, tribal, and federal fire departments and agencies.*

Summary of National Analysis Findings

The summary of the key findings resulting from the national analysis are described below. This information forms the context and basis for building the National Cohesive Strategy.

- ***Nearly all of the natural vegetation communities across North America historically burned—many quite frequently***. The basic biophysical environment and vegetation remains conducive to wildland fire; many biomes depend on it.

- ***The time intervals between wildfires have been extended, subsequently changing wildfire behavior and severity*.** Longer intervals between fires result is a gradual build-up of fuels that can lead to more extreme fire behavior unless fuels are reduced through other means.

- ***Present day regimes are strongly affected by the biophysical influences of vegetation, climate, natural ignitions, and human influences on ignitions and suppression***. Most wildfire incidents are caused by people and occur where people

live. Natural ignitions account for fewer fires, but a disproportionate share of area burned because of where and when they occur.

- ***Risk to communities is a function of the prevalence of fire, exposure of homes and other values, and the social capacity of a community to prepare for, respond to, and recover from a wildfire event***. Understanding these basic components aids the design of risk management strategies tailored to local conditions.

- ***Prescribed fire is one of the most effective and cost-efficient means of managing vegetation for multiple purposes, including hazard reduction, ecosystem restoration or maintenance, silviculture, and others***. Prescribed fire is not without risk, , however, which requires properly trained personnel, resources, and the willingness on the part of the landowners and nearby communities to accept the potential disadvantages of prescribed fire in exchange for the potential benefits.

- ***The degree to which fire – both naturally ignited wildfire and prescribed fire - can be tolerated within a given landscape depends upon community values and land management objectives***.

- ***Quantifying all of the values that could be threatened by wildfire across the nation is impractical***. Surrogates for many of the tangible values at risk can be used to inform decision-making at national and strategic scales. The combination of landscape resiliency classes and community clusters provides a powerful mechanism to discern and relate both the environmental and socioeconomic dimensions of the landscape simultaneously.

- ***Fire regimes are inherently dynamic, having changed historically and highly likely to change in the future due to multiple environmental drivers.*** Accurate predictions of the future remain elusive, but addressing the challenges of today prepares us for the future.

SECTION E: NATIONAL STRATEGY

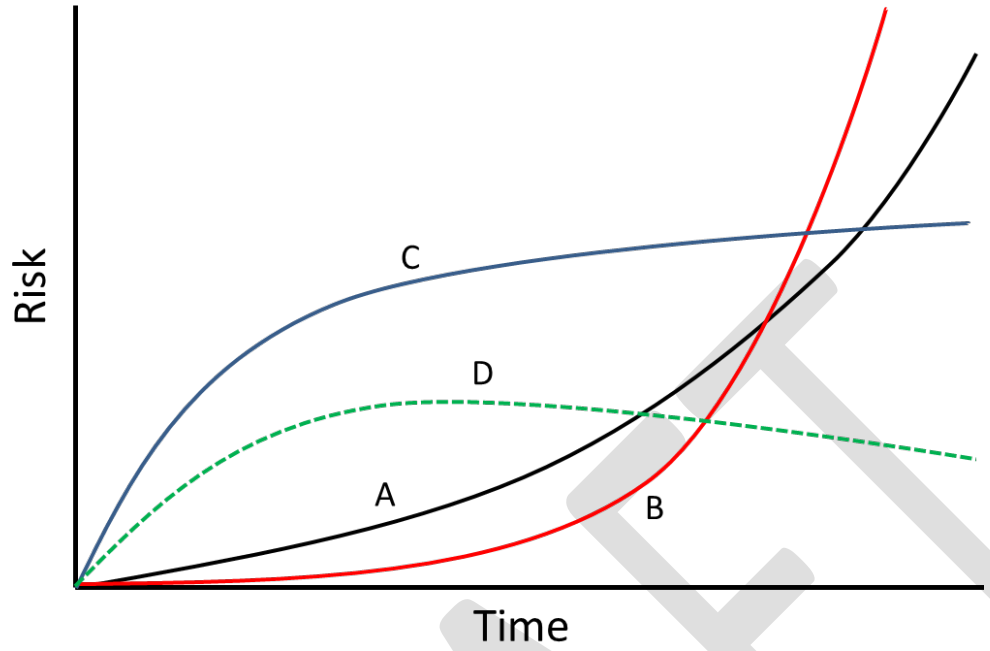
The Cohesive Strategy is about finding balance. This balance is encapsulated within the vision statement, "*Safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire*." Finding acceptable balance is not a scientific optimization problem, but a sociopolitical exercise which science can advise.

Risk Trade-offs

Every choice involves a question of value, and unfortunately, not everything is a win-win solution. Choices made at a national or regional level to emphasize one option or set of activities over another invariably affect all constituencies differentially. Similarly, choices made today affect all future options. For example, management choices made in the past have disrupted historical fire regimes, such that wildfires today are of much different character, magnitude, and extent than those that burned centuries ago. The net result is that fuel loads on much of the landscape are higher than historical levels, continue to accumulate, and are likely to contribute to larger, higher-intensity fires. As a nation, we must either accept and prepare for that eventuality or take active steps to reduce fuels. Fuel reductions carry their own risks, however, whether it comes from fire use or unintended collateral effects on other ecological or social values. Thus, all choices inherently involve trading one set of values for another.

The temporal nature of trade-offs can be visualized as a series of hypothetical curves reflecting the level of risk or expected losses over time under different policy scenarios (Figure E.1). In areas where fuel accumulation is a dominant factor, the black line (Line A) in Figure E.1 represents a "current policy" scenario in which risk progressively increases and losses mount with accumulating fuel loads. One alternative scenario might involve greater investment in response capacity, an emphasis on protection of homes and communities, and an assumed resource constraint that supports fewer activities for managing fuels (Line B). Over the short term, the losses do not increase as dramatically as under Line A, the current policy scenario, but at some point the accumulation of fuels overwhelms the increased suppression capacity and losses mount to the point that they actually cross over the trajectory projected by the current policy scenario. One might make a plausible argument that this is consistent with a common, contemporary trajectory because of ongoing investment decisions that focus on response and protection while less attention is given to the underlying causes of wildfires.

Figure E.1 – Hypothetical trajectories of risk over time under four investment scenarios.

