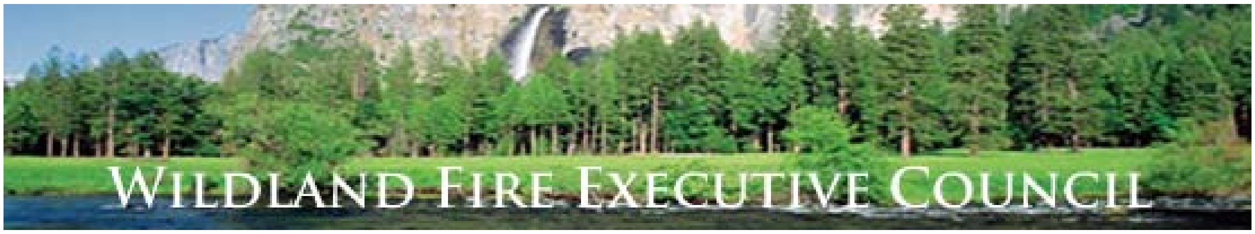


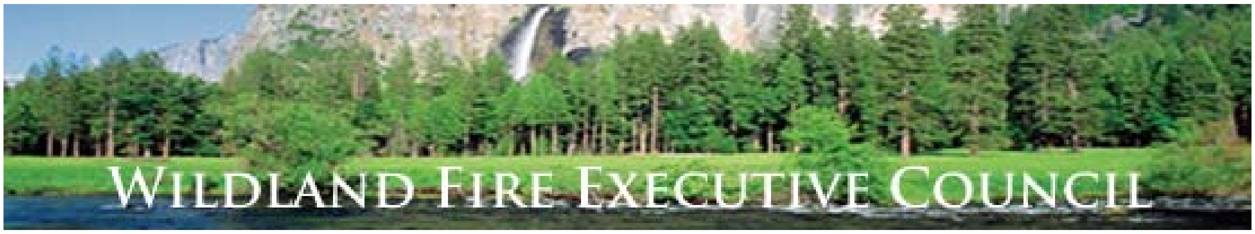
AGENDA

January 6, 2012

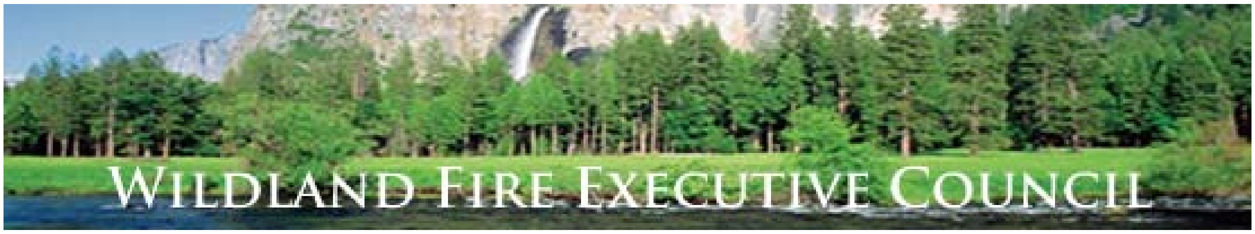
Yates Building, McArdle Room (1st floor)
USDA Forest Service Headquarters
1400 Independence Ave. SW
Washington, DC 20250
10:00 – 12:00 AM – Eastern Time
Conference Number: 1-866-675-7534; Passcode: 874608#

Reminder: Agendas, Notes and Handouts are available at myfirecommunity.net – WFEC Neighborhood

Time	#		*Topic*	*Presenter*
1000 – 1005	1		**Welcome/Introductions**	Roy Johnson
	2	☑ Information ☑ Discussion ☐ Decision	**Meeting Objectives & Expectations** Description: Outline the objectives and expectations of this meeting Outcome: 1. Understanding what we need to accomplish Reference Material: 1. Final Agenda	Tom Harbour
1005 – 1030	3	☑ Information ☑ Discussion ☑ Decision	**National Science and Analysis Team Phase II Report** Description: Submission of NSAT Phase II Report Outcome: 1. Acceptance of NSAT Report Reference Material: 1. NSAT Phase II Report 2. Summary of Comments Received	Danny Lee
1030 – 1100	4	☑ Information ☑ Discussion ☑ Decision	**WFLC Guidance Document** Description: At the WFLC meeting in November, the WFEC was asked to develop a guidance document for their review that would summarize the support the WFLC has for the Cohesive Strategy and the principles behind it, while also calling attention to the successes achieved to date. It was envisioned that such a document could be distributed within the agencies and organizations represented by WFLC members in order to further support continued participation in the process, as well as develop individual policies and strategies that support the Cohesive Strategy. Outcome: 1. Finalize the WFLC guidance document, and forward to the WFLC for their consideration. Reference Material: 1. Document entitled "2012 Guidance for	Mary Jacobs



Time	#		Topic	Presenter
			Implementation of the National Cohesive Wildland Fire Management Strategy" 2. WFLC Guidance Document Proposal	
1100 – 1130	5	☑ Information ☑ Discussion ☑ Decision	**Communication Plan – Resources Needed** Description: At the WFLC meeting in November, the WFEC presented three options for implementing the Cohesive Strategy Communications Plan (both documents included in the MyFireCommunity.net resource area). WFLC agreed upon the mid-level recommendation, which proposed 60-80 hours of staff time per week for more than a year, either through current agency staff, or by utilizing enterprise groups or outside consultants. The communications staff assigned to the development of the plan have begun to develop a list of implementation steps and a new tasking for consideration by the WFEC, but in order to finalize those, there needs to be a clearer understanding of the resources assigned to such a task. If multiple staff is assigned, there are different expectations, and the tasking needs to be modified accordingly. (For example, six or eight staff spending 10 hours per week on implementation will get a much different result than 2 staff spending 30 or 40 hours per week.) In addition, it would be better to finalize the tasking and implementation steps once the staff has been formally dedicated, so that their input is incorporated Outcome: Discuss options for staffing the implementation of the communications plan, specifically which agencies may be able to provide dedicated resources to the task. Discuss how those options may affect WFLC and WFEC expectations on implementing the communications plan. Determine a recommended approach, and identify next steps. Reference Material: 1. Cohesive Strategy Communication Plan 2. Communication Strategy Implementation Scenarios Presented to WFLC	Mary Jacobs



Time	#		*Topic*	*Presenter*
1130 – 1200	6	☑ Information ☐ Discussion ☐ Decision	**Public Comments** Description: Time for WFEC to hear from the public. Specific topics to be determined Outcome: 1. Awareness of public opinions related to WFEC activities Reference Material: 1. TBD	Public
1200 - 1230	7	☑ Information ☑ Discussion ☐ Decision	**CS Sub-Committee Status Reports** Description: Sub-Committees will report on the following: 1. Identify actions, milestones and deliverables that were **planned** to be accomplished since the last status report. 2. Report on **actual accomplishments** during that time period. 3. Identify actions, milestones and deliverables planned to **be completed** between now and the January 20 WFEC meeting. 4. Identify any issues or barriers that need to be resolved. 5. Identify what, if anything is needed from WFEC. Outcome: 1. Understanding of the activities of each sub-committee. 2. Agreement on any modifications to deliverables or timelines 3. Identify of next steps to resolve any pending issues and/or barriers Reference Material: 1. CSSC – No Report 2. WRSC – Status Report 3. WRSC – Program of Work 4. NERSC – Status Report 5. SERSC – No Report 6. CS-CS – No Report	Kirk Rowdabaugh (CSSC) Douglas MacDonald (RSC – West) Tom Harbour (RSC – Northeast) Jim Karels (RSC – Southeast) Mary Jocobs (CS-CW)
1200 – 1230	8	☑ Information ☑ Discussion ☑ Decision	**Identify Follow-up Agenda Items for the January 20 WFEC Meeting**	Tom Harbour
1230 – 1400	9		**Open Discussion**	Tom Harbour
1400			**Adjourn**	Tom Harbour



Scientific Basis for Modeling Wildland Fire Management

The Phase II Report of the National Science and Analysis Team

COVER PHOTO CREDITS

All photos were obtained from InciWeb (Incident Information System www.inciweb.org) and were compiled by Serra Hoagland, USDA FS Eastern Forest Environmental Threat Assessment Center.

TOP
Left to right: Oregon Badger Butte Fire (Mike Dolan, Fire Professional), fire crew on West Texas Fires (Texas US Forest Service), a line of retardant streaks the ridge on the Arizona Horseshoe 2 Fire (Kent Ellett, District Ranger Nogales National Forest).

BOTTOM
Aerial view of the Honey Prairie Fire. April 30, 2011. Georgia Okefenokee National Wildlife Refuge. (Howard McCullough, USFWS).

Scientific Basis for Modeling Wildland Fire Management: The Phase II Report of the National Science and Analysis Team

Contents

EXECUTIVE SUMMARY

The National Science and Analysis Team (NSAT) was established and chartered by the Wildland Fire Executive Committee to support the development and implementation of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) through the application of proven scientific processes and analysis. To achieve this goal, the NSAT is charged with three primary tasks:

1. Assemble credible scientific information, data, and preexisting models that can be used by all teams working on the Cohesive Strategy.
2. Develop a conceptual framework that describes the relative effectiveness of proposed actions and activities on managing risks associated with wildland fire.
3. Construct an analytical system using the products developed in Tasks 1 and 2 to quantitatively analyze regional and national alternatives identified by regional and national strategy committees.

Tasks 1 and 2 were addressed within Phase II, and will continue. Task 3 is exclusively a Phase III effort.

A wide range of individual scientists and analysts have participated in the NSAT, representing federal, state, local, and tribal agencies, universities, and various non-governmental organizations. During Phase II, the NSAT worked as a series of eight subteams, with each subteam assigned to a specific topical area. The topical areas were chosen not only to span the range of issues and processes involved in wildland fire, but also to take advantage of the special interests and knowledge of NSAT members. The eight topical areas are: 1) landscape resilience, 2) wildfire ignitions and prevention, 3) fuels management, 4) wildfire response, 5) fire adapted communities, 6) firefighter safety, 7) smoke management, and 8) policy effectiveness.

Wildland fire is a complex phenomenon that encompasses numerous interacting social, ecological, and physical factors. The Cohesive Strategy can be viewed conceptually as a collection of management actions, policies, and activities, that collectively influence four major interacting processes: vegetation composition and structure, wildfire extent and intensity, response to wildfire, and community preparedness and resiliency. These processes in turn influence the goods and services received from forests and rangelands, firefighter and public safety, and homes and property affected by fire.

The NSAT subteam efforts built upon and expanded each of these major processes. For example, the wildfire ignitions subteam considered a broad range of factors that affect where, when, and how wildfires start and how various combinations of engineering, enforcement, and education can influence human-caused ignitions. Similarly, the fuels management subteam examined how various combinations of prescribed fire and other fuel treatments affect vegetation structure and composition, which in turn influence (and is influenced by) wildfire extent and intensity. Such interactions play out differently across different ecological biomes and at different spatial and temporal scales.

Due to the complexity of wildland fire, many of the identified factors necessarily overlap or intersect between and among topical areas. This is especially true for the more integrated issues such as landscape resilience, fire adapted communities, and public acceptance and policy effectiveness. Thus the narratives provided by each subteam often reference components shared between teams.

In many ways the products from the subteam efforts reflect the state of knowledge about various aspects of wildland fire and the availability of existing models and data. Several trends are evident:

1. **Challenges increase with scale:** Fine-scale and short-term processes tend to be better understood than broad-scale or long-term processes or strategic issues. For example, there is an extensive literature on fire behavior and combustible properties of fuels; less is understood about the large-scale effectiveness over time of strategic fuel treatments.
2. **Imbalance among sciences:** There has been considerably more research focused on the biophysical aspects of wildland fire than has been directed at equally important socio-political issues. Thus we can assuredly state that fire-wise landscaping and construction materials will help reduce the incidence of homes lost to wildfire; we are less confident as to how to ensure such practices are implemented. Smoke is an archetypal issue—technically well-understood but socio-politically complex and difficult.
3. **Integrated research increasing:** Integrated research efforts that focus on interactions among human and physical factors are becoming more common and are highly promising. For example, there is a growing body of research into how socioeconomic, educational, regulatory and enforcement factors relate to wildfire ignition processes.
4. **Comprehensive data essential:** Understanding nationwide trends and patterns requires consistent, standardized data. Given the variation in data collection efforts among Federal agencies, States, and other entities, nationally consistent and comprehensive data sets are limited—with notable exceptions such as LANDFIRE and FIA. Considerable effort will be required to fully integrate data across all lands.

Each subteam has produced one or more conceptual models of the processes operating within their area of interest. Collectively, these conceptual models create a rich tapestry that illustrates the extensiveness, complexity and interconnectedness of wildland fire. Along with the information summarized on existing analytical models and data sources, the conceptual models provide a strong foundation for building more rigorous models in Phase III that can be used to compare and contrast alternative strategies for reducing risk.

The NSAT roles in Phase III will be primarily to develop analytical models, interact with the regional strategy committees and workgroups to interpret the goals, objectives, and actions proposed in their respective Phase II reports, explore management options for each region, and interact with all Cohesive Strategy committees on potential outcomes associated with identified management options. These efforts will include:

1. Translate conceptual models developed in Phase II into quantitative or qualitative models, as appropriate.
2. Compile and integrate appropriate data needed to quantify and validate the relationships presented in the models.
3. Identify performance measures that can be used across all regions and within a given region.
4. Identify geographic variations in the quantitative models to reflect appropriate differences across the regions.
5. Interact with the RSCs and WGs to validate that the modeled relationships are reasonable.
6. Explore potential management options across the regions that reflect the decision space available for broad national and regional choices related to wildland fire management and policies.
7. Interact with the regional committees to iteratively identify and refine regional strategies to include in the comparative risk assessment – national tradeoff analysis.
8. Conduct and document the comparative risk analyses – national tradeoff analysis. Coordinate efforts with other committees to report on results of the national tradeoff analysis.

INTRODUCTION

The Cohesive Strategy is an effort on behalf of Federal, state, local and Tribal governments and non-governmental organizations to collaboratively address growing wildfire problems in the United States. The Cohesive Strategy is being developed with input from wildland fire organizations, land managers and policy-making officials representing governmental and non-governmental organizations across all lands and jurisdictions. All stakeholders involved with wildland fire management have come together to develop a truly shared, national strategy. This holistic approach to wildland fire management will encourage further dialogue and action between local communities and national policymakers.

The intent of the strategy is to provide clear guidance on roles and responsibilities for all wildland fire protection entities. It also emphasizes how effective partnerships, with shared responsibility among stakeholders in the wildland fire community, will help maintain and restore resilient landscapes, promote fire-adapted communities, and improve wildland fire response.

The Cohesive Strategy addresses the nation's wildland fire problems by focusing on three key areas and goals with actions and outcomes:

1. Restore and Maintain Resilient Landscapes – Landscapes across all jurisdictions are resilient to disturbances in accordance with management objectives.

2. Fire Adapted Communities – Human populations and infrastructure can survive a wildland fire. Communities can assess the level of wildfire risk to their communities and share responsibility for mitigating both the threat and the consequences.

3. Response to Fire – All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildland fire management decisions.

Multiple committees and teams have been formed in order to develop the Cohesive Strategy. These include the Regional Strategy Committees (RSCs) and their associated work groups, which are charged with setting objectives for each region, identifying key policy issues or choices, and ultimately outlining a range of options that might be employed within the region. The National Science and Analysis Team (NSAT) was created to provide analytical support to the RSCs and others. More specifically, the NSAT was established to support the development and implementation of the Cohesive Strategy through the application of proven scientific processes and analysis. To achieve this goal, the NSAT is charged with three primary tasks:

1. Assemble credible scientific information, data, and preexisting models that can be used by all teams working on the Cohesive Strategy.

2. Develop a conceptual framework that describes the relative effectiveness of proposed actions and activities on managing risks associated with wildland fire.
3. Construct an analytical system using the products developed in Tasks 1 and 2 to quantitatively analyze regional and national alternatives identified by regional and national strategy committees.

Organization of NSAT Efforts

A wide range of individual scientists and analysts were invited to participate in the NSAT, representing federal, state, local, and tribal agencies, universities, and various non-governmental organizations (Appendix 1). The level of engagement has varied depending on individual interests, availability, and institutional support.

During Phase II, the NSAT has been working as a series of eight subteams, with each subteam assigned to a specific topical area. The topical areas were chosen to span the range of issues and processes involved in wildland fire, and to take advantage of the special interests and knowledge of NSAT members. The subteams include:

- Landscape resilience
- Wildfire ignitions and preventions
- Fuels management, wildfire extent and intensity
- Wildfire response and suppression effectiveness
- Fire adapted communities
- Firefighter safety
- Smoke management and impacts
- Public acceptance and policy effectiveness

In this report, we have summarized and consolidated the efforts of the individual subteams. Various subteam reports are available at www.forestandrangelands.gov.

Comparative Risk Assessment within the Cohesive Strategy

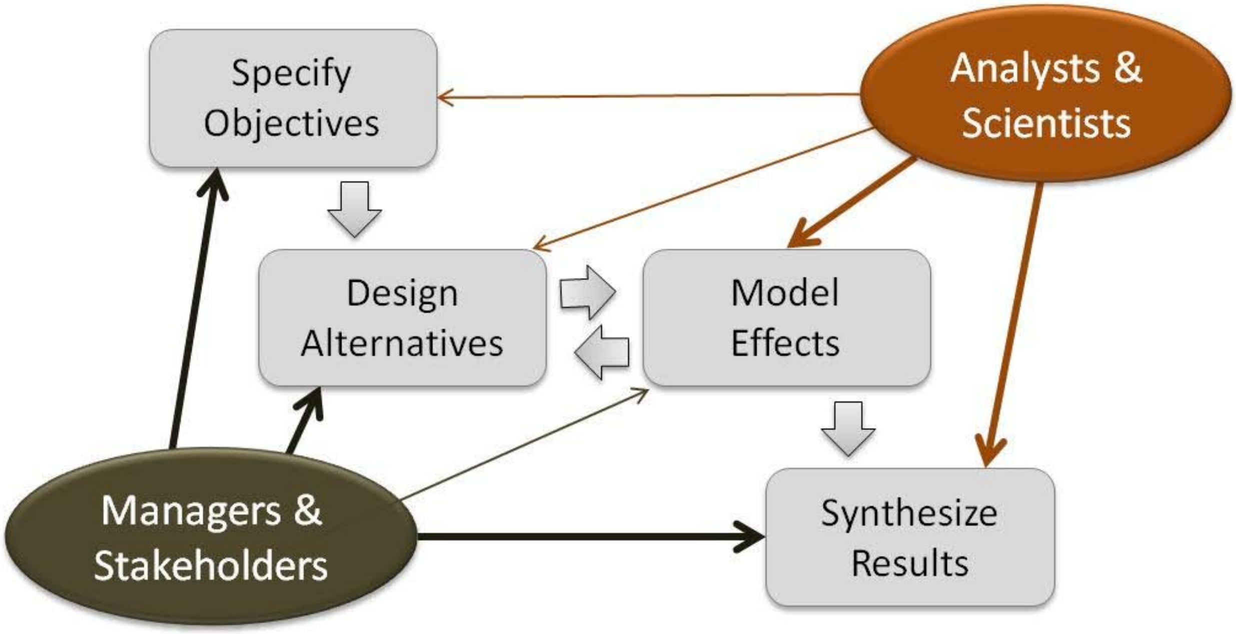
The Cohesive Strategy Phase I reports, *A National Cohesive Wildland Fire Management Strategy*, and *A Comparative Risk Assessment Framework for Wildland Fire Management: The 2010 Cohesive Strategy Science Report*, proposed comparative risk assessment as a structured process for evaluating the consequences of alternative wildland fire management strategies. As the Phase I report (p. 13) notes,

> *Risk is an inescapable component of living with wildfire. Whether one uses risk in the conventional sense of "something bad may happen" or a more precise definition such as the expected loss from an uncertain future event(s), the basic elements of uncertainty and loss are there. Following this basic reasoning, one can view the Cohesive Strategy as a classic problem of risk management. That is,*

> *effective management requires understanding the nature of wildfire and its contributing factors, recognizing the consequences—good and bad—of fire, addressing uncertainty, and crafting plans that reduce the chances of catastrophic losses. Real-world constraints on funding, available resources, and administrative flexibility further require consideration of economic efficiency and practicality.*

Given the premium placed on collaboration and engagement among all interested parties within the Cohesive Strategy, it is important that the quantitative aspects of risk assessment be embedded within a broader social discussion of values, options, potential consequences, and trade-offs inherent in any chosen strategy. To address this complex task of risk assessment and provide a structure for collaboration across the RSC's and the NSAT, an integrated decision support tool called CRAFT (Comparative Risk Assessment Framework and Tools) was employed. CRAFT is a structured process and set of tools designed to meet the needs of collaborative efforts to tackle complex resource management issues with conflicting values at stake and high levels of uncertainty. Planning teams are guided through a four-step process, broadly characterized as 1) specifying objectives, 2) designing alternatives, 3) modeling effects, and 4) synthesizing results. Each participant contributes to each step, although the roles played by analysts and scientists differ from that of managers and stakeholders (Figure 1). CRAFT is being used to help ensure consistency among RSC's, using tools that have been specifically tailored for the Cohesive Strategy. CRAFT also provides the basic framework for the work of the NSAT.

Figure 1. Schematic diagram of the four principal steps within the CRAFT process and the engagement of various actors within each step. The weight of the arrows between actors (analysts & scientists, or managers & stakeholders) and each step corresponds to the degree of engagement with and responsibility for each step.



Conceptual Overview of Wildland Fire

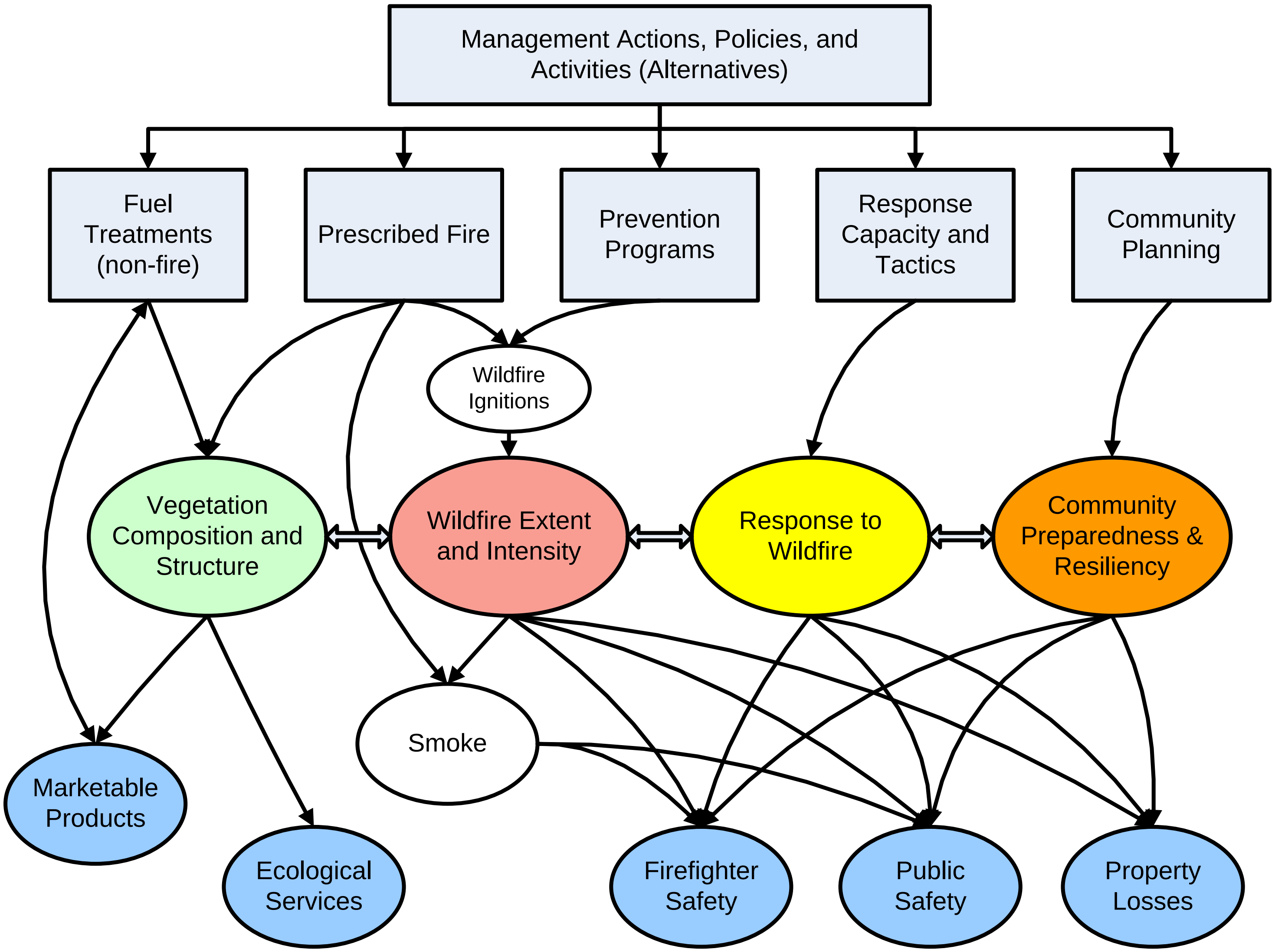
Wildland fire is a complex phenomenon that encompasses numerous interacting social, ecological, and physical factors. The Cohesive Strategy can be viewed conceptually (and simply) as a collection of management actions, policies, and activities, that collectively influence four major interacting processes: vegetation composition and structure, wildfire extent and intensity, response to wildfire, and community preparedness and resiliency (Figure 2). These processes in turn influence the goods and services received from forests and rangelands, firefighter and public safety, and homes and property affected by fire.

The NSAT subteam efforts built upon and expanded the components within the simple conceptual model presented in Figure 2. For example, the wildfire and ignitions subteam considered a broad range of factors that affect where, when, and how wildfires start and how various combinations of engineering, enforcement, and education can influence human-caused ignitions. Similarly, the fuels management subteam examined how various combinations of prescribed fire and other fuel treatments affect vegetation structure and composition, which in turn influence (and is influenced by) wildfire extent and intensity. Such interactions play out differently across different ecological biomes and at different spatial and temporal scales.

Due to the complexity of wildland fire, many of the identified factors necessarily overlap or intersect between and among topical areas. This is especially true for the more integrated issues such as landscape resilience, fire adapted communities, and public acceptance and policy effectiveness. Given that the descriptions below are predominately conceptual, some ambiguity is tolerated in describing the various components and their interactions. As the conceptual models described here are translated into more quantitative models, the various components and relationships among them will be made more explicit—which will tighten the linkages between topical areas and improve overall precision.

Burned terraced hillside in the upper Woods Creek Drainage, Idaho Saddle Complex Fire.
Credit: Bitterroot National Forest

Figure 2. 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).



RESILIENCY SUMMARY

Fundamental to the restoration and maintenance of both natural and human-dominated landscapes is the concept of resiliency. Resilience literally means to “spring back.” Countless disciplines utilize the concept of resilience. In engineering resilience is the ability of a material to store or absorb energy without permanent deformation. There is an economic resilience that measures the ability of local economies to overcome business interruptions after natural disasters. Psychological resilience is used to describe the ability of individuals to recover from misfortune. Examples abound of other scientific disciplines relying on the concept of resilience.

In an ecological context, resilience was first introduced in 1973 by C.S. Holling. He defined ecological resilience as the amount of disturbance that an ecosystem could withstand without changing the self-organized processes and structures. Similarly, Walker et al. (2004) defines resilience as the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks. The NSAT subteam working on fire adapted communities used this definition in their work. For more general purposes of the Cohesive Strategy, we propose the following definition:

Landscape Resilience is the ability of a landscape to absorb the effects of fire by regaining or maintaining its characteristic structural, compositional and functional attributes. The amount of resilience a landscape possesses is proportional to the magnitude of fire effects required to fundamentally change the system.

Resilience in any context has been notoriously difficult to define, let alone quantify. In the current context, the basic question is whether the frequency, severity, and extent of wildfires likely to be experienced within a given landscape will be sufficient to cause substantive and perhaps irreversible changes in the character of that landscape. Resiliency thus defined is inherently contextual. That is, two landscapes can exhibit very different fire regimes yet have equivalent levels of resiliency. A temperate rainforest in coastal Alaska can be equally resilient as a fire-adapted sagebrush system in Nevada. Both maintain their character in the face of the fire regimes that they will likely encounter.

The challenge with resiliency can arise in two primary ways. First, there can be shifts in the fire regimes that arise because of climatic changes or anthropogenic influences. The new regime may be inconsistent with the existing character of the landscape and so adjustments in both the regime and landscape occur over time. Historical examples are common where either the climate has abruptly changed or human activities have either increased or decreased the amount of fire on the landscape. The results have been corresponding changes in the composition, structure, and pattern of dominant vegetation across the landscape. Such changes can lead to both transitional and long-term losses (or gains) in ecosystem services such as clean and abundant water derived from these landscapes.

The second dilemma arises when fire regimes that are dictated primarily by climate and natural vegetation are at odds with human uses and values. The classic example is that of homes being built among natural vegetation where wildfires are to be expected and cannot be excluded. Considerable effort is required to either protect homes from inevitable fires or fundamentally change the fire regime.

North Carolina Pains Bay Fire.
Credit: Chris Carlson, NCDFR

It is important to note that resiliency does not inherently imply value, i.e., favorable or unfavorable conditions. There is a natural tendency to think that resilient systems are preferable to non-resilient systems, but that is because the system in question is often one that we wish to maintain or preserve. Resiliency can be a barrier to achieving management objectives, however, when the management objective differs from the current conditions. The best examples of this situation are rangelands overrun by the invasive cheatgrass (*Bromus tectorum*) or southern pine forests infested with cogongrass (*Imperata cylindrical*). In both cases, the invasive grass changes the natural fire regime in ways that promotes further expansion of the species. The end result can be a highly infested system that is resilient to both fire (prescribed and natural) and other management attempts to eradicate it.

New grass growth in burned area.
Minnesota Superior National Forest. Credit: USFS

WILDFIRE IGNITIONS AND PREVENTION SUMMARY

All wildfires start with an ignition, so it is appropriate to begin there. Wildfire ignitions can be broadly classified into two major categories: natural and human-caused. The vast majority of natural ignitions are due to lightning, whereas human-caused ignitions arise from a wide range of accidental and intentional activities. The most accessible, nationwide records of wildfire locations and statistical causes are for lands administered by Federal agencies. Similar records exist for many states and localities, but these records have not been consolidated with a degree of consistency that allows an accurate portrayal of trends across the United States. Summary statistics of fire activity on federal lands indicate that lighting is the dominant source of ignition on these lands, many of which are located in western states (Table 1). Such statistics do not mirror fire activity on other government or private lands, particularly in eastern states where human-caused ignitions play a much larger role on the privately owned lands that comprise the bulk of the landscape.

Biophysical variables

At the most basic level, fire is a physical process and many studies of ignition patterns have tried to incorporate biophysical predictor variables capturing the essence of that process. For a successful ignition to occur, the presence of fuels with low enough moisture levels to allow the combustion process to begin is required. Assuming fuels are present, moisture content is largely a function of temperature, solar radiation, humidity, and precipitation duration and amount. Consequently, variables capturing the variability of temperature, radiation, humidity, and precipitation are commonly used to characterize ignition patterns at varying spatial and temporal resolutions. A number of studies relate ignitions to daily weather conditions, fuel moistures, and fire behavior indices—whether measured at individual weather stations or inferred from satellite imagery. Other studies rely on monthly summary statistics of precipitation and temperature or other weather-derived variables and long-term climate averages to explain past ignition patterns.