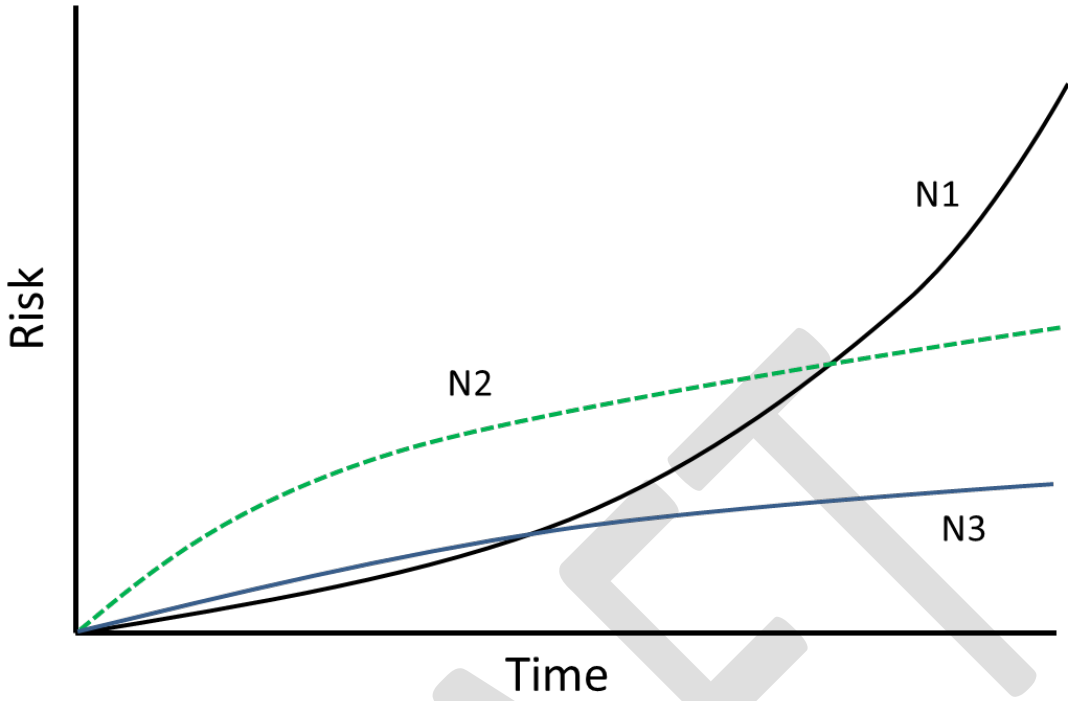


A third scenario assumes that greater investments are made in reducing fuels at the expense of investments in suppression or community protection (Line C). This scenario results in a trajectory wherein the risk quickly increases in the short term and then plateaus at some level higher than the current level of risk, but less than future levels under scenarios A and B. The short-term increase in risk is due in part to the risk associated with allowing fire to be part of the fuels management strategy. Finally, one can imagine a scenario in which the levels of investment in fuel treatments, suppression, and community protection are sufficient to lead to a trajectory in which risk goes up in the short-term, but then plateaus and perhaps even comes down over time (Line D).

The trajectories shown in Figure E.1 are mainly applicable to counties where fuels are a driving factor in the wildfire equation, which includes much of the Southeast and the West. Areas of the Northeast where the driving issues are primarily ignitions, homes, and response could be represented by different, but comparable trajectories. Clearly, the actual shape and magnitude of these curves vary considerably throughout the country. In some areas, the curves will be relatively flat, but there is little justification for expecting declining curves in any significant portion of the country. The curves here are exaggerated to better show the qualitative nature of the inherent trade-offs, and should not be interpreted quantitatively.

One can use a similar logic to imagine risk trajectories that might apply to the nation as a whole (Figure E.2). In this instance, Line N1 in Figure E.2 represents the current trajectory, recognizing that fuel loads are accumulating in much of the landscape, expansion of the WUI continues, and climatic changes, invasive species, and other environmental factors are likely to contribute to worsening risk. One can imagine that a return to near-historical levels of wildland fire would aggressively address the fuels problem—leading to reduced long-term risk—but also quickly escalate overall risks beyond what might be acceptable in many communities (Line N2). A more ideal solution would be a trajectory that marginally increased risk in the short-term, but began paying long-term benefits relatively quickly and kept risks at manageable levels (Line N3).

Figure E.2 – Three hypothetical scenarios for temporal trends in risk nationwide: continuation of current policies and actions (N1), return to historical levels of wildland fire (N2), and a mix of prudent policies and actions that effectively reduce long-term risk (N3).



Line N3 represents the vision of the Cohesive Strategy, where we are able to restore and maintain fire-resilient landscapes, create fire-adapted communities, and safely and effectively respond to wildfire. The temporal nature of the curve helps conceptualize a National Strategy, as the vision of the Cohesive Strategy is to address risk in the immediate and short-term as well as the much longer-term future. The exact trajectory is not fully defined. Each area of the country will follow a unique path, but there will be a point at which the level of fuel treatment is adequate to temper fire behavior to manageable, non-destructive levels. Simultaneously, the investments and priority actions undertaken within and near communities are sufficient to protect homes and communities. The potential rise in risk in the near term is related to the risk associated with expansion of the use of fire as a tool to manage fuels. Safe and effective response is universal, works in tandem with other programs and activities, and is commensurate with the need.

The wide variation in current conditions and trajectories across the country makes it impossible to generalize the specific actions that are best suited to each given area. The policy options explored in the preceding section and the analysis of resiliency classes and community clusters suggest where to look first for setting priorities and providing emphasis. No county can be perfectly characterized by a national analysis, but understanding commonly shared attributes provides a good start. Combining policy options to best fit a combination's unique character, coupled with consideration of local available information and circumstances should yield favorable outcomes.

Identifying National Priorities

The vision for the Cohesive Strategy is clear, the goals are well articulated, potential policies and actions have been explored, and the desired trajectory of risk has been mapped. What remains is perhaps the hardest part of any planning exercise: who does what when and where? Many of these details will be worked through in collaborative exercises, but the blueprint for those deliberations and commitments comes from national-level spatial and temporal prioritization.

The first element in that blueprint is response. Safe and effective response to wildfires must be the first priority of the National Strategy. Placing priority on the protection of the health and safety of the public and firefighters implies the need for, and assumption of, a safe and effective response organization. This presumes that immediate threats are the most important—and wildfires are an immediate threat throughout the country. Although the analysis does not suggest widespread deficiencies in suppression capacity, Options 8-10 explored above suggest locations that might benefit from greater preparedness, especially if paired with other actions that reduce hazards. Improving preparedness can take many forms beyond merely more equipment and personnel. Improved coordination, communication, and training enhance response efficiency, and belong in any prudent regional or national strategy.

It would be shortsighted, however, to assume that a safe and effective response to fire is the only priority. Indeed, one could argue that the suppression challenges today are symptomatic of more fundamental underlying issues. Ample evidence suggests a trajectory of increasing risk that cannot be headed off by simply adding more suppression resources. Relatively inexpensive, effectual, and broadly applicable actions head the list of additional priorities. Of those considered, options that focus on anthropogenic ignitions are logical next choices. Human caused ignitions are a widespread issue that is relatively inexpensive to affect, especially when prevention programs are carefully targeted.

Activities that focus on individual homes or structures and community-level protection is an equally important component of the Cohesive Strategy. Large wildfires that threaten entire communities are relatively rare, yet their impact to public perception and the reality that large fires have significant consequences leads to aggressive and costly suppression efforts even when other approaches might be considered. Efforts that engage communities in taking proactive action prior to wildfires engender public support, work in conjunction with other actions, enhance management flexibility in response, and are not necessarily expensive.

The gradual accumulation of wildland fuels is perhaps the most difficult and challenging issue to address. An analogy can be made to walking up the down escalator. One has to be moving just to stay in place; the only way to move up is to move faster than the escalator is moving down. Current estimates of areas being treated intentionally or burned in wildfires suggest that fire-adapted landscapes are falling further behind in managing fuels. In some areas, the principal means of reducing fuels appears to have been unwanted wildfires over which we have little apparent control. Broad-scale efforts to reduce fuels across the landscape can be expensive and time-consuming, and require strategic coordination. Success will not be achieved overnight. Prescribed fire and managing wildfire for resource objectives have the greatest potential for treating large areas at lower cost than mechanical treatments, but use of fire entails greater inherent risk that must be addressed at a local level. Mechanical, biological, or chemical treatments play an important role wherever they are economically feasible.

Spatial Prioritization

The policy options described in the National Analysis suggest that there is a broad range of actions that would be effective in advancing the goals of the Cohesive Strategy. Spatial prioritization of activities at a national-scale, based upon a rigorous analysis of available information, was conducted to reveal opportunities for greater success, as well as possible barriers (other than resource constraints) that could hinder or prevent some policy options from being followed.