Topographic exposure affects the amount of solar exposure and drying rates of moisture loss from fuels. Consequently, this predictor variable also is commonly included, especially in studies that used monthly weather summaries or long-term climate summaries. This may confound explanation when general vegetation type categories are used because it is uncertain if the topographic variables reflect topographic effects on fuel moisture or further differentiate vegetation types.

The potential impacts of climate change on ignition patterns are intuitive: if climate shifts are warmer and drier in a location, then conditions will be more favorable for ignitions in that location. However, shifting climatic conditions are not likely to result in such simple, two-dimensional changes in variables important to wildfire processes, particularly ignition processes.

Table1. Fire causes, reported average annual ignitions, reported average annual area burned, and percentage shares of fires by causes, Department of Interior (DOI) and USDA Forest Service (USFS) (Jan 2000-Dec 2008) combined.

Cause	Average Annual Ignitions Reported	Average Annual Area Burned Reported, Acres	Percentage Share of Reported Ignitions	Percentage Share of Reported Area Burned
Natural/Lightning	10,874	5,496,235	45.34	79.90
Campfire	1,964	179,338	8.19	2.61
Smoking	418	22,387	1.74	0.33
Fire Use/Debris Burning	1,538	100,971	6.41	1.47
Incendiary/Arson	2,969	268,962	12.38	3.91
Equipment (Use)	1,338	246,804	5.58	3.59
Railroad	117	14,193	0.49	0.21
Juveniles/Children[1]	1,063	20,464	4.43	0.30
Miscellaneous and unknown[2]	3,704	529,313	15.44	7.69

[1] Classification of wildfire starts as Children require that the child be 12 years of age or younger (National Wildfire Coordinating Group 2005, p. 83); the same applies to the DOI General Cause of Juveniles
[2] The USFS Statistical Cause of Miscellaneous includes fires of unknown origin, and we have added to these wildfires without valid Statistical Cause codes entered into the National Interagency Fire Management Integrated Database (2011); similarly, DOI wildfire records without a valid General Cause were added to the miscellaneous category.
Sources: DOI General Causes are from National Wildfire Coordinating Group (1998, p. 17); USFS Statistical Causes are from USDA Forest Service (1995). DOI wildfire data are from the Wildland Fire Management Information database (National Interagency Fire Center 2011) and the United States Fish and Wildlife Service (2011). USFS wildfire data are from the National Interagency Fire Management Integrated Database (2011).

Societal Variables

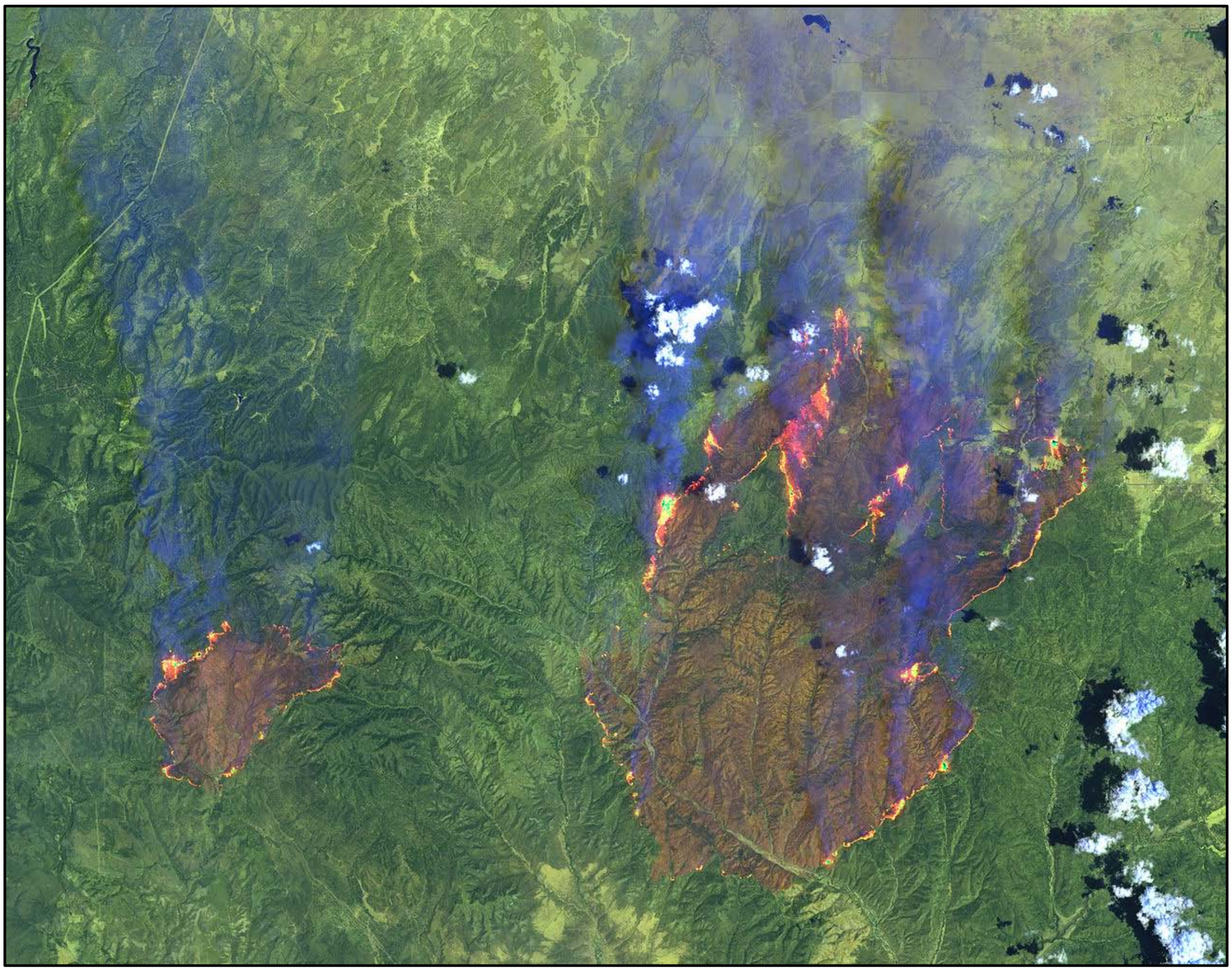
Helicopter support
Florida Afternoon Fire
Credit: National Park Service

Human-caused ignitions are also heavily influenced by biophysical conditions but require the additional consideration of how humans interact with their landscapes to fully understand their patterns. Research by Butry et al. (2010a,b) and Prestemon et al. (2010) found that human-ignited wildfires in Florida depend on weather (fire weather indices, precipitation) in ways expected from theory. Presumably, higher counts of wildfire starts occur when fuel and weather conditions are favorable for fire spread.

Many studies have identified a number of variables emanating from society that are correlated with, or expected to affect, wildfires of various categories. Society influences the frequencies of wildfires of most causes in multiple ways. These range from altering land cover and fuel types, building roads and other hard surfaces that serve as transportation corridors, generating a subpopulation of individuals that intentionally set or accidentally ignite wildfires through their work and leisure activities, including operation of a wide range of machines that can accidentally ignite wildfires. From a wildfire reporting perspective, more people living within an area increase the possibility that an accidentally (or even a naturally) ignited wildfire is reported and therefore is included in a wildfire occurrence database.

Spatial and Temporal Ignition Patterns and Trends

Wildfire ignitions of various causes tend to be clustered in space and time and have been observed in the United States to be undergoing long-term trends. The clustering has been linked in the research to the presence of fuels, humans and their infrastructure, and it might also be connected to varying levels of wildfire prevention efforts, including law enforcement. Short-term trends can also be explained by human deviance, such as serial fire-setting behavior by particular individuals in concentrated locations over short (multi-day) and long temporal scales. Long-term trends in wildfire occurrences may be attributable to climate driven changes in vegetation, but also to more gradual changes in society. Gradual changes that might be connected to wildfire occurrence include those associated with the frequency of outdoor activities, rates and mixes of wildfire prevention efforts, the size of the active population of arsonists, land use patterns, smoking rates, evolving technology, and altered legal environments. There is also the possibility that improved wildfire investigation capacities have contributed to some of the observed changes in the mix of wildfires by cause. Locating where ignitions are clustered in space and identifying trends is useful for predicting future wildfire occurrences when the analyst lacks sufficient data to adequately capture the hypothesized causal or driving factors behind them.



Satellite imagery June 28, 2002 of the Rodeo-Chediski Fire in Arizona set by an arsonist and a stranded motorist. Credit: Jesse Allen, based on data courtesy of Landsat 7 NASA

Fuels Management Effects on Ignitions

Land managers take a number of actions that are intended to affect wildfire occurrence, spread, and severity, in the interest of minimizing or maximizing or achieving an optimal combination of output given costs. These include efforts to manipulate the fuels that are required for successful ignition and spread, and actions intended to reduce the frequencies of ignitions. Although fuels themselves (structure, quantity, moisture content) might be connected to ignition success, there is limited understanding of the role that fuels management plays in wildfire ignition processes. For example, Butry and Prestemon (2010a) and Prestemon and Butry (2010) report an inverse statistical relationship between some human-ignited wildfires and the total area of authorized hazard-reduction prescribed burn permits in Florida. One possible explanation for this finding, however, is that burn permit requirements for prescribed fire are an effective form of wildfire prevention, thus reducing the likelihood of accidental fires of several causes.

Prevention

There has been scant research published in the refereed literature on the effects of wildfire prevention efforts. The National Wildfire Coordinating Group (1998), in its Wildfire Prevention Strategies publication, defines wildfire prevention to consist of administrative, education, enforcement, and engineering activities. The administration portion of wildfire prevention could be classified as long-term efforts to reduce unwanted wildfire, including such activities as planning, development of early warning systems, and training of wildfire prevention personnel. Education includes 26 activities, ranging from public service announcements to signage. Engineering consists of eight activities, ranging from the establishment of building and land use codes to hazard fuel reduction. Enforcement is broken into seven activities, including fire investigations and compliance checks. With such a long list of prevention activities that could affect human-ignited wildfires, statistical analyses are hampered by a lack of accurate and complete reporting and by analytical (statistical) problems that might arise due to high numbers of potential variables that could influence ignitions. Fire management agencies have typically done a poor job of collecting and archiving consistent data on wildfire prevention activities over long time spans and large spatial scales. This lack of consistent and long-term reporting makes scientific analyses of the effects of prevention difficult.

In spite of data limitations, some analysts have successfully quantified some of the effects of various prevention efforts on wildfire occurrences. Wildfire prevention education studies include those focused mainly on Florida and confined mainly to the education component of prevention in Florida (Butry et al. 2010a,b; Prestemon et al. 2010). Studies of incendiary wildfires (Prestemon and Butry 2005, 2010) found that law enforcement is effective at reducing incendiary fire starts.

A Conceptual Model of Wildfire Ignitions

The conceptual model (Figure 3) shows the primary linkages among wildfire ignitions with the various biophysical, societal, prevention, and management variables or drivers described above. Naturally, wildfire ignitions are the centerpiece of this model (‘Wildfire ignitions’ box) and are separated into three general categories in the conceptual model. Natural ignitions include primarily lightning-caused ignitions. Accidental ignitions are generally human-caused ignitions that were not intentional (including escaped prescribed fires), whereas arson ignitions are those that were generated with malicious intent. Among these three general categories, the occurrence of natural ignitions is largely beyond our control, but the frequency of human-caused ignitions can be altered through strategic prevention efforts.

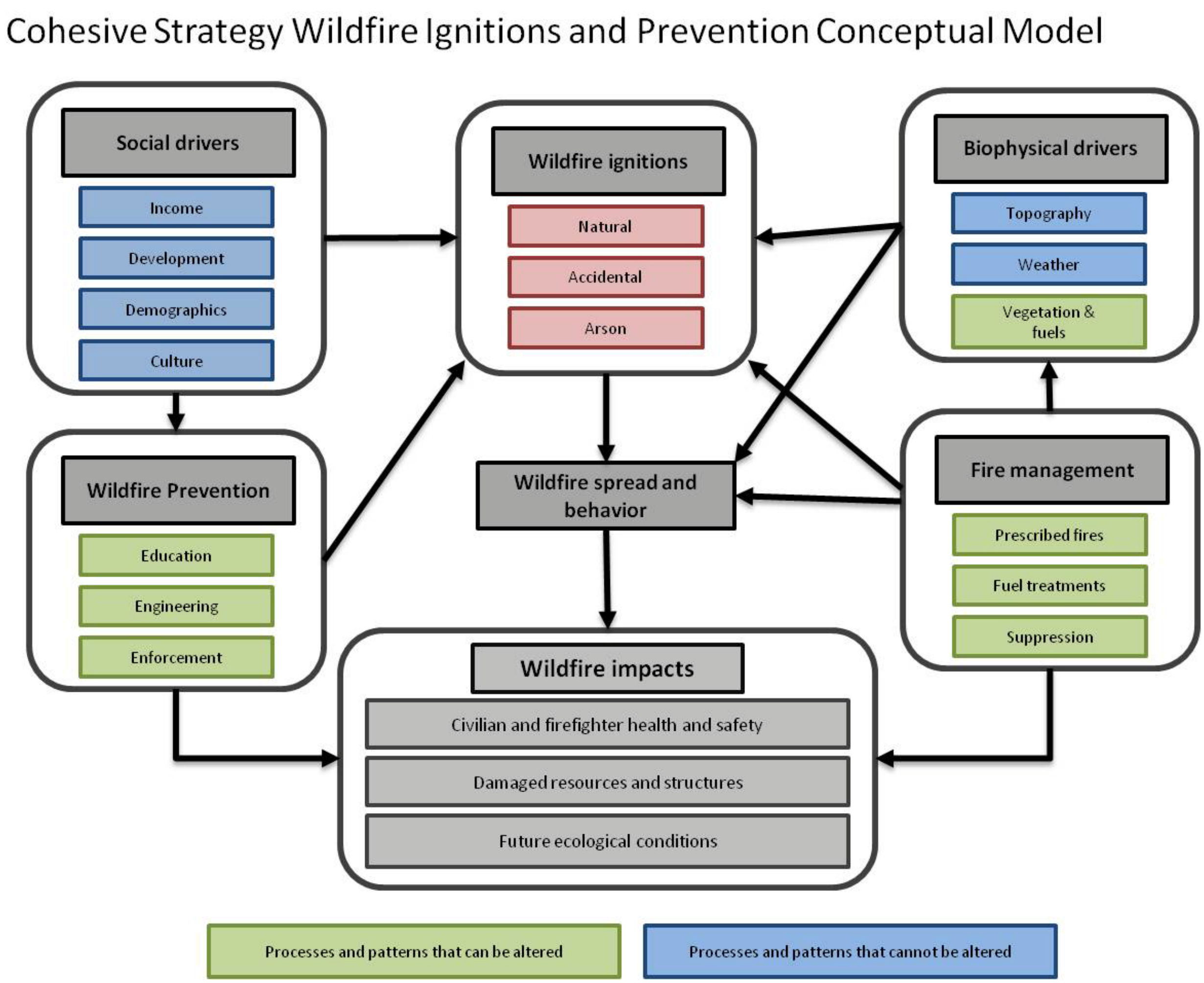
The boxes connected to the “Wildfire ignitions” box in the conceptual model indicate the potential pathways through changes in human behavior and activities that affect ignition frequency or through alterations in the biophysical conditions necessary for successful ignition. Many of the variables listed in these boxes have been described above. However, several variables may affect more than just wildfire ignition patterns. For example, biophysical drivers have a large influence on fuels and fuel moisture conditions that determine whether or not ignition is even possible. These same variables also influence wildfire behavior and spread. Thus, to accurately characterize the patterns of ignitions and the mechanisms influencing them, it is critical that the wildfire ignition and behavior processes remain separated in modeling efforts.