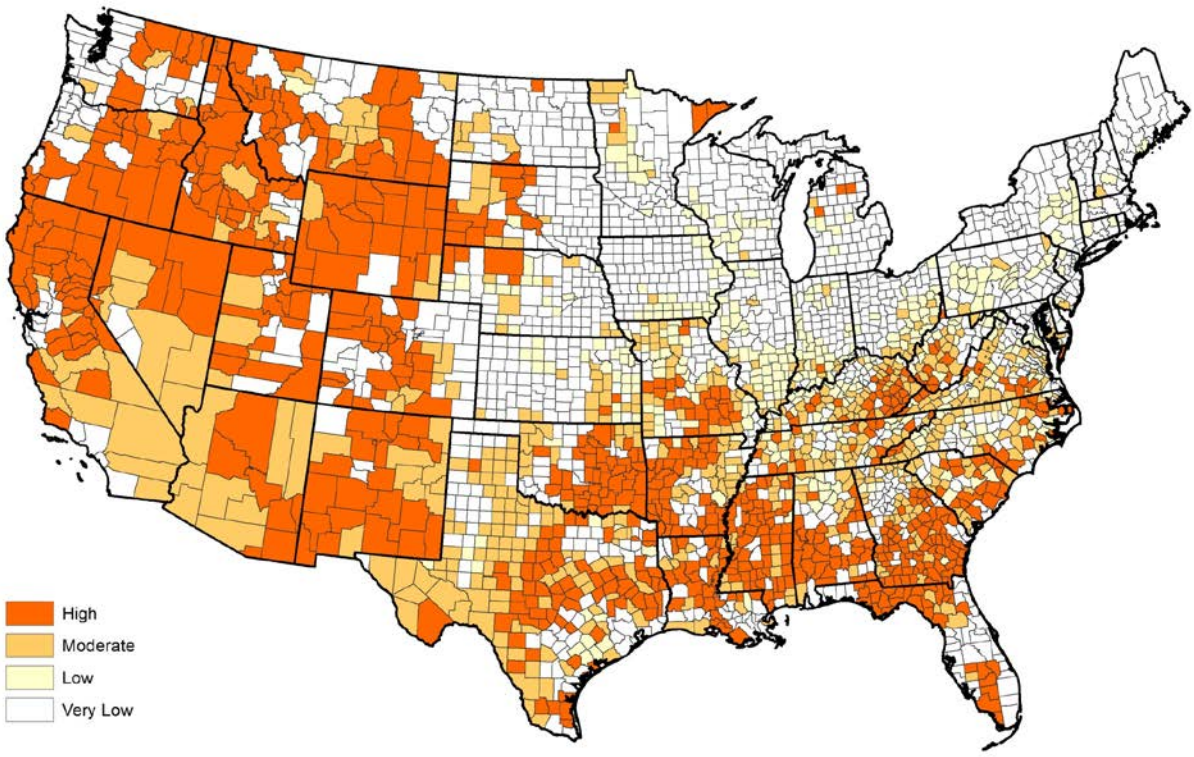
The concept of a national priority for thematic actions follows the premise that concerted actions are most likely to be efficient or effective in areas where conditions contributing to an issue are most acute. The attributes of counties falling within each combination of community clusters and resiliency classes relative to three themes were analyzed at the national scale: managing human ignitions, community planning and coordination, and broadscale fuel management. The characteristics of these combination classes relative to each theme were then used to suggest relative priorities from a national perspective. The general process was to identify a subset of resiliency classes or community clusters that were associated with higher or more troublesome levels of the variables of interest. The intersection of these identified classes and clusters created a high priority combination class. Second-tier sets of clusters or classes were also identified and used similarly to indicate combination classes that would receive second or third-level priorities.

Broad-scale Fuels Management

National prioritization of areas for broad-scale fuels management (as distinct from hazard reduction in proximity to structures) suggests a primary emphasis in the West and

Southeast (Figure E.3). These included counties with the highest level of wildfire, fire-adapted native vegetation, and communities concentrated within a broader wildland landscape. Each location would utilize the mix of options most suitable for local conditions, as described in Options 1-4.

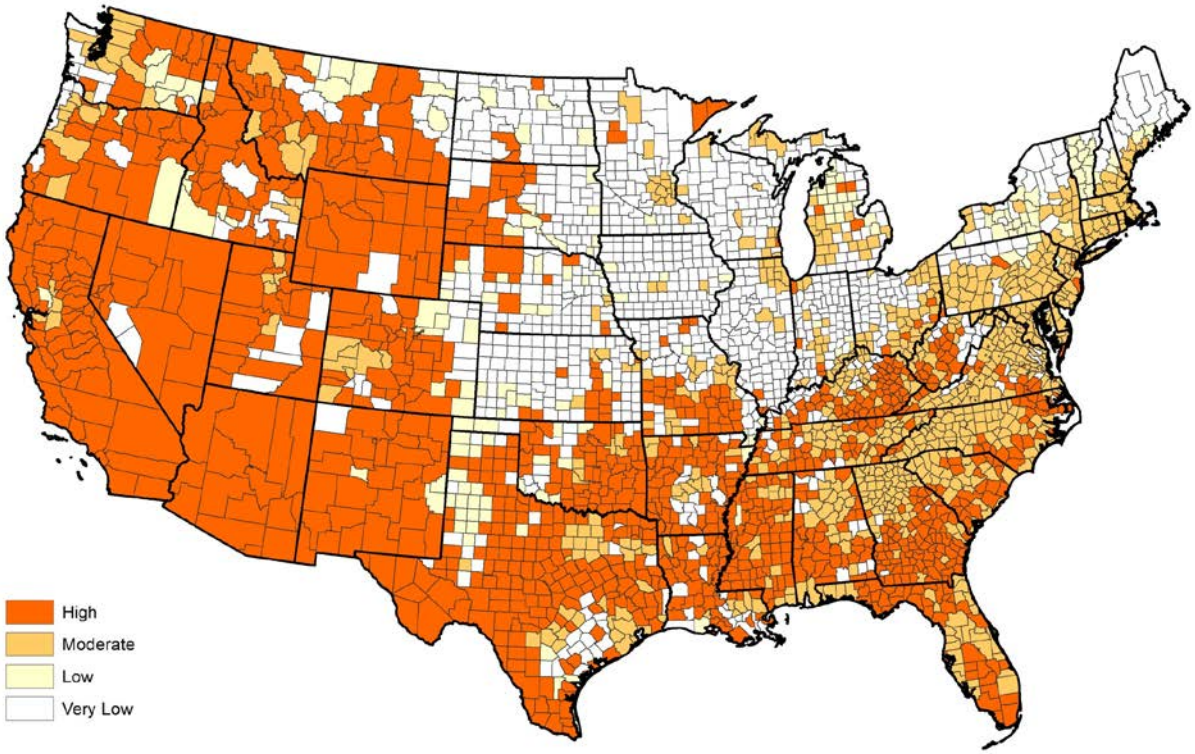
Figure E.3 – National priorities for broad scale fuels management utilizing a mix of options best suited for local conditions



Community Planning and Individual Homeowner Action

Candidate counties for national prioritization of community and individual homeowner action would include those described above under Options 6.a and 6.b, with consideration for landscape resiliency class (Figure E.4). Counties characterized by higher-than-average annual area burned, structures lost, and homes exposed within the WUI were assigned the highest priority for community action. More urban and suburban counties (especially in the East) were assigned the second-highest level of priority.