Societal variables are present in the conceptual model as four general categories – income, development, demographics, and culture. These drivers are considered to be largely immutable by actions that land-management agencies can make, even though they may be influenced by more broad-scale local, state, and federal government policies. Development, whether measured through housing, population, and/or road density, provides a proxy measure of human use of the landscape, with the idea that more use will result in more ignitions. Income, demographics, and culture may also alter that relationship, including how often and what kinds of work and leisure activities occur in fire prone locations, but these variables are more likely to play a role in the extent to which prevention activities can be implemented and how well those activities are accepted by residents.

Prevention variables are subdivided into three categories: education, engineering, and enforcement. These categories are designed to capture the potential influence of management actions specifically designed to reduce the frequency of ignitions and/or wildfire effects. The fourth category of wildfire prevention, administration, is assumed to operate at a higher level for land and fire management organizations. Administration could be defined as activities and decisions that create a more efficient and effective wildfire prevention environment.

The pathways through which management variables affect ignition patterns are not always direct. The only land management action that directly affects ignition occurrence is through escaped prescribed fires, which can be considered as wildfires within our framework. Fuel treatments may alter ignition frequencies and spatial patterns by changing the structure and arrangement of fuels on the landscape, thus altering fuel types and fuel moisture conditions that influence ignition probabilities, though these same alterations are likely to have a greater influence on fire behavior and spread. Suppression could be considered as an ignition reduction action, but suppression generally occurs after successful ignition and ultimately alters the area burned by wildfires.

Figure 3. Conceptual model of wildfire ignitions and prevention.



Recommendations for Statistical Modeling of Ignitions

The conceptual model provides a framework and the pathways that could guide construction of a probabilistic ignition model or wildfire production function. A random ignition model is always a simple option, but available scientific literature documents that the spatial and temporal patterns of wildfire ignitions can be characterized through a wide variety of predictor variables. If a wildfire ignition production function endeavor is developed for the Cohesive Strategy, we provide these recommendations:

- Use a proper statistical framework, particularly when relating counts of fires by individual causes to social, biophysical, and management drivers.
- Recognize differences among weekends, holidays, and seasonal variations in wildfire occurrences when modeling at fine temporal scales.
- Recognize and explicitly account for long-term trends in various wildfire causes.
- Use separate models for each ignition source, at a minimum natural vs. accidental vs. arson.
- Include biophysical variables that capture weather and fuel moisture conditions appropriate to the temporal resolution of the models.
- Social and prevention and management variables should measure or be proxy measures of things that can be directly manipulated.
- To account for the effects of fire prevention, take advantage of the range of data that are available.

Furthermore, the historical coverage, completeness of coverage within covered time frames, accuracy of cause attribution, and spatial accuracy of the ignition location varies greatly among the various data sets available. Models that are applicable to particular locations, agencies, or combinations thereof require at least a minimally reliable data set. Even if flawed, such analyses might allow for a first approximation that could be built upon or coupled with other datasets in developing a reliable, forward-looking model.

Arizona Horseshoe 2 Fire. June 6, 2011. Credit: Matthew Clark

FUELS MANAGEMENT SUMMARY

Given a sustained ignition and the absence of active suppression, three major components jointly drive wildfire behavior: topography, weather, and fuels. Fuel conditions and ignitions are the two primary drivers over which humans can exert meaningful control prior to the wildfire event. Proactive fuel management seeks to alter the quantity, spatial arrangement, structure, and continuity of fuels so as to induce desirable changes in fire behavior should a wildfire occur. Two fundamental conditions exist for a fuel treatment to function effectively: first, the treatment must spatially interact with an actual wildfire, and second, the treatment must mitigate fire behavior according to design objectives. Broadly speaking, fuel management activities are designed to reduce the risk of catastrophic fire, protect human communities, reduce the extent and cost of wildfires, and restore fire-adapted ecosystems. Translating these policy goals into field-based implementation can be guided by adhering to a formal decision process:

1. Identify specific problems to be addressed by fire/fuels management.
2. Identify cause of problems as relating to fuels or fire behavior.
3. Describe desired outcome of treatment measure (how much change in fuel or fire behavior is necessary).
4. Identify appropriate scale of treatment needed to effectuate desired outcome.
5. Describe specific cause and effect relationship between desired outcome and proposed treatment(s).

A comprehensive review of the fire behavior modeling, vegetation modeling, and spatial analysis systems used by fuel management analysts, as well as published reviews of models and use (e.g., Peterson et al. 2007; McHugh 2006), concluded the following:

- Relatively few existing fire behavior models are suitable for addressing specific analysis requirements for risk assessment and fuel management projects; most models were developed as part of basic fire behavior research.
- Every fire behavior model has a unique data input and output format; these data are not widely available for all models.
- Planners require both stand and landscape fire behavior modeling tools to test stand prescriptions and landscape effectiveness of fuel treatment packages.
- Most fuel treatment projects have multiple objectives and constraints that must be integrated with the analysis of fuels and fire behavior.
- The bulk of the analysis process for fuel treatment projects did not involve fire behavior modeling, but rather organization and processing of a wide spectrum of data within GIS to meet the broader resources analysis requirements of the project.

Similarly, a comprehensive review of fuel treatment effectiveness found the following:

- Fire effects on the overstory trees are most effectively mitigated by treatments that address both surface and crown fuels through combination treatments such as thinning followed by a prescribed burn or by removing slash after thinning forested areas.
- Prescribed burn treatments vary in effectiveness and become less effective with time since treatment (importance of maintenance, especially as more areas are treated).
- The importance of spatial arrangement and spatial heterogeneity of fuels and fuel treatments is poorly understood (mosaics, edge effects).
- Fuel treatments are not designed to stop fires but rather to modify fire behavior (e.g., reduce crown fires, enhance suppression and firefighter safety, achieve desired ecological benefits, etc.).
- Fuel treatments' effects vary with weather and can inadvertently exacerbate undesirable fire behavior under certain conditions (e.g., treatments may spur understory growth, which favors spread; they may permit higher wind speeds, which increase flame length and spread rates).

Thus the limited state of fuel treatment decision support (with exceptions e.g., ArcFuels [Ager et al. 2011]), paired with limited information on fuel treatment effectiveness in modifying wildfire behavior challenge analysis of fuel management alternatives from project to landscape scales. That said, there is much to be learned in fuel treatment design and implementation from the many years of experience gained by forest and rangeland managers who manage vegetation for other objectives. This experience combined with modeling provides a basis for sound principles of fuels reduction.

The report of the fuels management subteam addresses in more detail many of the issues important for evaluating fuel management programs, including: (a) conceptual representations of wildfire behavior, extent and intensity and their relation to fuel and vegetation conditions; (b) qualitative descriptions of how fuel management alternatives can affect wildfire extent and intensity; (c) evaluations of existing models and data for prospective policy and scenario analysis; (d) regional illustrations of strategic fuel planning; (e) review of limitations challenging fuel treatment analysis and implementation; and (f) identifies informative references for assistance in developing and evaluating regional fuel management policies. The focus of this section is to synthesize and distill information useful for evaluating fuel management opportunities within the context of the Cohesive Strategy. Specifically we provide and review: (a) a conceptual model for evaluating the consequences of fuels management; (b) a workflow of the strategic fuels treatment decision process; and (c) decision frameworks and taxonomies for designing fuel treatment strategies premised on comparative risk assessment.

A Model for Fuel Management Planning and Decision-Making

Fuels management involves both a larger landscape and smaller parcel or unit perspective. Decision variables on smaller units deal largely with specific vegetation management objectives and their relation to fire behavior metrics such as intensity, crown fire potential, and rate of spread. These metrics can in turn inform estimates of direct and indirect fire effects. Decision variables across larger landscapes scale deal largely with the frequency, magnitude, and especially the spatial pattern of treatments, which in turn are related to both to the spatial pattern of values at risk and the predominant fire risk factor (intensity, spread, etc.). Timing is another key variable, and most treatments require maintenance in order to offset re-growth and fuel accumulation.

Figure 4 displays the "big picture" conceptual model, which graphically illustrates the relationship between fuels management, fuel conditions, and wildfire behavior, extent and intensity. Driving variables are separated by color according to whether we can exert meaningful control, and boxes/ovals highlighted in red correspond to other National Science and Analysis Team (NSAT) sub-teams (Ignitions and Prevention; Fire Adapted Communities; Smoke; Landscape Resilience, etc.).

Texas South Complex. Crew Member (Shawn Whalen) Sawing Down Burned Tree. Credit: Blue Team

Figure 4. "Big Picture" Conceptual Model of Fuels Management.

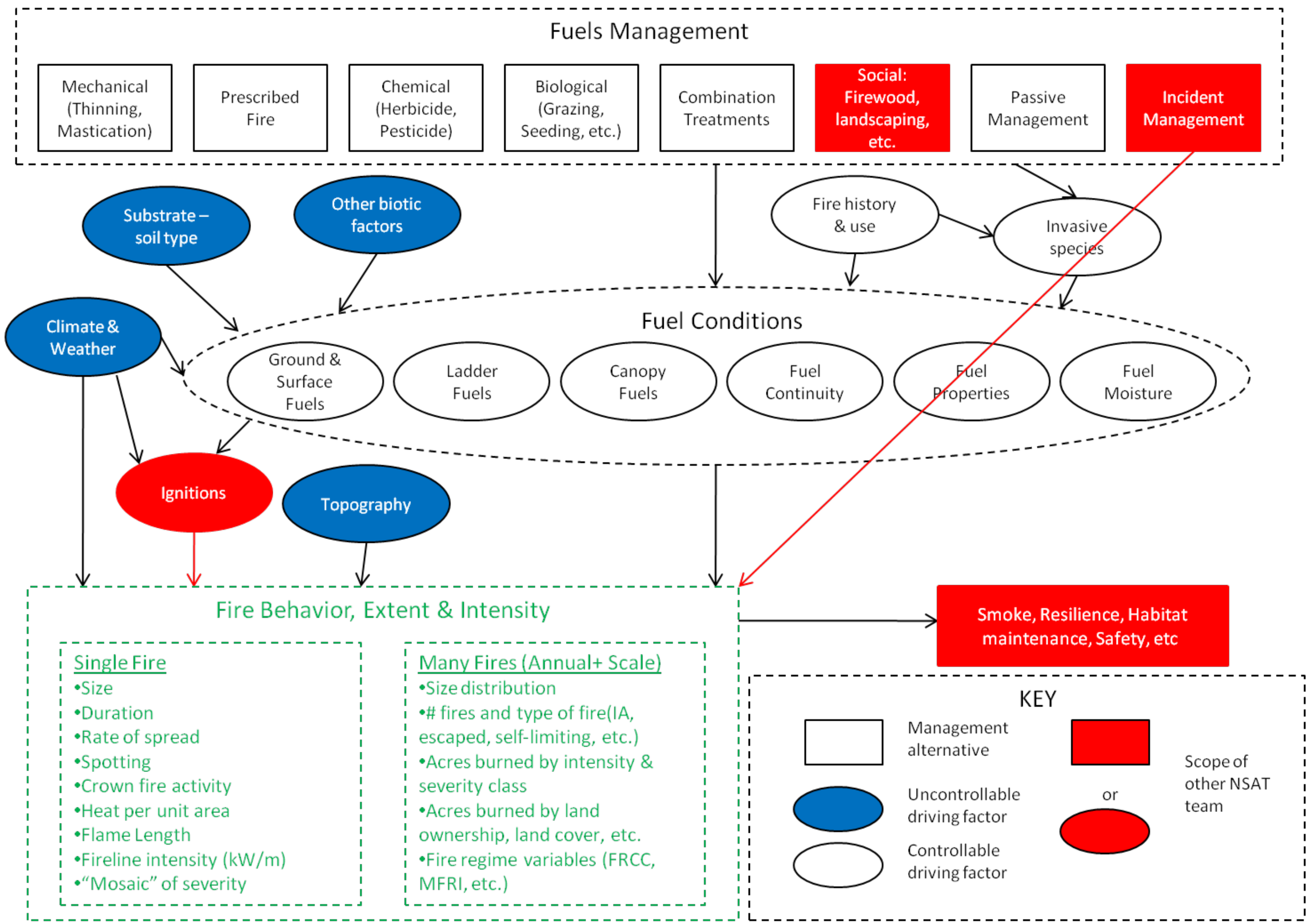


Figure 5 displays a conceptual workflow for the strategic fuels treatment decision process. Ultimately all management activities are driven by desire to achieve a goal and a need for intervention to achieve that goal. In step 1 this planning context is defined, wherein treatment objectives are articulated and analytical needs are outlined. For planning across large landscapes this could entail evaluating treatments spanning multiple ownerships, necessitating a transparent process for inclusion and consideration of stakeholder objectives. Steps 2-4 comprise the basic elements of wildfire risk analysis: geospatial data management, wildfire behavior simulation, and fire effects analysis. Step 5 entails the design of treatment strategies as well as analysis of their impacts beyond immediate changes to fuels and fire behavior (e.g., smoke production, biomass utilization). Steps 6-8 correspond to steps 2-4 (wildfire risk analysis) under the hypothetically changed arrangement of fuels across the landscape. An iterative process repeating steps 5-8 evaluates the impacts of various alternatives and seeks to learn from analysis results to design optimal treatment strategies.

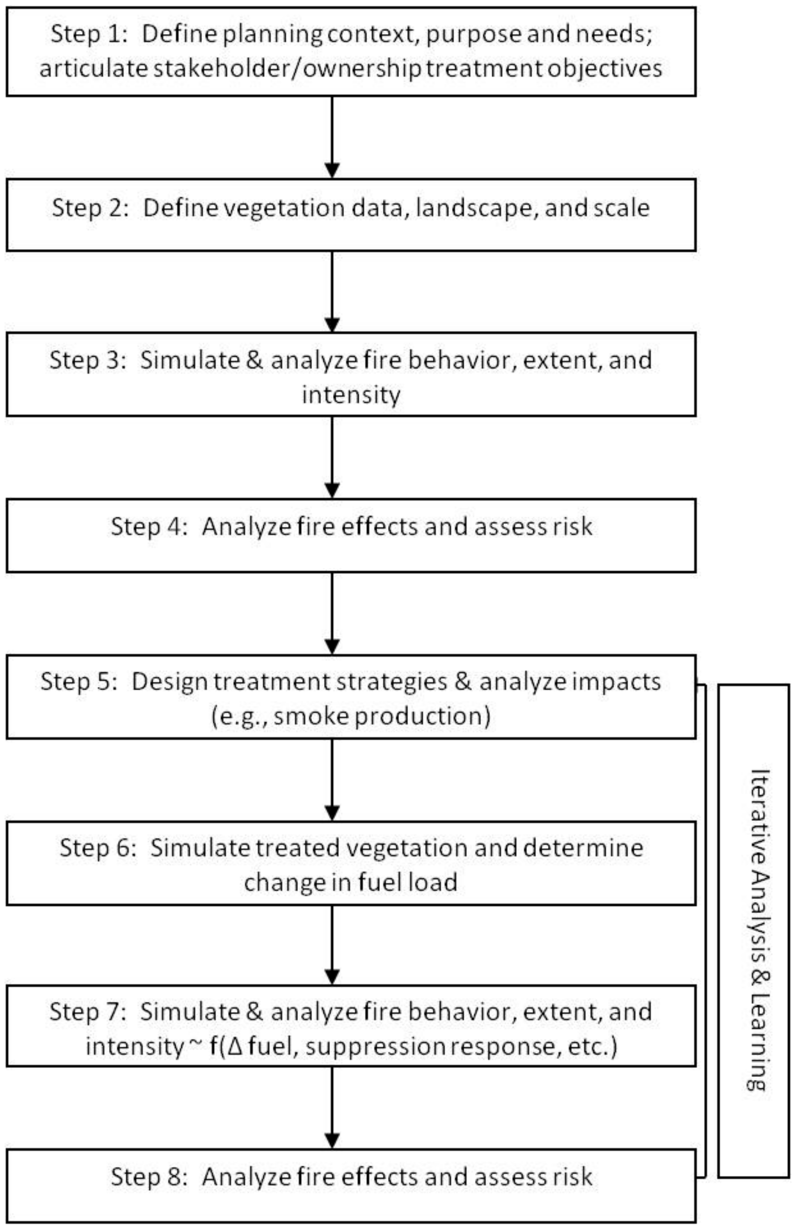
Strategic Fuel Planning

While the field application of non-spatial fire behavior models (e.g., BehavePlus[3]) for a single fuel type and constant weather conditions is relatively straightforward, the design and evaluation of large-scale risk assessment and fuel management activities requires more complex landscape fire modeling to fully understand the potential benefits of fuel management proposals.

Landscape fuel treatment involves a tradeoff between treating more areas of the landscape at least once and repeatedly treating a more limited area to maintain treatment effectiveness. Funding limitations and multiple other constraints limit our ability to implement treatments at broad scales across landscapes, necessitating a strategic approach to treatment design and placement in order to cost-effectively limit fire spread and severity, while also meeting other management objectives as appropriate. Primary variables involving the coordination of stand-level treatments across a landscape include the size of individual treatment units, the placement/pattern of the treatments, the proportion of the landscape treated, and treatment longevity. Important constraints including habitat preservation (and the issue of trying to reduce fire behavior within areas where treatments are largely prohibited), human communities (affects placement priority and limits prescribed burning), air quality concerns, regulation and appeals, and economic realities (influenced by variables such as amount of merchantable material harvested, end-use of harvested material (timber markets, biomass, etc.), terrain, and treatment type). Collectively these constraints can hinder the effectiveness and limit application of optimally located treatment patterns, and generate uncertainty over whether it will be possible to effectively treat the area recommended by fire modeling studies.

[3] BehavePlus, FlamMap and other software packages are available through public domain at http://fire.org

Figure 5. Conceptual workflow for fuel treatment planning process (modified from Funk et al. 2009)



A realistic process for landscape-scale fuel treatment would identify feasible management opportunities and pair that information with risk-based analysis of fuel management needs. Management opportunity can be defined temporally (burning windows, treatment longevity, etc.), spatially (ownership, restricted areas such as critical habitat, etc.), and economically (availability of funding, and whether they may yield positive net benefits). Prior definition of the spatiotemporal "box" within which fuel treatments can be implemented allows for informed prioritization and planning efforts. Key decision variables are the spatial pattern and magnitude of treatments, the extent of the landscape treated, and the timing between re-entry. Important questions driving strategic fuel planning include:

- Is the treatment intended largely for restoration or protection objectives?
- If protection, what is the spatial pattern of values at risk and what is their response to fire?
- If restoration, what is the target fire regime and how can it best be achieved?
- How likely is the area to interact with fire?
- What is the predominant risk factor of concern (fire occurrence, spread, intensity, etc.)?
- How do the planned treatments align with other resource objectives?
- What is the nature of the planned engagement with suppression response?
- Where are opportunities for leveraging with existing fuelbreaks (roads, water bodies, previous burns, etc.)?

Apart from a limited set of instances where wildfires opportunistically interact with fuel treatments, evaluation of landscape-scale fuel treatments is largely a modeling exercise. As such, results of modeling experiments have been characterized as hypotheses that are waiting to be tested. Typically landscape modeling attempts to characterize where/how fires are likely to spread and the subsequent impacts, considering heterogeneity in topography, vegetation, land uses, and land management objectives. ArcFuels in particular has emerged as a useful tool for risk-based fuel treatment evaluation, leveraging the Forest Vegetation Simulator growth and yield model with a suite of fire behavior and growth models within a GIS environment (Ager et al. 2011).

Results of modeling studies provide insights that can guide future planning and implementation. Perhaps most important is the realization that while targeting high hazard stands may reduce severity within treated areas, the treatment may not affect broader landscape fire processes. That is, the benefit of the treatment might be limited only to the area treated. Strategically placing area treatments within a matrix of untreated areas can slow the spread of a large wildfire or cause a drop in intensity across a larger landscape, thus reducing severity in both treated and untreated areas. The synergistic effect of a broader landscape strategy can outweigh the more direct benefits of treatments concentrated near values at risk in some circumstances.

Earlier work outlining the scientific basis for the Cohesive Strategy described comparative risk assessment as a basis for guiding field-level fuel treatment planning consistent with policy objectives. Figure 6 presents a conceptual overview of that risk-based process, in which overall fuel and fire management strategies are developed through jointly evaluating fire likelihood, intensity, and potential effects combined with spatial patterns of values, fire management objectives, and fire regimes. Risk analysis entails understanding the likely interaction of valued resources with wildfire activity (e.g., probability of occurrence, fire intensity and severity), and estimating the nature (beneficial/detrimental) and magnitude of resource response to fire. Fire management objectives consider ecological conditions and determine the extent to which long-term risk management will emphasize restoring natural fire regimes or will emphasize resource protection via hazardous fuels reduction and suppression. Lastly, management opportunity dictates the spatiotemporal extent to which treatments can be implemented consistent with management goals and funding constraints. Management activities and implementation of fuel treatments then stem from the selected mitigation strategy.


North Carolina Pains Bay: Large smoke plume results from burnout operation. Credit: Cory Waters, USFWS

Figure 7 displays some example scenarios that cover a range of fuel treatment strategies and fire restoration management objectives. Variables implicitly considered within the treatment strategy include engagement with suppression and the cost-effectiveness of treatment types. For instance with the first column (low severity fire regime) treatments are planned to create conditions under which suppression efforts are largely unnecessary, whereas with the last row (high severity) treatments (fuel breaks) are specifically planned for engagement with suppression resources. With respect to the latter category, recent work in southern California demonstrated that fuel break effectiveness was directly tied to interaction with suppression activities (Syphard et al. 2011). Recognizing the divergence in management objectives and spatial treatment needs enables optimization approaches to move beyond strategic placement of area treatments (SPLATS; see the 2nd column mixed severity) to optimally locate treatments to achieve a variety of objectives.

Figure 6 Combining risk analysis with management opportunity and ecological conditions with respect to fire determines coordinated landscape fuel treatment strategies. Blue rectangles indicate the overall analysis component (e.g.,, the spatial pattern of values, estimated fire behavior, and resource response jointly influence risk analysis, which in turn influences the mitigation strategy). Green rectangles describe/define the respective analysis components, and orange rectangles correspond to attributes descriptive of the particular analysis component (e.g., estimated fire behavior can be characterized by burn probability, flame length, and fire size). (Credit: Nicole Vaillant & Alan Ager).

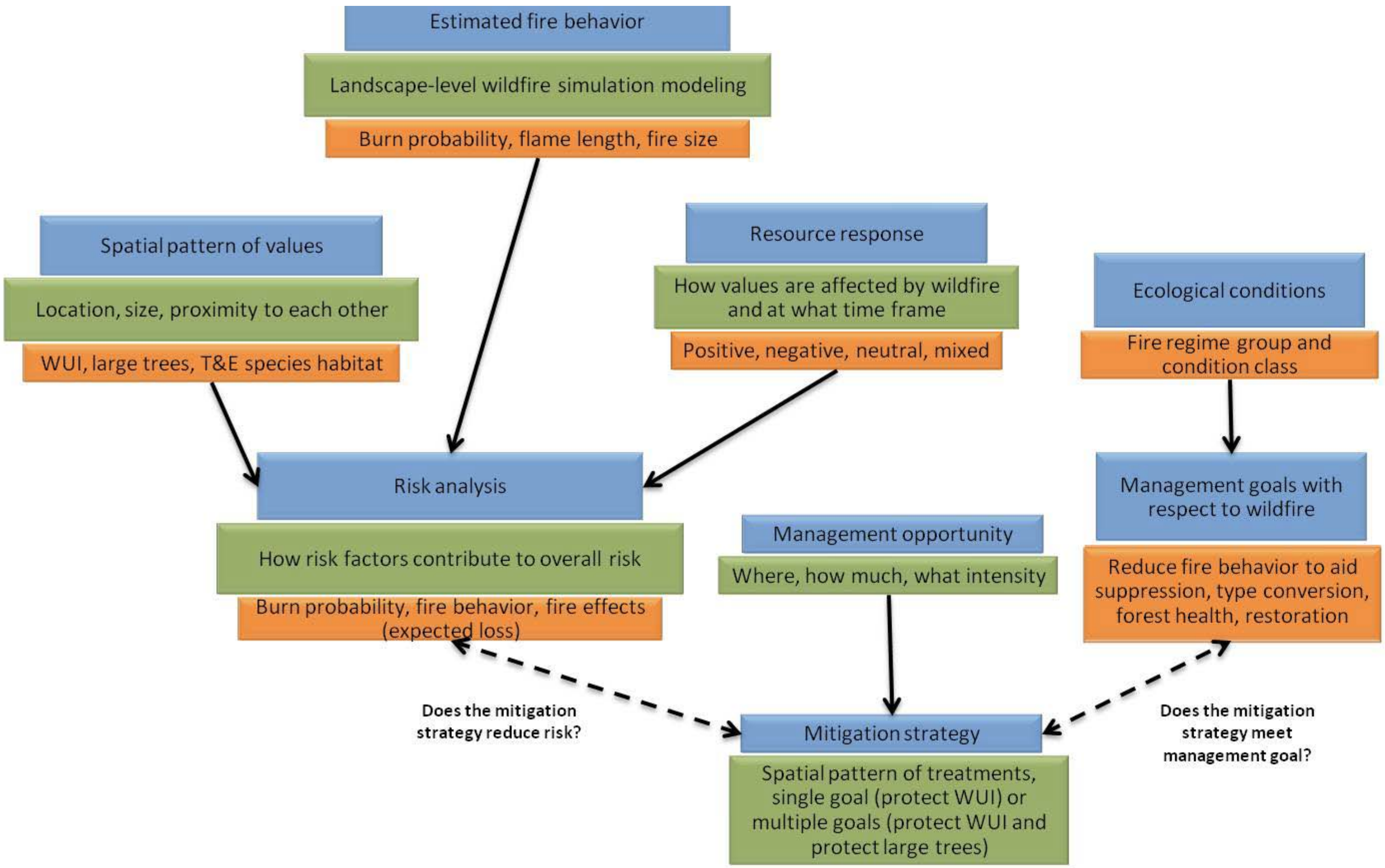
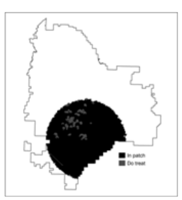
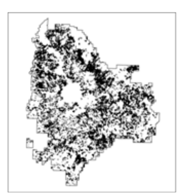
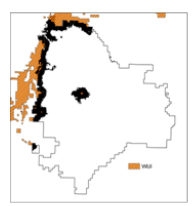
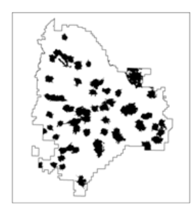
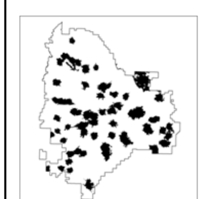


Figure 7. Strategic fuel treatment taxonomy, with illustrative examples of optimally placed treatments given variable motivation, fire regime, spatial pattern of values, and ultimate treatment strategy/system (Credit: Alan Ager and Nicole Vaillant)

Motivation	Restoration	Protection	Protection	Protection	Restoration	Protection
Fire regime	Low severity (+ fire)	Mixed severity (+/- fire)	Mixed severity (+/- fire)	High severity (- fire)	High severity (- fire)	High severity (- fire)
Pattern of values	Dispersed (large trees)	Dispersed and prevalent (low density WUI, T&E)	One clump	Clumpy	Any	Low or none
Treatment Strategy	Create large contiguous areas of low hazard (minimum treatment for maximum area)	Strategic (SPLATs/SPOTs)	Localized protection (targeted treatments)	Localized protection (targeted treatments)	Restore natural fire barriers	Defensible fuel breaks along roads and other barriers
Treatment system	Low hazard fire containers	Treatment optimization model (FlamMap; TOM)	Defensible fuel breaks	Defensible fuel breaks	Strategic restoration	High hazard fire containers
Spatial treatment pattern						

WILDFIRE RESPONSE AND SUPPRESSION SUMMARY

Nearly all wildfires in the Unites States elicit some form of active response. In the vast majority of cases, the intent of the response is to safely contain and extinguish the wildfire as quickly and effectively as possible. In certain circumstances where wildfires can be used for beneficial purposes, the response may be to primarily monitor the fire and ensure that public safety or valued resources are not threatened. Wildfire response and suppression has three temporal elements: pre-fire, during fire, and post-fire. The pre-fire stage includes all planning, fuels management, pre-positioning, training, and funding in preparation for a fire event. Active suppression tactics and associated management decisions are relevant during an event. Post-fire actions examine the consequences of the event, feeds into socioeconomic and policy arenas, and builds collective experience.

Interactions among the various components of response and suppression can greatly influence the success of management actions at each stage in the process. These interactions can be portrayed within a conceptual model that was built to better understand systemic relationships and inform potential process improvements (Figure 8). The different shadings of the factors influencing wildfire response and suppression represent differing degrees of point-wise control of the system. The solid dark blue shading is used for actions that are controllable. The translucent shading is for factors that are partially controllable or can be mitigated to some extent, and the white are uncontrollable factors. Arrows depict relationships between the factors, described below.

Uncontrollable factors

Uncontrollable factors in the conceptual model include location and topography, and weather and climate. Location and topography refers to the geographic and geomorphic site characteristics that a manager must contend with. Remote wildfire locations or areas with terrain that is difficult to traverse clearly influence tactical decisions—both during a fire event and when preparing for a possible fire event. Location and topography also influence fire intensity and extent. Sloped terrain and areas prone to wind may enhance fire intensity and spread rate, but the terrain may offer natural fire breaks as well.

Weather and climate also strongly influence fire intensity and extent, and provide conditions for ignitions. Having advanced knowledge of fire weather enables better pre-positioning of assets such as air tankers, helicopters, and wildland firefighting crews for initial attack.

Partially controllable factors

Partially controllable factors fall somewhere between completely controllable and completely uncontrollable factors, meaning that there are unavoidable random processes in play that can thwart management intentions. Fuels and ignitions fall into this category for many of the reasons described in preceding sections. Fire intensity and extent is partially controllable through suppression, but variability in weather, fuels, location, and suppression effectiveness all contribute to reduced management control. The uncertainty in fire intensity and extent naturally carries forward into uncertainty in consequences.

Several partially controllable factors directly influence suppression capacity and placement and expectation of consequences. Among these, socioeconomics and policy is viewed pragmatically in the model, meaning that optimal policies are not necessarily a given, and the interplay between demographics, zoning, local economies, and local community acceptance cannot be predetermined with certainty. Funding relies on public and private allocations and policy directives. Again, since these inputs are not completely controllable or known with certainty, neither can funding levels be known with certainty. Funding is broken into two categories: capacity investment and operational. Capacity investment refers to asset purchases and infrastructure changes. Operational funding refers to maintenance, staffing and tactical planning. Finally, the transport network is viewed as fixed in the short term but can change based on long-term investments in infrastructure.

Controllable factors

Although realistically no factor can be perfectly controlled or predetermined, perfect control is assumed here for the sake of model simplicity. Of the 17 factors identified in the conceptual model, only 7 of these factors are seen as completely controllable. Among these, fuels management refers to treatments and spatial locations of such treatments (addressed above). Similarly, prevention and law enforcement are management choices that directly influence ignitions as described above.

The expected consequences factor represents management's expectations of a given situation. More specifically, expectations could refer to a given fire event—thus soliciting a given suppression response; or expectations could refer to gains in preparedness through training or asset pre-positioning.

Suppression capacity and placement is assumed to be known with certainty. That is, for a known budget, known transport network, complete knowledge of assets and using standard performance measures of different types of assets, suppression capacity is well defined. Placement (meaning location of the home base of an asset) and pre-positioning (meaning a temporary displacement of an asset away from its home base) are also assumed to be under complete control of a planner/manager.