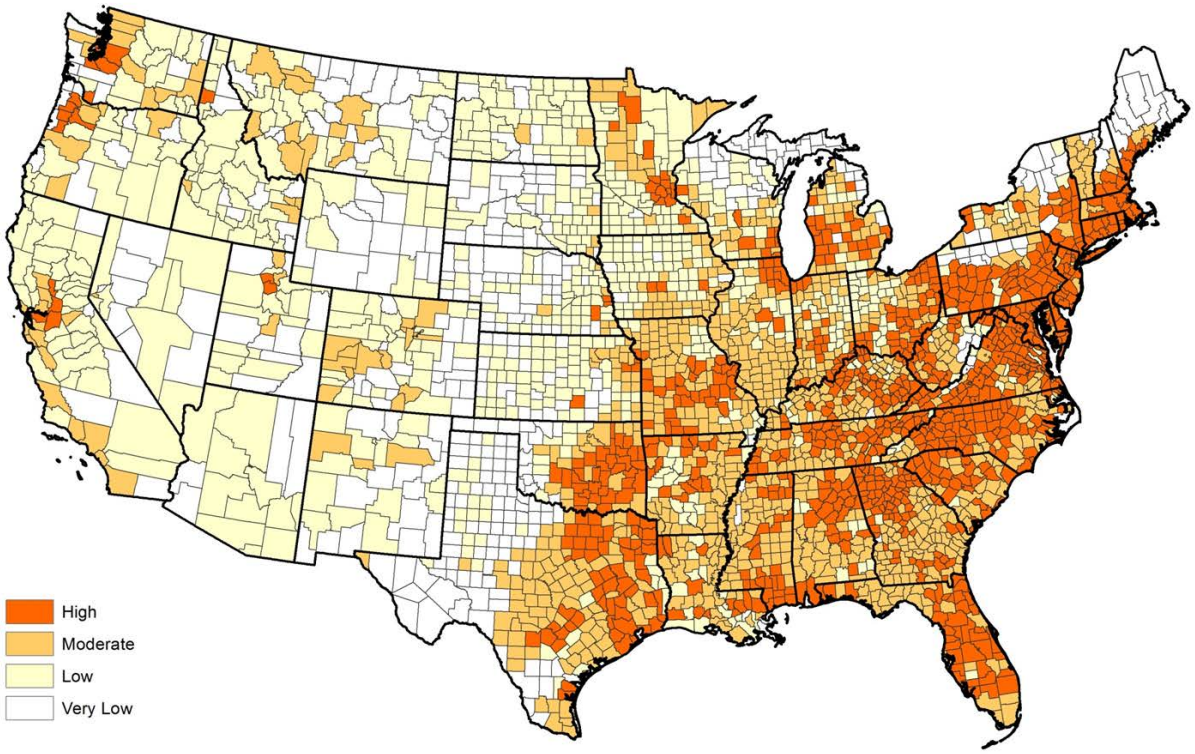
Figure E.4 – National priorities for community planning and coordination as suggested by county attributes



Managing Human-Caused Ignitions

The available data on human ignitions and its consequences identifies counties where human ignitions dominate and lead to above-average area burned or buildings impacted by wildfires. These data suggest a prioritization that would target many eastern counties and populous western counties (Figure E.5).

Figure E.5 – National priorities for managing human ignitions



The spatial prioritization maps presented here work in tandem with the policy option maps presented in Section D. Policy options were mapped in an attempt to show where they would be most reasonable or potentially effective and generally were developed independent of each other. The prioritization maps reflect a higher level of aggregation in that multiple policy options can be employed in the same location for similar purposes. Both maps are intended to highlight opportunities, not to exclude the use of any management option from other locations.

Similarly, the purpose in developing the classification systems for counties was to create a common set of narratives that would be broadly applicable, not identify individual counties for a particular prescription. Therefore, if errors in data or interpretation erroneously led to a misclassification of a county, it is anticipated that more localized planning efforts would correct such errors and adjust county-level recommendations appropriately.

Additionally, implementation of any policy option and action requires a trained, committed, and supported workforce. It is likely that the same individuals will be called upon to implement multiple facets of the overall strategy. For example, first responders may be the only ones with the requisite knowledge and experience to conduct prescribed burning in many locations. If they are occupied responding to wildfires, prescribed burning is cancelled or postponed. Similarly, the best ambassadors for prevention programs and community planning are often local firefighters. When resources are stretched, secondary programs suffer.

Management and Policy Recommendations

The national risk analysis and spatial prioritization of actions provides a basis for establishing strategic and intergovernmental direction for wildland fire management. Several national, intergovernmental management and policy recommendations related to the four themes analyzed in the national risk analysis emerge, and are listed here. If the intergovernmental actions and decisions across the nation are aligned with these recommendations and investments are focused on national priorities that can be discerned spatially, the likelihood of achieving the three broad goals of the strategy in an effective and efficient way will be enhanced.

Broad-scale Fuels Management

1. Where wildfires are unwanted or threaten communities and homes, design and prioritize fuel treatments to reduce fire intensity, structure ignition, and extent so that suppression efforts are more likely to be effective and can be conducted more safely.

2. Prioritize fuel treatments that have a high likelihood to reduce fire intensity. Fuel treatments that are effective at reducing fire intensity can lead to reduced severity (fire effects), which can lead to reduced harmful or even beneficial ecological effects and may more closely mimic historical fire effects.

3. Where feasible, implement strategically placed fuel treatments where landscape effects can extend beyond the perimeter of the area physically treated, either through affecting fire behavior directly or by facilitating ecologically sensitive suppression strategies.

4. Continue and expand the use of prescribed fire in counties where prescribed fire is currently applied to substantial portions of the landscape. Expand the use of prescribed fire to those areas suitable for meeting objectives and mitigating

potential consequences. For example, many areas in the West as well as counties in the central Appalachians appear to be suitable for increased prescribed fire activities.

5. Where allowed and feasible, manage wildfire for resource objectives and ecological purposes to manage fire-adapted ecosystems and achieve fire-resilient landscapes. The inherent risks must be recognized and it becomes important to involve partners in planning and implementation. This method of managing fuels is affirmed in the Federal Wildland Fire Management Policy, though typically prohibited by state and local policies or statutes. Use of this method to manage fuels in wilderness, parks, and similar remote and wild areas has proven effective.

6. Utilize fuel treatments involving mechanical, biological, or chemical methods when economically feasible and greater control over the project objective and outcomes is necessary. Where possible, these treatment types should be linked with active economic markets where byproducts can help offset the cost of treatment. Expand forest product and biomass markets where sustainable use is feasible and aligns with landowner objectives.

Home and Community Action

1. Plan for and mitigate risk posed by wildfire in communities and homes situated near or adjacent to natural vegetation. Wildfires that originate outside the perimeter of the community require coordinated action at the community level because they can threaten the community as a whole. In most instances, action is required by both the community and individual homeowners if risk to communities and their values is to be avoided or mitigated.

2. Emphasize proactive wildfire risk mitigation action, especially where new development and expansion into natural vegetation is occurring. Prioritize actions that mitigate risk and enhance response effectiveness at the community and individual structure level where communities and homeowners take responsibility to plan for and implement actions.

3. Pursue municipal, county, and state building and zoning codes and ordinances that mitigate fire risk and help protect life and property from wildfire – this is most easily accomplished for new construction. Develop and promote building materials and fire-resistant construction standards.

4. Emphasize community and homeowner defense actions that protect structures in areas where wildfire risk is evident and past wildfires have involved structure damage and/or loss.

5. Ensure that wildfire mitigation strategies consider protection of community infrastructure and values. For example, municipal watersheds, viewsheds, parks, and other recreation facilities are less costly to protect than to restore after a fire. Collaborative planning and partnerships become essential to allow activities to be coordinated based on a shared set of values and establishment of jurisdictional roles and responsibilities.