Actual suppression response is assumed to be controllable. In reality, suppression response for a specific fire event may not be completely controllable for an incident commander if requested resources are not available. This could occur during multiple fire days when demand for assets exceeds supply. Yet at any given location, a hierarchy of dispatch rules is assumed known and completely controllable.

Training leads to increased knowledge and experience, which in turn influence suppression capacity and placement and active suppression response.

Effectiveness and functional relationships

How effective management is for any controllable or partially controllable factor depends on management's intentions or objectives. Effectiveness is therefore defined as the deviation between management objectives and the actual outcome. This definition permits evaluation of effectiveness for any controllable or partially controllable factor, and metrics can be defined uniquely per factor.

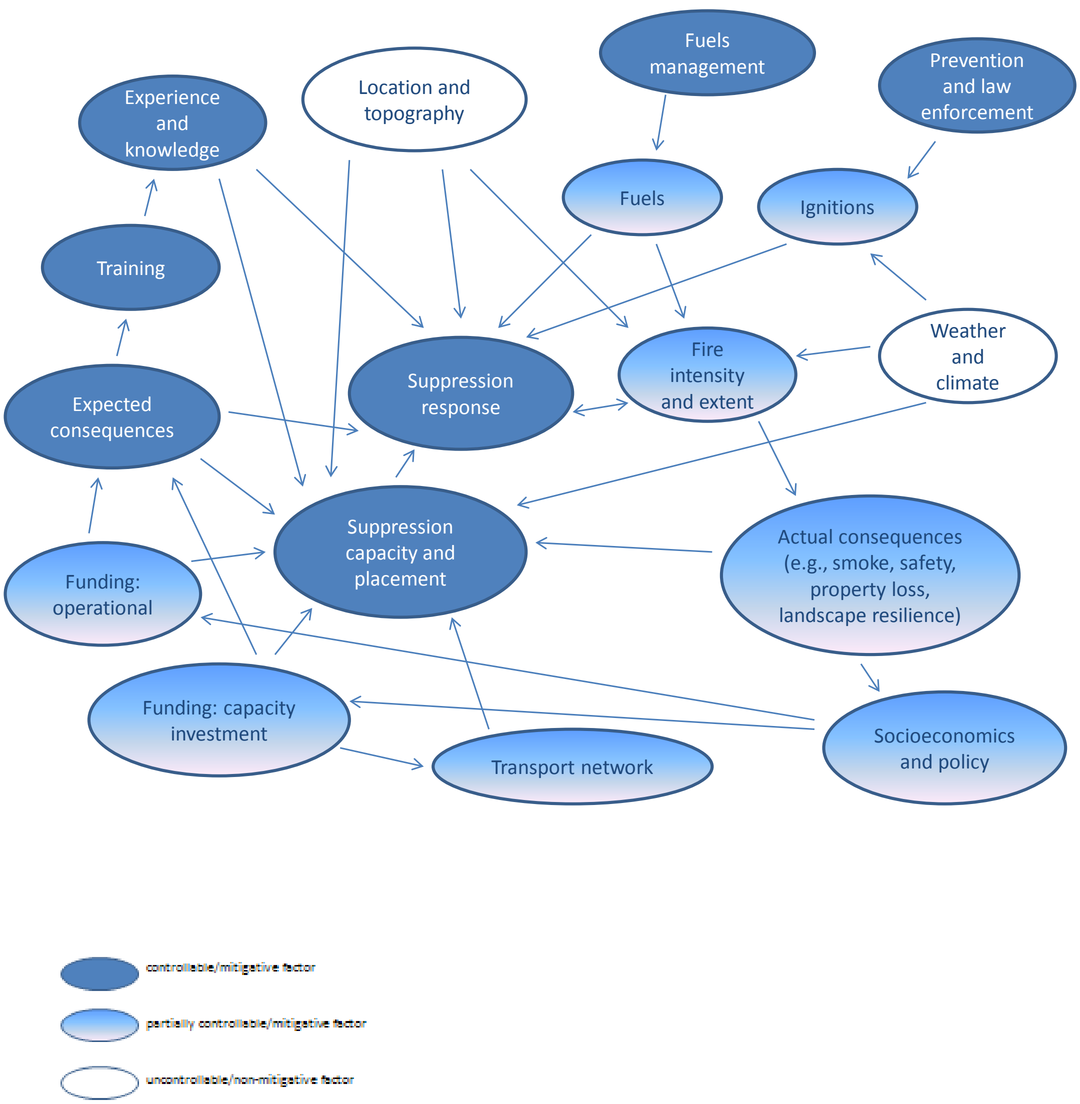
The connectedness of the various factors implies that the degree of effectiveness at any particular factor depends on the degree(s) of effectiveness for all its contributing factors. In other words, effectiveness is a cumulative function, and how well objectives match outcomes at any particular level is influenced by how well objectives met outcomes at upstream levels, and so on. This phenomenon of nested effectiveness is significant. It implies that the effectiveness of downstream actions is constrained by prior outcomes. Further, this structure enables planners to anticipate where potential threats may be and take advanced action.

In all, a holistic cohesion can be shared across individual players to improve overall system performance. The conceptual model can also help identify factors that lead to cost savings, improved firefighter safety, etc. Any investment in the system is tractable, and the return on investment in one or more factors can be measured through the system.

Coordination of resources

Implicit in the conceptual model is coordination between Local, State, Tribal, and Federal resources. Across the nation, a range of formal agreements between organizations have been established. Because threat levels, ownership patterns, and asset mixtures are different from one geography to the next, so too are the arrays of agreements. An exploratory analysis using the initial response model of the Fire Program Analysis (FPA) system demonstrates that multiagency coordination and sharing of resources can lead to reduced response time, bring more resources to bear on individual fires, and substantially improve initial response success rates. Similar efficiencies might be expected for extended attack on larger fires, although the increased complexity of such events compounds the difficulty of modeling large fire responses.

Figure 8. Conceptual model of wildfire response and suppression.



Quantitative Modeling of Wildfire Response

Analyzing investments in wildfire response can be very complicated. In addition to the complexities of fire behavior, one has to address interactions among the distribution of available resources, their performance on the fire, the dispatch logic used to send resources to a fire, and multiple operational constraints. FPA includes a highly detailed Initial Response Simulator which addresses many of these issues, but is designed to only simulate responses in the first 18 hours following discovery of a wildfire. Although 18 hours may seem brief, in reality the vast majority of wildfires are suppressed during this initial window. Extending FPA modeling capacities beyond the federal resources is challenging due to the very large number of local and state resources involved in wildland fire response. Thus it is likely impractical to expect to use FPA models directly. A more promising route may apply combinations of FPA modeling results, empirical fire occurrence data from all localities, and expert opinion to build simpler models that capture the essential elements of initial response.

Simulating initial response not only demonstrates the effectiveness of investments in preparedness, it also is essential to understanding the feedback between initial response effectiveness and behavior of fires that escape. Highly successful initial suppression efforts means that fires escape only under the rarest and most extreme weather conditions, becoming more severe. Thus, the long-run potential benefits accruing from having a greater share of wildfires burning under moderate conditions are never realized. The end result is that effective initial suppression in the short run leads to greater demands for initial response resources in the long run. Through more detailed analysis and the modeling, this feedback process may become understood and incorporated into the risk framework.

Once a wildfire has escaped initial containment efforts, further complications arise as resources are drawn from remote locations, fire behavior becomes difficult to predict, and even the objectives of the suppression response may change from day to day depending on circumstances that are not easily understood or modeled. Recent research focused on understanding the factors contributing to the high costs of large fire suppression offer insights that could be used to more rigorously structure the relationships identified in Figure 8. In addition, ongoing research directed at better understanding the management context and decision processes used in large fire suppression may lead to more reliable models that can capture the principal factors influencing performance—however it might be measured.

FIRE ADAPTED COMMUNITIES (FAC) SUMMARY

The significant social and economic costs of recent wildfires draw attention to the need to understand society's exposure to wildfire impacts. Wildfire impacts are thought to be increasing for a variety of reasons, including declining forest health, decades of fire suppression, climate-induced stresses, and increased residential development in the wildland urban interface (WUI). These factors contribute to devastating losses to lives, homes, and infrastructure, as well as substantial expenditures by the members of the fire management community.

Here we concisely document our understanding of the various characteristics, relationships, and factors that affect a community's vulnerability and resilience to wildland fire threats. This summary is necessarily brief and general, recognizing that various issues or topics that are regionally important have been omitted, yet can be addressed in more specific analyses. The intent is to capture the primary drivers affecting communities' exposure to risk from wildfire. A secondary objective is to conceptualize the problem so that it can be appropriately modeled in Phase III. Potential data sources are identified as a suggestion or starting point of how to implement a Phase III FAC model.

Background

A fire adapted community is one where the population, natural capital, and built infrastructure can withstand a wildland fire without loss of life or significant damage; and where the community can assess their wildfire risk, share responsibility for mitigating threats, and accept the consequences according to their risk tolerance. Similarly, communities foster a fire resilient landscape and acknowledge that their community actions play a role in affecting the larger socio-ecological systems in which they are embedded. For example, the USDA Forest Service's FAC Program fosters knowledgeable and engaged communities in which the awareness and actions of residents regarding infrastructure, buildings, landscaping, and the surrounding ecosystem lessens the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape. The overall goal is to reduce risk from wildfire in at-risk communities, reduce damage due to wildfire, and reduce fire suppression and structural protection costs without compromising firefighter or civilian safety.

To describe the elements of a fire adapted community, we use specific terms from the vulnerability literature (ecological and social), including:

Exposure: the nature and degree to which a community, individuals, assets, or other values are threatened by a hazard. Exposure is often quantified as the probability of loss.

Vulnerability: (social and community) the culmination of social factors and forces that create the susceptibility or exposure of various groups to a hazard (Cutter et al. 2003); (physical and ecological) the degree to which a system is susceptible to, or unable to cope with, adverse effects of wildland fire. As defined, vulnerability can be viewed as either increasing the probability of loss, or increasing the consequences of loss. Both have the net effect of increasing risk.

Preparedness: a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action in an effort to ensure potential losses are minimized.

North Carolina Pains Bay: US 264 was closed due to firefighter activity and smoke. Credit: Scott Lanier, USFWS

Research from the fields of wildland fire social and behavioral science can inform our understanding of fire adapted communities, their response to, and mitigation of, wildfire threats. Yet much remains unclear in this relatively young area attempting to understand complex human behavior and actions. For example, an important question is what motivates individuals to undertake wildfire mitigation activities on their property. Using fire-safe landscaping, construction materials and techniques, and developing and maintaining defensible space are actions that significantly improve the chance of a structure surviving a fire, yet the reported responses of individuals is mixed, with varying levels of participation. Common elements influencing homeowner decisions include risk perception, ecological or amenity values, the cost and time of creating defensible space, and social pressures (McCaffrey et al. 2011).

At the community level, there are examples of apparent trends in community vulnerability and participation in wildfire risk mitigation programs. Studies in Arizona and the Southeast indicate that vulnerability and exposure to wildfire hazards are positively related based on a comparison of indices of vulnerability and wildfire threat with participation in Community Wildfire Protection Plans (CWPP), Firewise Community/USA, or Firewise Council/Chapter designations (Gaither et al. 2011; Ojerio et al. 2011). These analyses provide methods that could be used in the next phase of the Cohesive Strategy to highlight areas needing increased education, outreach, or other program actions, or to address potential equity or environmental justice issues.

On the threat side, many advances in wildfire modeling (described above) can provide important data to determine the risk facing communities from wildfire. For example, wildfire ignition models can simulate the occurrence of wildfires across space and time, including their clustering tendencies. In turn, fire behavior models can simulate the burn probability, direction, and conditional flame length at a national extent for any given pixel on the landscape. These data can then be used to identify structures, population, and other values at risk. Operation decision support systems like the Wildland Fire Decision Support System (WFDSS) already have this capability at the landscape scale and are used to strategically deploy fire response and suppression resources. Our understanding of FACs and the proposed methods to be developed in Phase III can aid wildland fire management by illustrating how programs and actions can reduce the exposure of human communities to wildfire threats, thereby making them more fire adapted.

Characteristics of fire adapted communities and mitigation actions

A FAC can be decomposed into the primary components of individual and household elements, community elements, and physical and environmental elements (Figure 9). The combination of these elements and their interactions leads to a community being more or less fire adapted. Household preparedness is the level of knowledge and planning in preparation for a potential wildfire. Social vulnerability refers to the factors influencing individuals that may make them more susceptible to adverse effects of wildfire, such as poverty, physical disabilities, or lack of knowledge. Community vulnerability describes emergent vulnerabilities at the community level, which may be affected by economic resilience and community social capital, such as the work of voluntary organizations. Institutions and governance include government policies, programs, or informal social norms that influence actions pertaining to exposure to wildfire threats. Neighborhood characteristics describe the spatial pattern and arrangement of structures on the landscape in relation to wildfire threats, while structure characteristics depict the construction materials used. Ecosystem services are the benefits to society derived from the natural environment, and may be affected positively or negatively by wildfire and mitigation activities. Not shown, but implied, are the complex interactions among elements.

Mitigation and management actions can push communities towards a more fire adapted state. This can occur, generally, in three phases. Similar to McCool et al. (2006), we describe actions affecting communities by time horizon, and classify actions as occurring pre, during, and post wildfire event (Figure 10). As in the previous figure, actions listed are broad and may include multiple specific actions or existing programs. Examples include collaboration, education and outreach, communication and information management, or post-fire assessment of fuel treatments. These actions do not constitute the entire suite of potential wildfire mitigation possibilities, but rather a representative set of primary actions used to affect the characteristics of FAC and their exposure to wildfire hazards. Studies have shown that there is a synergistic effect of multiple activities to protect homes and communities from wildfire (Renner et al. 2010). The more actions the community and individual members of the community have taken, the more fire adapted it becomes.

The specific characteristics these actions affect are outlined in the Fire Adapted Communities Phase II Report, and are organized according to the groups in Figure 9. Actions and programs affect individual, community, and physical and ecological elements, though not all characteristics can be changed within the timeframe or by wildfire programs. Understanding social vulnerability, for example, can influence evacuation planning, but wildfire programs do not address the underlying causes of social vulnerability. Figures 11 and 12 clarify which characteristics can be altered by wildfire programs by pre, during, and post event period.

Figure 9. An overview of the composition and goals of a fire adapted human community.