Wildfire Response

1. Enhance wildfire response preparedness in areas where there is a higher likelihood of large, long-duration wildfires. From a national perspective these areas include much of the West, Southeast, and mid-Atlantic regions as well as scattered counties of the upper Midwest.

2. Enhance wildfire response preparedness in areas where high rates of structures loss per area burned occur. From a national perspective this includes areas in the Central Plains and Eastern regions. Prioritize areas that exhibit a combination of both high area burned and high structure loss rates for proactive fuels management, preparedness, aggressive suppression, structure protection, or a combination of multiple policy options. While relatively small in number, these counties may be the most problematic from a response perspective.

3. Jointly emphasize structure protection and prevention to support initial response, which is often the responsibility of a local fire department or agency.

Managing Human-Caused Ignitions

1. Emphasize programs and activities that prevent human-caused ignitions. Human caused ignitions, whether accidental or incendiary, are a universal problem that affects much of the United States. Prevention programs are most effective when they focus on the underlying causes of human-caused ignitions locally and tailor prevention efforts to specific causal factors and community dynamics.

2. Target prevention programs in the southeastern and south-central states and in the far West to prevent human-caused ignitions.

3. Target prevention programs in large portions of the East and more populated counties of the West for prevention of incendiary ignitions where these ignitions combined with high levels of area burned suggest greatest need.

Implementation

The national analysis yields consistent information to evaluate the relative opportunities and risks of each policy option and explores where they might be focused across the nation. The National Strategy lays the foundation for taking the next step of establishing the priorities and actions necessary to making progress in the three goals, emphasizing the shared responsibility among stakeholders and partners. On-the-ground actions and activities can be consistent, aligned, and complementary to supporting the National Cohesive Strategy.

The need for continued discussion and effort remains. Implementation of that strategy will involve both national executives and a cascading series of regional and local officials. The strategy described here is intended to inform broad and strategic discussions among intergovernmental stakeholders. Final implementation will require concerted effort on the part of numerous individuals and stakeholders, not specific allocation of funds or placement of resources.

SECTION F: NEXT STEPS

The Cohesive Strategy was developed to be informative at multiple scales and utilized by a diverse set of stakeholders. Phase II of the effort focused specifically on regional understanding of wildfire risks, challenges, and opportunities. As a result of Phase II, the Regional Strategy Committees assembled a comprehensive list of actions and activities within the regional action plans that would collectively advance the goals of the Cohesive Strategy. Implementing the regional action plans through local and regional planning and decision-making processes is necessary and ongoing. The National Action Plan will bring together issues of national significance and initiate actions to address the barriers and critical success factors identified by the Regional Strategy Committees. The keys to success in implementing the regional and national actions plans are:

- **Engagement and Leadership**: Sustained leadership and broad intergovernmental coordination.

- **Collaboration**: Facilitate and expand collaboration at all levels, including supporting coordination of activities and landscape-scale planning and prioritization.

- **Partnerships**: Maintaining and continuing to build the relationships among stakeholders throughout implementation.

- **Accountability**: Redeeming roles and responsibilities and fostering accountability to track progress toward achieving the Cohesive Strategy goals.

The work completed in the regions, including the Regional Action Plans, defined what should be pursued, while the national risk analysis explores spatial prioritization of broad policy options across the nation. By design, the national trade-off analysis provides a broad strategic overview of the challenges and opportunities to inform choices that can be made. Analytical capability and utility is far beyond what is presented within this report. Future analyses can be explored to focus on different scales and/or scopes.

The analysis of options suggests where actions could be focused from a national program management perspective. With an understanding of the complexity of wildland fire management challenges across the county, the Cohesive Strategy does not - and cannot - prescribe a single, one-size-fits-all solution. The Cohesive Strategy recognizes that choices can be made, and the available scientific information can be utilized to inform those choices occurring across the nation, at various scales.

The following areas represent the critical areas in which work will continue in order to facilitate implementation of the Cohesive Strategy.

Priority Setting

The Science analysis assembled approximately 100 data sets that form the basis for prioritization and decision-making. Priorities for actions will be developed by the decision-making bodies and incorporated in the National Action Plan. The regions have stated that prioritization is essential – prioritization of actions, as well as geographic prioritization of where these actions are likely to provide the desired outcomes. The WFEC has acted on the science information and a national perspective of prioritization is presented in Section E. The regions have developed action priorities in their Action Plans, but regional geographical priorities were not specified. The science analysis provides a tool for national and regional priority setting.

The national analysis is broadly applicable to the regions in a number of ways. Summary sheets were developed for each landscape resiliency class and community cluster combination, showing the counties within each cluster (refer to Appendix 6). The summary sheets can be utilized to help decision-makers at various levels answer specific questions tailored to the attributes of the resilience class and community cluster combination. Summary sheets will be useful to communities and counties involved in creating or updating a CWPP. Each summary sheet describes the combination of landscape and community factors, maps the counties in that cluster, lists the policy options to consider for reducing wildfire risk in those counties, and gives the relevant priority rating for the three national policy options. Figure F.1 shows a sample summary sheet.

The national analysis provides insight into which policy options are useful in different areas of the country and facilitates prioritization at the national and regional levels. Local information can then be applied to address these issues strategically and tactically. The summary sheet clusters provide maps of counties with the intersection of landscape and social risk factors. Detailed knowledge of locations within the counties, available from the states and counties, can show where fuels, communities, or response capacity need to be addressed within those counties. The Cohesive Strategy envisions decision-making being shared between national, state and local levels.

Figure F.1. Summary Sheet 3G

3G

Community Cluster.....3

Resiliency Class.....G

Description

These counties have a sizable federal land area, have many ignitions, but not have experienced a large fire. Most are in the Southeast, where there is a high Wildland Urban Interface (WUI) and demographically stressed population.

Example of a Typical County

Yell County, Arkansas: Yell County has a large area in the Ouachita National Forest. It experiences occasional large fires, as it did in 2003 and 2007.

Policy Options and Opportunities

Managing Fuels Across the Landscape
These counties can consider using prescribed fire as one of their primary fuel management options. In addition, there may be an active forest products industry nearby, which could support fuel treatments.

Managing Ignitions
Human caused ignitions are a problem in these counties. Reduce accidental human-caused ignitions through the enforcement of burning bans or greater education of the danger of attended fires. Reduce human-caused incendiary ignitions by focusing on enforcement programs

Home and Community Actions
These counties could adjust building and construction codes in non-municipal areas.

Response to Wildfires
Response organizations continue to protect structures, treat fuels and target ignitions as local conditions apply.

National Priorities

Fuels Management	High
Community Planning and Coordination	High
Managing Human Ignitions	Low

The scientific analysis provides information on policy options that can be considered for the 3,109 counties of the coterminous United States. The policy recommendations work together to make a county more resilient to fire. For a single county there could be recommendations for prescribed fire use, wildland fire use, efforts to reduce accidental and intentional ignitions, community protection and buffers, building codes, and more. In areas

of high risk, a multi-faceted approach is the best approach to reducing wildfire effects. High risk areas require multiple approaches which include reducing fuels, reducing ignitions, reducing structural ignitability, and increasing community preparedness for maximum fire readiness. To protect communities, fuels treatments should be strategically placed.

A review of the Regional Action Plans to utilize the science analysis for geographic priority setting is a next step for the regions.

National Action Plan

The National Action Plan and the Regional Action Plans will work together to address issues which the three regions have identified through the scientific analysis and through experience, as having the highest priority for action. The National Action Plan will spell out actions, tasks, lead agencies and timeframes for addressing the high priority barriers and critical success factors, other national issues, and will take a national approach to monitoring and evaluating progress.

Actions may be derived from the following sources:

- Actions to address the barriers and critical success factors identified in Phase II of the Cohesive Strategy; new barriers and critical success factors that may be identified in the future;

- Actions in relation to policy options derived from the tradeoff analysis;

- Actions from regional action plans that are national in scope or common to multiple regions;

- Overarching actions from the above sources.

Barriers and Critical Success Factors and Other National Issues

Analysis of the 11 barriers and critical success factors (CSF) has begun. Each was selected by the RSCs as being the highest priority to be addressed for successful implementation of the Cohesive Strategy. WFEC has assigned task groups to review and validate the national barriers and critical success factors. The task groups will identify activities necessary to mitigate the barrier and or critical success factor and identify appropriate resources necessary to address them. While time frames will vary for each barrier and critical success factor, it is anticipated that actions to address barriers and critical success factors will be included in the National Action Plan.

1. Increase Fuels Management on Private Land
2. Increase Fuels Management on Federal Land
3. Growth Management, Land Development and Zoning Laws
4. Inefficiencies in the National Qualification Standards
5. Remove Policy Barriers and Process Complexities for Sharing Resources
6. Enforceable Fire Prevention State/Local Ordinances
7. FEMA Pre-Disaster Mitigation Program
8. Assisting Communities at Risk
9. Investment in Firefighting Workforce
10. Improve Fire Data
11. Intergovernmental Wildland Fire Governance

Additional issues or concerns were noted in the Regional Risk Analysis Reports. These issues and concerns will be addressed further in the National Action Plan:

1. Prescribed fire and smoke management
2. Rehabilitation of damaged lands
3. Biomass utilization
4. Increasing collaboration with stakeholders and regulatory agencies
5. Expand fire adapted communities programs
6. Protection from unwanted fires for all lands
7. Implement actions from the three regional action plans

Communications

The National Communication Working Group will shift its communication focus from development to implementation, and new communication strategies are needed to meet implementation objectives. The following communication strategies will support implementation.

The Working Group expects a large majority of Cohesive Strategy implementation projects to be undertaken by local community-based collaboratives focusing on single or a few joint actions. It also believes that the success of these collaboratives will largely determine continuing support for the Cohesive Strategy and its enduring success. The Working Group's next steps include the following.

- Increase knowledge of the Cohesive Strategy in fire and land management organizations;

- Expand other stakeholder knowledge and understanding of the Cohesive Strategy;

- Fire education: Improve stakeholder and public knowledge of wildland fire fundamentals;

- Collaboration: Mobilize higher education and extension resources to provide opportunities for stakeholders to improve their collaboration knowledge and skills;
- Knowledge utilization: Improve and expand communication between scientists and stakeholders implementing the Cohesive Strategy to ensure that the best science and proven professional practices are used;

- Promote evidence-based wildland fire prevention communications and education;

- Encourage and support a continuous, rolling, and collaborative dialog among stakeholders and across regions to enhance shared understandings, roles, mutual trust, and willingness to pool resources and take joint actions.

The Framework to support Cohesive Strategy implementation addresses identified national and regional priorities. It is designed to adapt to new information and changing conditions. It will be updated periodically as progress is made, lessons are learned, new activities are planned, and as Cohesive Strategy goals are achieved.

Monitoring and Accountability

Performance measures drive progress toward key desired outcomes. They are statements describing the level of performance to be accomplished within a timeframe, expressed as a tangible, measurable objective or as a quantitative standard, value, or rate. Performance measures also occur at different levels or scales. The format generally accepted as the model for developing performance measures – "The Logic Model" - calls for developing outcome measures to measure the ultimate end result, intermediate measures that serve as leading indicators to let organizations know if they're on the right track, and inputs and outputs, which track activities.

Throughout the development of the National Cohesive Strategy, it has been recognized that for a country as large and diverse as the United States, one size does not fit all. Therefore, the national outcome measures flow directly from the Vision and Goals of the Strategy and will be intentionally broad to be inclusive of many different factors across geographic regions. Together, the national outcome measures will enable us to communicate to partners and policy-makers progress toward meeting the goals of the Cohesive Strategy. They will help leadership answer questions such as: Are landscapes resilient to wildfire in support of our management objectives? Can human populations and infrastructure in

communities at risk withstand wildfire without loss? Is there effective collaboration in using risk management to improve the safety, effectiveness and efficiency of our wildland fire management actions? The national outcome measures will be used to help the Congress, the national wildland fire management community, and other stakeholders assess national progress toward achieving the expected results for each of the three goals of the Cohesive Strategy. Beneath the national outcome measures are intermediate outcome measures, which will be more narrowly focused on measuring specific activities that must happen if we are to be successful in achieving the national outcome measures.

- The federal agencies are accountable to the Office of Management and Budget and Congress through formal performance measures. The Cohesive Strategy national outcome performance measures will not supersede the formal agency performance measures but will be used to demonstrate and report progress toward achievement of the Cohesive Strategy goals. However, it is desired that all agencies and organizations with a stake in wildland fire management will seek to align with or incorporate these national outcome measures into their own planning and performance processes. These national outcome measures are important and implementation of the Cohesive Strategy includes strategies and commitments to collect the information required for these measures. National outcome, intermediate, and efficiency performance measures along with definitions and targets will be established.

- The national performance measures will be developed using a set of basic premises ensuring measures: (1) are "SMART" (specific, measurable, achievable, relevant, timely), (2) clearly illustrate achievement of the three goals of the Cohesive Strategy over time, and are (3) guided by the national trade-off analysis to ensure they are focused on measuring the most critical accomplishments. In addition, the national outcome measures will take into account the Guiding Principles that were agreed to during Phase I of the development of the Cohesive Strategy.

In addition to national outcome measures, associated national efficiency measures will be developed for each goal to measure the efficiency of investments related to significant cost centers associated with each goal. Specifically, efficiency measures will be used to:

- Track priority investments by Cohesive Strategy goal, over time with the intent of establishing trend information (where applicable) on the effects of investments to achieve goal outcomes.

- Help Congress, OMB, and decision-makers assess which investments are the most cost effective means of achieving the goals in order to make informed investment trade-offs with respect to wildland fire program appropriations.

- The measures will be incorporated into the National Action Plan to be completed in 2014.

Data Gaps

The Cohesive Strategy has involved an integration of datasets that cover very different aspects of wildland fire. Few if any of these datasets were collected with an integrated science or management framework in mind. Instead data have long been collected to satisfy narrower objectives, and past improvements in data quality have focused on problems of completeness and consistency within and among reporting entities.

Gaps and data quality issues will probably always exist from this perspective, but what comprises a functionally important *data problem* is dependent on the scale of the analysis and the scale of the decisions to be made. For certain types of decisions, data gaps may not matter; for others, data gaps can be critical. Put another way, for certain considerations of tradeoffs, an approximate understanding of an issue or problem is not likely to lead you toward a different decision than if that data were perfect.

Decisions related to the Cohesive Strategy involve how we are going to affect the present or future, so whether or not something constitutes an important historical data gap needs to be put in context with how well it helps us understand the present or predict the future. Historical data quality generally improves over time, but communities, weather, markets, and invasive species are also changing. If the past does not accurately inform what we are about to experience, the depth and representativeness of historical data might suggest important data gaps that may be only resolved through modeling.

The data gaps listed here are those considered most important for national to regional scale prioritization and integrated decision making. While some shortcomings may be overcome by combining different types of data, such as use of MODIS hotspots as well as reported fire data, having better quality data would likely improve our understanding of the processes involved and our confidence in the associated tradeoffs.