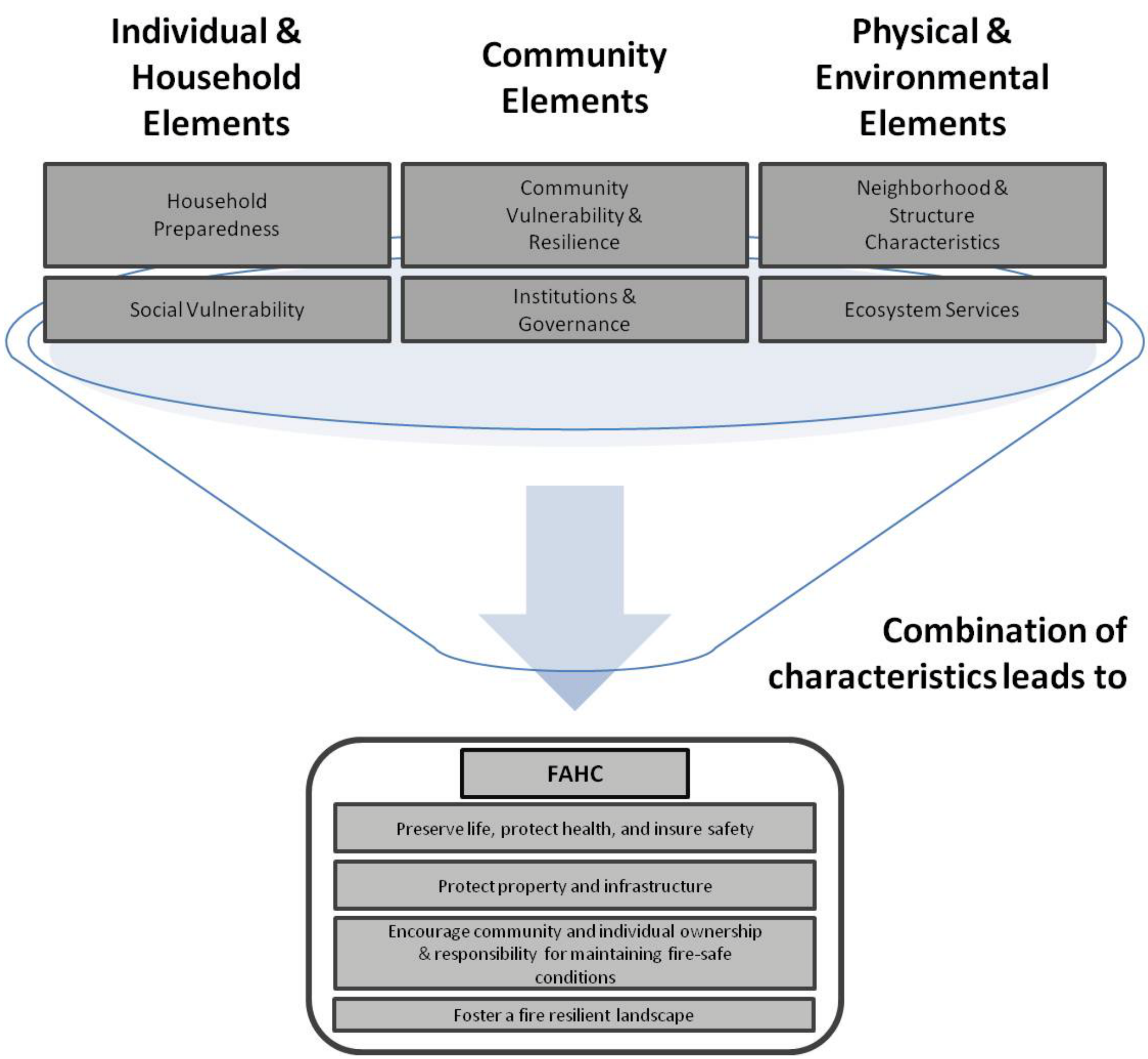


Figure 10. FAC conceptual model of actions by wildfire timeframe.

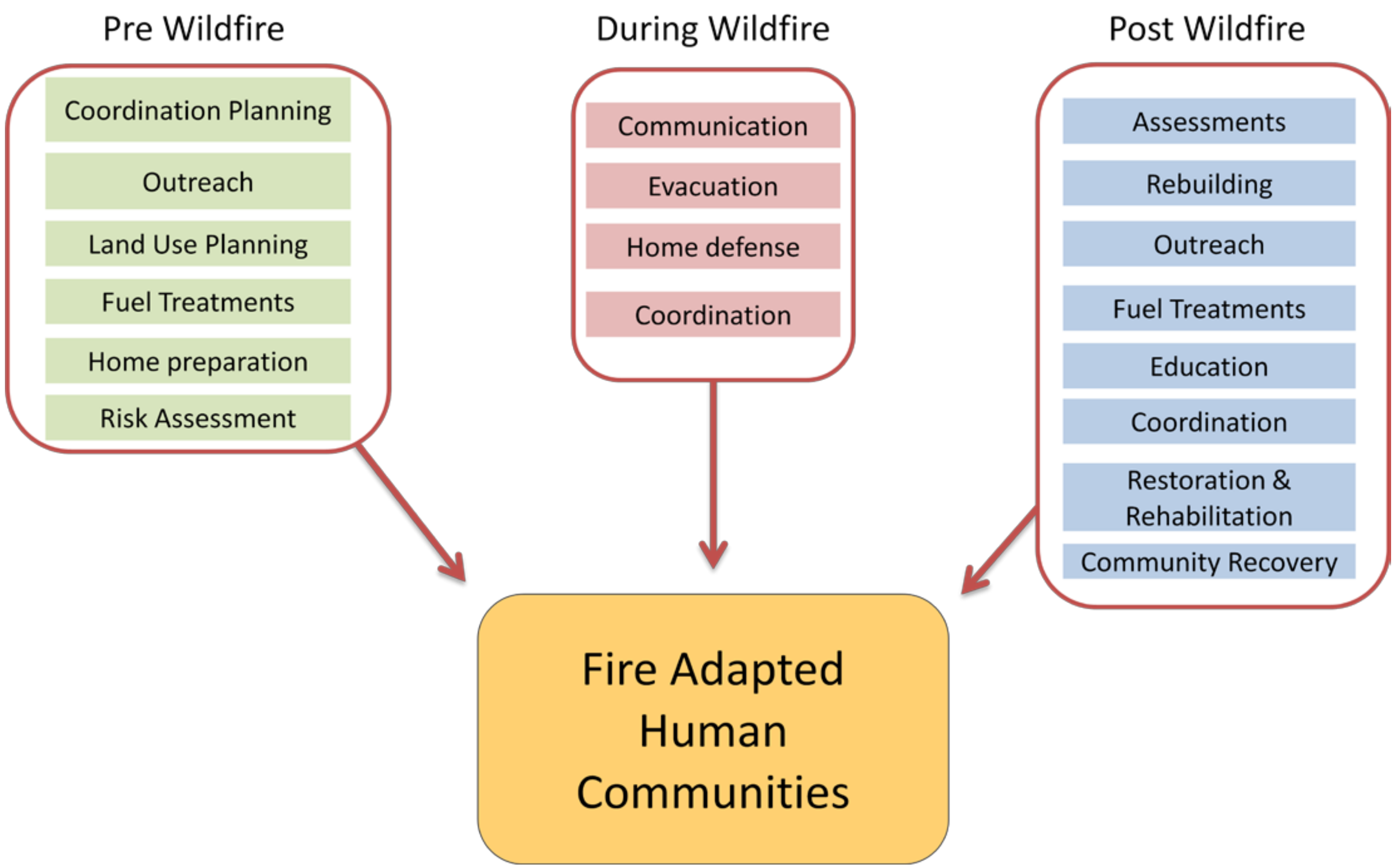


Figure 11. Conceptual model diagram for pre and post wildfire FAC.

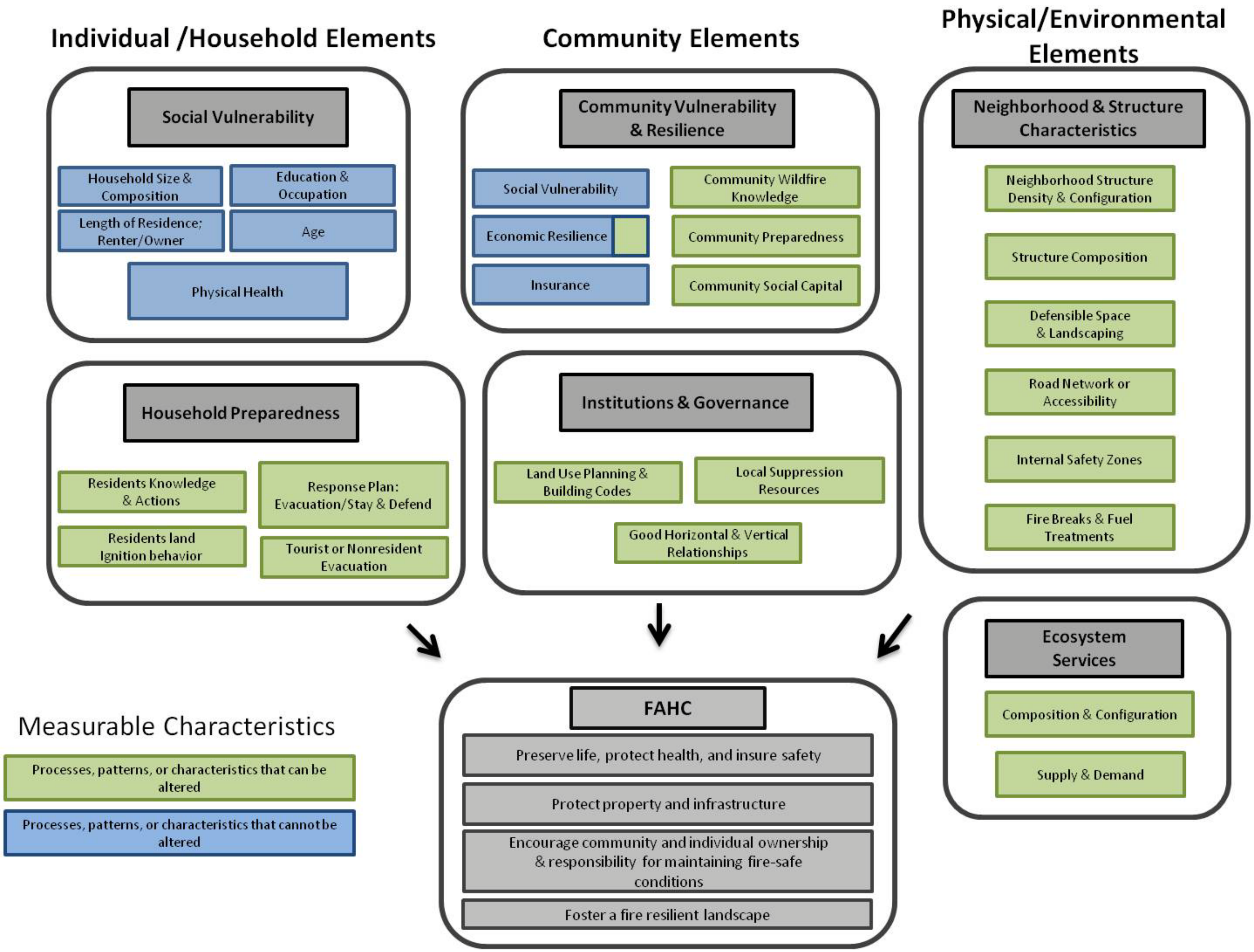
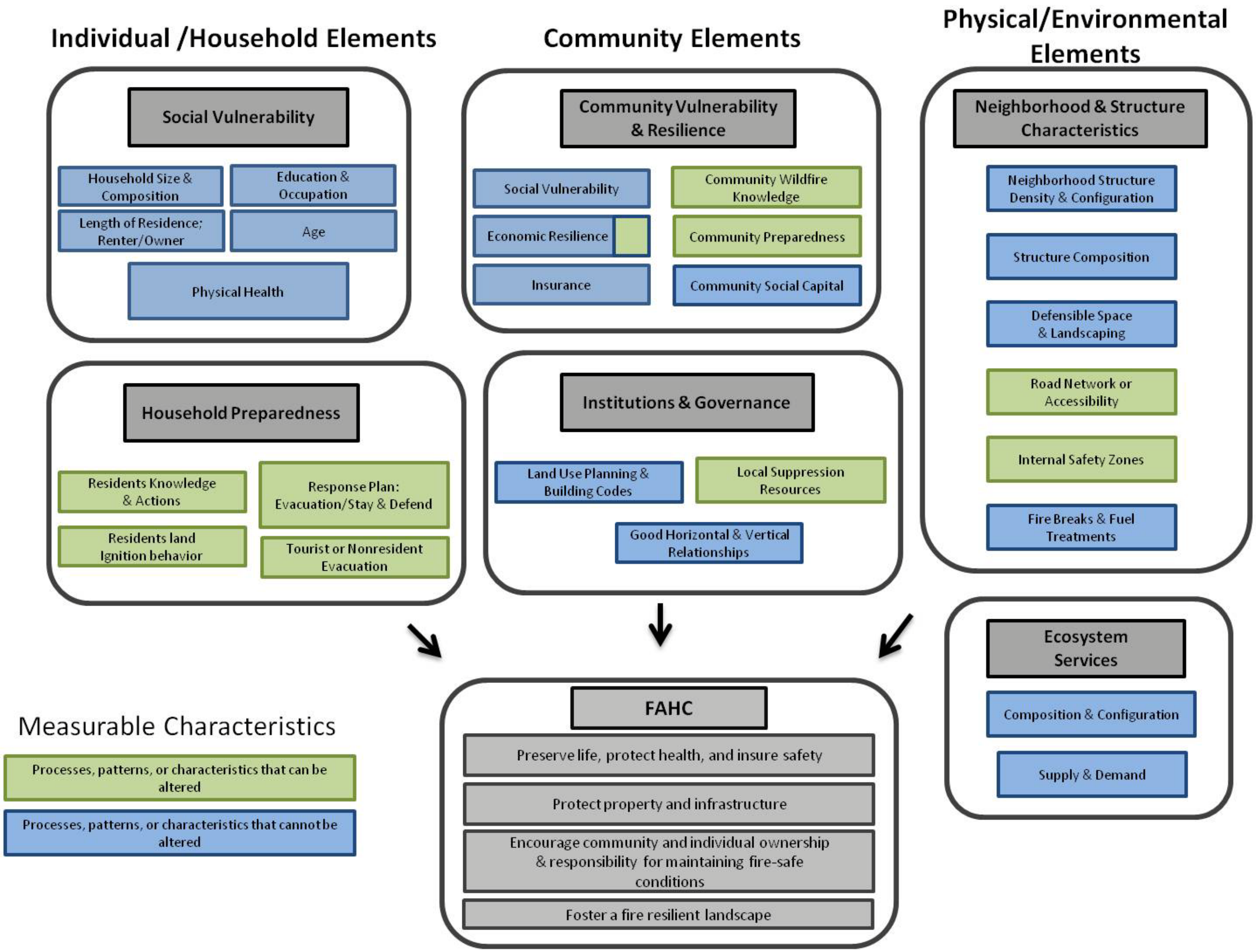


Figure 12. Conceptual model for during wildfire FAC



Phase III Modeling

The FAC model will likely be most useful as an exposure assessment using our conceptualization of a FAC and wildfire hazard data from other subgroups and sources. Bayesian belief networks will describe the conditional probability of the intersection of FAC elements and wildfire threats, illustrating the location and heterogeneity in risk across the nation. Quantifying the diagrams with comprehensive and current data in a tradeoff analysis or influence diagram will be challenging. A flexible modeling environment will likely be required as deterministic causal relationships will be difficult or unrealistic to establish. Expert knowledge could be used to judge the potential impact of programs or actions on FAC characteristics. Though research assessing the social aspects of communities' risk to wildfire is scarce at the landscape or national level, the creation a FAC model in Phase III will be aided by several ongoing efforts, including Haas et al. (in review) who demonstrate a method to assess the risk of wildland fire to populated places, and FEMA's HAZUS program which estimates potential hazard losses from earthquakes, hurricanes, and floods. Several potential data sources include:

- Landfire, Finney et al. (2011), and data and output from other sub-teams;
- Census 2010 for demographic information;
- ESRI Community Analyst and Tapestry Segmentation products;
- Landscan & Haas et al. (in review);
- WFDSS data on various values and infrastructure at risk;
- FS data/methods to determine the natural resource dependence of a community;
- State Forest Action Plans, Regional and State fire assessments, Communities at Risk data;
- Tribal communities, fire, and land management data sources;
- Insurance data: ratio of insured/total in a community, possibly from IBHS;
- Location of CWPPs, Firewise designations, State Fire Assistance grants, and NFP actions;
- HAZUS data and methods for physical damages, economic losses, and social impacts from hurricanes, earthquakes, and floods. FEMA Loss Avoidance Study: Wildfire Methodology Report;
- Ecosystem services: Carbon stocks from Land Carbon project, Woods Hole Research Center, methods from (Hurteau et al. 2008; Hurteau & North 2009; Ager et al. 2010a); InVEST models to determine the value of other services (InVEST user's manual or website).