1. Prescribed fire data is critical for understanding questions of resilience, yet data are inconsistently collected across jurisdictions, if it is collected at all. Federal fires that involve fuels treatment programs are available and sometimes in GIS format, yet state or local data is more challenging. Knowing where prescribed fire is being

conducted would refine our understanding of where fuels management and resilience depends on it, and where fire conflicts could occur. Military lands and states (or home rule counties) that have limited or no burn reporting requirements are especially incomplete.

2. Knowing the actual effectiveness of fuels treatments—as measured across a range of values—is a fundamental gap in existing data. While difficult to measure, a general emphasis on fuels treatment is not guaranteed to be effective overall. And effectiveness if often better measured by not one treatment, but implementation of a sustained fuels treatment regime. We have limited knowledge of fuel treatment regime effectiveness across jurisdictions.

3. Substantial attention has been afforded to the problem of jurisdictionally-consistent wildfire data. Federal, state and NFIRS (DHS-US Fire Administration) data differ in many respects and vary in their completeness. Military lands are very incomplete.

    a. To get at national to regional patterns in wildfire occurrence, consideration of all three datasets is critical, yet non-reporting, inconsistencies, missing fields, and redundancies make integration difficult. This makes it difficult to explore tradeoffs involving regional and local response efficiency, responder and community safety and resilience.

    b. Knowing how much and what parts of large fires are managed for resource benefits could increase broad-scale understanding of this alternative and its tradeoffs.

    c. Location-specific information is critical for sub-regional decisions as it affects tradeoffs involving resilience and risks to communities. Past location information is especially error prone or of low resolution.

    d. Having an accurate knowledge of wildfire cause is important for specific tradeoff considerations, yet definitions vary across datasets and jurisdictions. A high fraction of wildfires are attributed to unknown or miscellaneous causes. Inconsistencies in general and specific causes can suggest a basic need for data quality assurance, especially in NFIRS and state reporting.

4. Smoke constitutes one of the greatest tradeoffs of wildland fire. Its occurrence and duration result from decisions involving suppression, fire for resource benefit and fuels treatments, and can impact the health of prescribed fire practitioners and the

public. For many broad decisions and planning, making a general association with different types of fire and exposure may be sufficient, but more local decisions require more.

5. While large fire datasets include homes, outbuildings and commercial structures lost, fires in the NFIRS dataset only describe structures involved more ambiguously. Having a uniform understanding of this problem could help refine and prioritize solutions that involve response, community preparation and fuels treatments.

6. Having a better understanding of the implementation of existing community protection programs could help us judge the relative and conditional effectiveness of these programs.

7. In some regions, markets can help defray the costs of fuels treatments, but national data are not as current as they once were due to budgetary cutbacks.

8. Hazards to fire responders can be characterized broadly by fatality and some injury data, but injury data in particular could be improved. Wildfire fatalities may not convey the future hazard across the landscape due to the erratic nature of fire, weather, travel or chance. Injury data are available in larger datasets, but these are not particularly useful when they lack sufficient detail.

9. LANDFIRE data issues have been recognized in the barriers and critical success factors identified by the Regional Strategy Committees, and are being addressed by a task group.

For sub-regional to local questions, there are numerous other data shortcomings that may affect the quality of decisions.

The scientific analysis in this report covered the 48 coterminous states, excluding Alaska, Hawaii, Puerto Rico, and the Pacific Island territories. Where it is available, state level and LANDFIRE data should be utilized to produce comparable research products for these areas. Where the data is deficient, efforts should be made to collect data to extend the study to all areas covered by the three regions.

In November, 2012, the National Fire Protection Association (NFPA) assembled a group of 18 representatives from the states, National Association of State Foresters (NASF), U.S. Department of the Interior (DOI), U.S. Forest Service (FS), U.S. Fire Administration (USFA), and other fire service organizations to discuss how organizations with wildland fire data management responsibilities could effectively and efficiently consolidate existing wildland

fire data sets to create an integrated data set that could produce an accurate national cohesive wildland fire risk profile. This Wildland Fire Data Reporting Initiative (WFDRI) was tasked with identifying problem areas and challenges associated with wildland fire data reporting, as well as developing a strategy for wildland fire data reporting that would produce quality end-use data and facilitate accurate analysis to support decision-making related to the goals of the National Cohesive Strategy. Workgroups were formed to begin addressing three near-term objectives documented during the workshop: data and terminology standardization, analysis standardization, and data quality and completeness. Work in each of these areas is ongoing.

Future Governance

The Wildland Fire Leadership Council (WFLC) oversees wildland fire management for the nation and the Cohesive Strategy effort, as called for in the Federal Land Assistance, Management and Enhancement Act. The WFLC appointed the Wildland Fire Executive Committee (WFEC), to support the Cohesive Strategy. WFEC is a Federal Advisory Committees Act (FACA) chartered committee and its membership reflects that of the WFLC.

The WFEC will continue to work with the CSSC and RSCs. When it is determined that the CSSC is no longer needed, that group will sunset and the RSCs will work directly with WFEC. Each Regional Strategy Committee has a guidance document, approved by WFEC, which sets out the intent of the committee, the composition of membership, and how governance will proceed in the future.

The Regional Strategy Committees are sub-committees of the WFEC and report to the WFEC. The RSCs are not subject to the FACA charter of the WFEC. The RSC provides regional support for the WFEC and the national effort of implementing the Cohesive Strategy. Mobilization of regional work groups will be established as necessary to assist the RSC in implementation of the Regional Action Plan. Regional Coordinators have been hired to work with the RSCs and the stakeholders to guide implementation activities identified in the Regional Action Plans.

All members of the RSCs and work groups will carry out their activities in a coordinated and mutually beneficial manner and will work together to track implementation of the Regional Action Plans. The Regional Action Plans will not restrict or direct local authorities and associated collaborative in their decision-making.

Summary of Next Steps

The Cohesive Strategy is an organizing strategy that brings together disparate groups that each has a role in addressing wildland fire, and through communication and coordination, will make the work more efficient and effective. Wildland fire is a challenge to the nation, and requires a national focus, with hard decisions related to setting priorities at the national level. But every fire is a local event, with local impacts to people, landscapes, and resources. The Cohesive Strategy recognizes this duality and has built it into the strategy. The National Action Plan will coordinate with the Regional Action Plans to address wildfire issues with both a national and a local perspective.

The strategy has taken a large step forward in bringing together data for all the counties of the continental United States, and analyzing them as a unit, to get the big picture of wildfire. Working together, the national and regional perspectives provide a comprehensive view of wildfire, with information that will assist decision-makers in making strategic and tactical decisions, to prepare for and deal with wildfire.

Important next steps include:

- **Priority Setting:** Geographical and action priorities will be described in the National Action Plan, and Regional Action Plans will be updated to include geographic priorities.

- **National Action Plan**: Issues of national scope will be addressed in the National Action Plan, with actions, tasks and lead agencies designated. The Action Plan is scheduled to be completed in March, 2014.

- **Barriers and Critical Success Factors**: Each barrier and critical success factor is assigned to a task group for recommendations on actions to improve each situation.

- **Communication**: Stakeholders and partners will continue to be involved and informed as the Cohesive Strategy is implemented.

- **Monitoring and Accountability:** National outcome measures and efficiency measures will be set out in the Action Plan, and regional monitoring will be keyed to these measures. The Cohesive Strategy will be reviewed every five years.

- **Data Gaps**: The Wildland Fire Data Reporting Initiative (WFDRI) will review the data gaps and work with agencies to improve data collection nationally.

- **Future Governance**: A task group is working on the governance issues and will make recommendations for seamless and efficient governance and oversight.

The next steps as described above provide a brief description of how we will move forward with the completion of the National Action Plan, revision of Regional Action Plans, and implementation of the Cohesive Strategy. More information can be found in the following conclusion section.

SECTION G: CONCLUSION

This Phase III report has been developed using an innovative national and regional collaborative approach, along with an extensive national science analysis designed to address the increasingly complex wildland fire management situation in the United States. This analysis and set of national recommendations have been developed through stakeholder input, expert opinion and a powerful data-driven modeling system that demonstrate potential impacts and tradeoffs around the implementation of the Cohesive Strategy.

The National Science and Analysis Team (NSAT) was asked to explore potential policy options for achieving the national goals of the Cohesive Strategy and to identify the challenges, opportunities, and trade-offs inherent in each option. These policy options are broadly defined as strategic national direction that would lead to achieving the goals of the Cohesive Strategy.

In order to develop these policy options, a national perspective of the wildland fire situation has been developed by analyzing significant sets of data and information – historically, temporally and spatially, to better understand underlying relationships among biophysical landscapes, the people that inhabit them, and wildland fire.

For this national analysis, the Wildland Fire Executive Council and other advisory groups helped identify the 19 policy options that were considered from a national perspective. These options are grouped into four management themes: broad-scale fuels management, managing human ignitions, home and community actions, and response to wildfire. These policy options were further evaluated with conclusions and findings presented, based on the pertinent data and regional recommendations that have been put forward.

As a result of the national analysis, several national level, collaborative, management and policy recommendations have been developed and listed in the National Strategy section. These recommendations, organized by the four broad themes listed above, are intended to form the basis for policy option decisions that will lead to developing a set of national implementation actions that are focused on national priorities and designed to help achieve the three broad goals of the Cohesive Strategy.

The report provides a blueprint for evaluating and applying the policy options across the country. For example, a strong wildfire prevention program would be a good investment in the areas shown as high priority for prevention activities. And areas shown as high priority for home and community actions could be targeted for assistance and education programs, such as Firewise, CWPPs, Ready-Set-Go, ordinances for defensible space, and building

codes for fire resistant building materials. Areas designated as high priority for fuels treatments, are prime locations for investing in actions to reduce the accumulation of fuels, using active management tools such as thinning, prescribed fire, and other treatments. In some areas, all three policy options may be needed because the wildfire threats are so high.

As the example above illustrates, the information generated by the Cohesive Strategy can be utilized to inform decisions and suggest management options tailored to meet needs identified at the national, regional, state and county levels. This new science-based approach and set of analytical tools used to conduct landscape, social and fire analysis will continue to be used into the future.

The importance of collaboration in developing the Cohesive Strategy, of hearing all the voices, and involving all the partners cannot be overemphasized. The time and care that were taken in developing the strategy will result in better understanding of what needs to be done, and greater ease in working with the multitude of agencies and individuals who need to work together to collectively reduce the threat of wildfire.

SECTION H: APPENDICES

Appendix 1: Glossary

Abiotic – In biology, abiotic components are non-living chemical and physical factors in the environment.

Barriers – Policy or administrative impediments that must be removed in order for the Cohesive Strategy to be successful.

Biotic – Of, relating to, or resulting from living things, esp. in their ecological relations

Critical Success Factors – Policies, programs, agreements, partnerships, resources, and other factors that must be present for the Cohesive Strategy to be successful.

Fire-adapted community – Human communities consisting of informed and prepared citizens collaboratively planning and taking action to safely co-exist with wildland fire.

Fire-adapted ecosystem – An ecosystem is "an interacting natural system, including all the component organisms, together with the abiotic environment and processes affecting them" (NWCG Glossary). A fire-adapted ecosystem is one that collectively has the ability to survive or regenerate (including natural successional processes) in an environment in which fire is a natural process.

Fire community – A term that collectively refers to all those who are engaged in any aspect of wildland fire-related activities.

Fire exclusion – The land management activity of keeping vegetation or ecosystems from burning in a wildland fire.

Fire management community – A subset of the fire community that is has a role and responsibility for managing wildland fires and their effects on the environment.

Fire science community – A subset of the fire community consisting of those who study, analyze, communicate, or educate others on the components of fire management that can be measured, such as fire behavior, fire effects, fire economics, and other related fire science disciplines.

Resilient – Generally referred to in this document as "resilient ecosystems," which are those that resist damage and recover quickly from disturbances (such as wildland fires) and human activities.

Regime – A fire regime is the pattern, frequency and intensity of wildland fire that prevails in an area.

Risk – A situation involving exposure to danger; the possibility that something unpleasant or unwelcome will happen.

Stakeholder – A person or group of people who has an interest and involvement in the process and outcome of a land management, fire management, or policy decision.

Appendix 2: Acronyms

BAER	Burned Area Emergency Rehabilitation
BAR	Burned Area Rehabilitation
CWPP	Community Wildfire Protection Plan
DHS	Department of Homeland Security
DOD	Department of Defense
DOI	Department of the Interior
EACG	Eastern Area Coordinating Group
FEMA	Federal Emergency Management Agency
FEPP	Federal Excess Personal Property
FFP	Fire Fighter Property
FFT2	Firefighter 2
FLAME	Federal Land Assistance and Enhancement Act
FLN	Fire Learning Network
FWS	US Fish and Wildlife Service
GACC	Geographic Area Coordination Center
GAO	Government Accountability Office
IAFC	International Association of Fire Chiefs
IMT	Incident Management Team
ITC	Intertribal Timber Council
JFSP	Joint Fire Science Program
MAC	Multi-Agency Coordination
MNICS	Minnesota Incident Command System
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAASF	
NACo	National Association of Counties
NASF	National Association of State Foresters
NEMAC	National Environmental Modeling and Analysis Center (UNC Asheville)
NFPA	National Fire Protection Association
NGO	Non-Governmental Organization
NIFC	National Interagency Fire Center
NLC	National League of Cities
NPS	National Park Service
NSAT	National Science and Analysis Team (for Cohesive Strategy)
NWCG	National Wildfire Coordinating Group

OWF	Office of Wildland Fire (DOI)
PPE	Personal Protective Equipment
RSC	Regional Strategy Committee
SRS	Southern Research Station (USDA-USFS)
TNC	The Nature Conservancy
USDA	US Department of Agriculture
USFA	US Fire Administration
USFS	US Forest Service
VFA	Volunteer Fire Assistance
VFD	Volunteer Fire Department
WFEC	Wildland Fire Executive Council
WFLC	Wildland Fire Leadership Council
WG	Working Group
WGA	Western Governors' Association
WUI	Wildland Urban Interface

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Appendix 3: References

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USDA Forest Service, Fuel Treatment Effectiveness Success Stories Briefing Paper, July 2, 2013

Appendix 4: Links to Phase I and II Reports and Other Key National and Regional Documents

Fire Adapted Communities, www.fireadapted.org

Firewise Communities, www.firewise.org

Forests and Rangelands website, www.forestsandrangelands.gov

United States Fire Administration, www.usfa.fema.gov

Appendix 5: Committee, Council and Work Group Members

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The National Science and Analysis Team is led by Danny C. Lee (USDA Forest Service) and Thomas M. Quigley (METI Corporation) and includes over sixty individuals from various agencies, organizations and universities (see Phase II report). The national analysis described in this report was completed by a small team from the NSAT using much of the information assembled and prepared previously by the NSAT. In addition to Drs. Lee and Quigley, the national analysis team included Steve Norman and William Christie from the USDA Forest Service, and James Fox, Karin Rogers, and Matthew Hutchins from the University of North Carolina – Asheville.

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Appendix 6: Summary Descriptions of Each Combination of Community Cluster and Resiliency Class

This Appendix has been saved as a separate attachment to this document. Please see document *CS Phase III National Risk Analysis Appendix 6 - Summary Descriptions 08012013*.

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