WILDLAND FIREFIGHTER SAFETY SUMMARY

Wildland firefighter safety holds an important position within the Cohesive Strategy. To achieve each of The Cohesive Strategy's broad objectives—landscape resiliency, fire-adapted communities and effective wildfire response—wildland firefighters are on the front line. Wildland fire personnel conduct the fuels treatments that enhance and maintain landscape resiliency, work with the public to reduce community risks from wildfire, and often put their lives in jeopardy when responding to wildfires. Firefighters bear many of the health and safety consequences of how society deals with fire.

Firefighters die or are injured during driving and aviation activities, from burnovers and other line incidents, and for medical reasons related to work stress. Repeated exposure to smoke and other environmental hazards can have additional implications for long-term firefighter health. While most of these occupational hazards are partially mitigated through training, safety equipment, and incident management, a synthetic and cross-jurisdictional understanding of how injuries and fatalities are affected by broad fire management strategies is lacking. This section summarizes some of what is known about wildland firefighter health and safety issues and presents a conceptual understanding of the various factors that decision makers can and cannot control. Framing firefighter risk within a network of causes conveys how individual solutions may be only conditionally effective. By building a conceptual understanding of this broader problem, solutions are more likely to be successful.

Rangers monitoring smoke in the Florida Afternoon Fire. Credit: National Park Service

What causes firefighter injuries and deaths?

Two approaches are commonly used to learn from past firefighter injuries and fatalities. Narratives provide detailed descriptions of the context and consequences of fire management activities involving safety incidents, and statistical summaries provide insights into the importance of hazards by causal categories. When causes are summarized by region, patterns emerge that appear to be consistent with differences in wildland fire response operations (Figure 13). Aviation and entrapment (which includes burnovers) are proportionally more common in the West where wildfires are larger and often on Federal lands, while driving and overexertion (which includes heart attacks) are more common in the East where small fires are numerous, and local fire departments have less strict age and fitness standards. To formally capture such causes behind the statistical cause, a third approach that relies on conceptual models is useful. Conceptual models integrate the richness of narratives, with the categorical simplicity of databases. Graphical conceptual models show the primary direct and indirect cause-effect relationships that exist from environmental factors and pre-fire, during-fire and post-fire management decisions. The conceptual models described here have been designed to be broadly applicable across jurisdictions and geographic regions.

The NSAT subteam working on firefighter safety created separate conceptual models for incidents involving aviation, driving, burnovers, hazard trees, heart attacks, smoke and long-term firefighter health (see full subteam report for more details). Figure 14 shows an integrated conceptual model for all incident hazards. Hazardous exposure is influenced by fire attributes and job assignment; the consequences of that hazard are mitigated by improved situational awareness and firefighter response. This model also shows the primary means by which uncontrollable drivers contribute to the hazards that firefighters face.

Long-term health issues for firefighters can result from incremental exposure to hazards during repeated events or seasons. These hazards include the cumulative effects of smoke or hazardous silica exposure from wildland fires, chronic problems caused by repetitive motion, hypersensitivity to toxic plants from repeated exposure, and an elevated skin cancer risk from extended sun exposure.

In Figure 15, long-term health is influenced by cumulative exposure which in turn is influenced by hazardous duty assignments, the characteristics of fire events, and how hazards on individual fire events were mitigated. Awareness of the risks of long-term exposure can be improved with monitoring equipment, better training, and improved incident management.

Long-term firefighter health can involve changes in firefighter sensitivity to hazards over time from exposure, but this is conditional on genetic and other attributes of individuals. Long-term health monitoring and early intervention can mediate long-term health, as can fitness, lifestyle choices and genetics factors that are hard to manage except through screening.

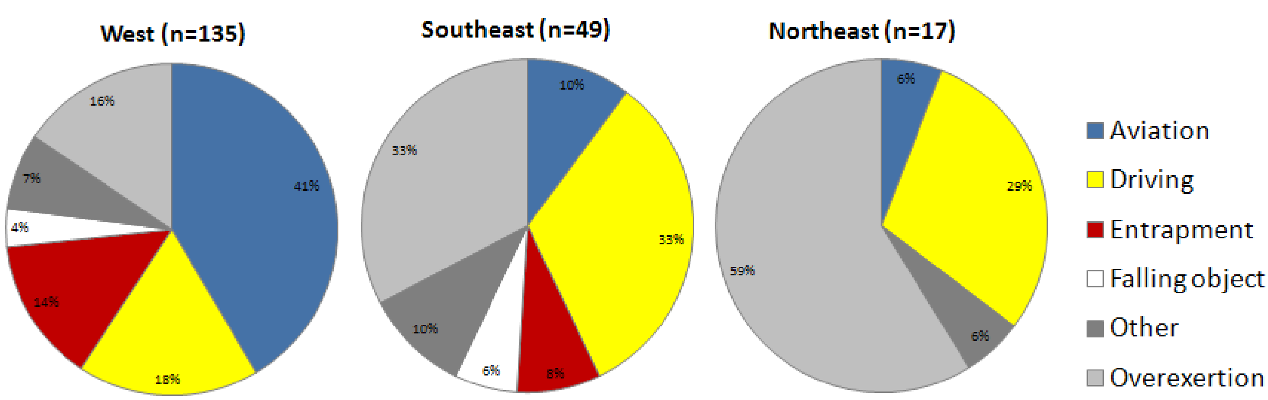
Management strategies conveyed by conceptual models

Conceptual modeling of incident risks suggests that multiple pathways exist for reducing firefighter injuries and fatalities. These can be grouped as efforts that emphasize improvements in the firefighter workforce, refinements in the way fire incidents are managed, and changes the attributes of wildland fire (Table 2). The pathway that targets the workforce could involve improved personnel screening and fitness programs, better training, greater work experience and better equipment. Each of these solutions would occur before the fire occurs.

A second pathway for reducing injuries and fatalities is through changes in incident management during the fire. Incident decisions drive job assignments, which involves the use of direct and indirect suppression tactics and therefore exposure to hazards from falling trees, burnover, smoke, stress, and aviation factors. Continued improvement of fire behavior modeling tools and post-fire learning can make such incident decisions more effective.

A third pathway for reducing injuries and fatalities involves changes in the number, size, duration or intensity of wildfires. This strategy involves wildfire prevention, fuels treatments and other efforts that influence firefighter exposure in ways that are consistent with the Cohesive Strategy goals of increasing landscape resilience and fostering fire adapted communities.

Figure 13. Cause of death for wildland firefighters 2000-2009 for all jurisdictions by the Cohesive Strategy Region in which the fatality occurred. Categories have been reclassified from the United States Fire Administration's Fallen Firefighters Database based on incident descriptions.



Existing data and prospects for quantitative modeling

A diverse range of firefighter health and safety data exist. The US Department of Homeland Security's United States Fire Administration (USFA) and the National Fallen Firefighter Foundation (NFFF) support a database that includes both structural and wildland firefighter fatalities. The National Wildfire Coordinating Group (NWCG) in association with the Wildland Fire Lessons Learned Center collects and reports both fatality and injury data. The simple number of injuries and fatalities sustained during large incidents are included in Federal 209 incident reports for individual fire events, although these reports lack detail. Several parallel efforts provide incident narratives which are more useful for conceptualizing the problem than for modeling or analysis. Injury data exist from similar USDA Forest Service and USDI efforts, although these only address Federal incidents. Safenet and Safecom are interagency efforts to address unsafe conditions and report mishaps involving fires and aviation issues, respectively. No existing efforts systematically document long term health effects.

In quantitative modeling that explores different management scenarios, aspects of firefighter safety could be linked to results from fire behavior and smoke modeling efforts through the concept of exposure. Useful variables include fire attributes such as size, duration, and behavior, which are affected by landscape fuels treatments, fire ignitions (and prevention efforts) and climate scenarios. Linking job assignments with simulated fires and incident management decisions may be more difficult. Hazard mitigation is also difficult to model, as it involves factors such as communications, training and equipment that may be best modeled as a workforce mitigation factor. Changes in firefighter screening or fitness could drive the number of age or fitness-associated fatalities.

Long-term firefighter health is most difficult to model due to the broadened complexity of the issue and a general lack of data. Creative approaches could be developed that estimate cumulative exposure from changes in the distribution of fire intensities, durations or numbers that result from different management scenarios.

Table 2. Pathways to reducing firefighter deaths and injuries and associated strategic investments.

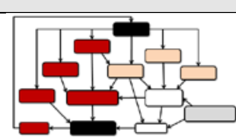
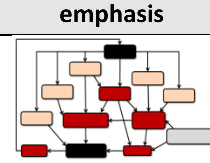
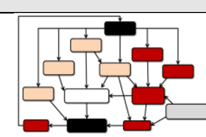
Strategic investment	**Workforce emphasis**	**Incident management emphasis**	**Fire attribute emphasis**
Position within Figure 14 shown by black and red:			
Standards, training, experience	X	X	
Technology, equipment	X	X	
Communications	X	X	
Health monitoring	X		
Personnel standards, screening efforts	X		
Incident learning	X	X	X
Fire behavior and weather modeling	X	X	X
Wildfire prevention efforts			X
Fuels reduction			X
Forest and disease management			X

Figure 14. An integrated conceptual model for firefighter safety related to incidents.

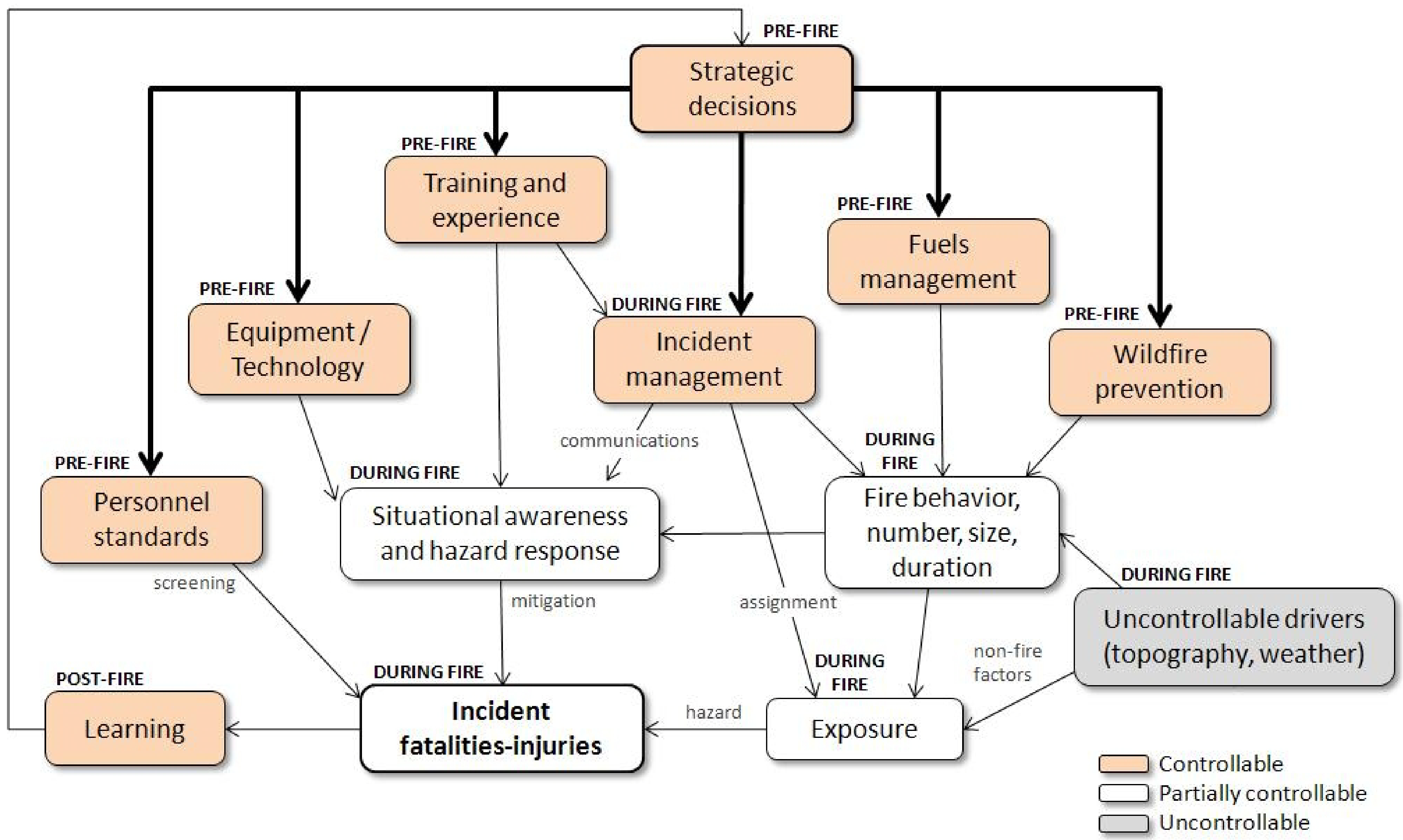
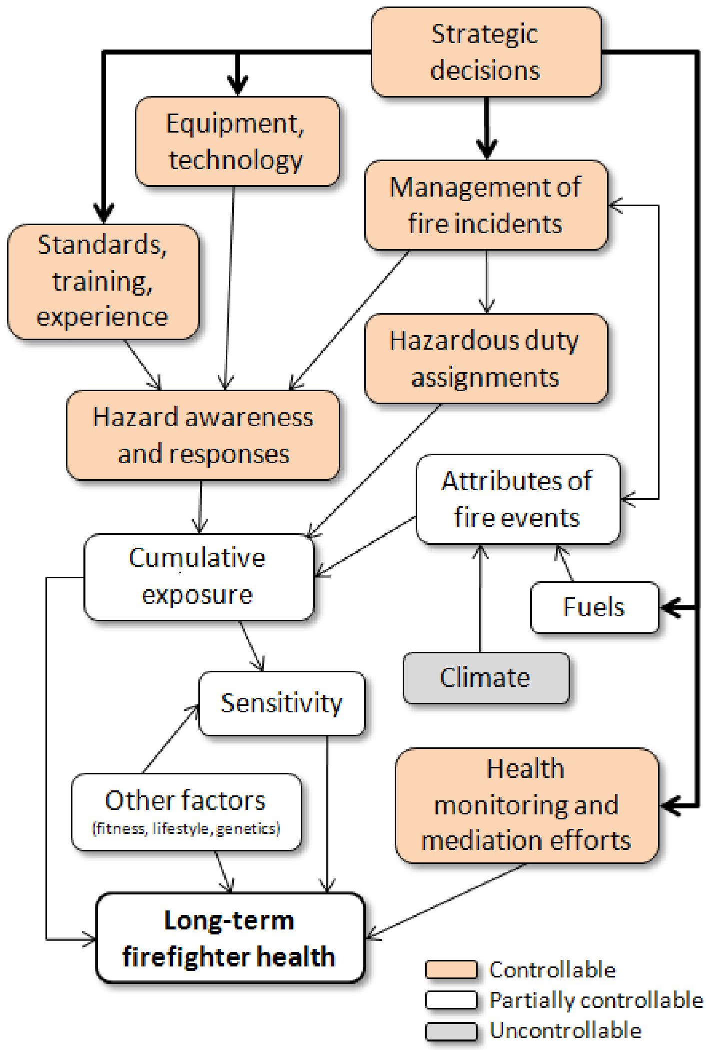


Figure 15. A conceptual model for long-term fire-fighter health.



Smoke Management and Air Quality Summary

Smoke has the most far reaching impact of wildland fires. Smoke from wildfires can easily affect air quality hundreds, even thousands of miles from the source, affecting millions of individuals. While large wildfires often have the most far reaching impact, the frequent use of prescribed fire as a management tool to reduce the risk of large wildfires also can have adverse smoke impacts.

Smoke impacts can generally be characterized into two classes, visibility related and health related. Visibility impacts range from regional haze that obscure general visibility and degrades scenic vistas, to dramatic visibility reductions that creates a hazard to both air and ground transportation. Health related impacts are regulated through the National Ambient Air Quality Standards (NAAQS) outlined in the Clean Air Act. The Clean Air Act is at the core of most air quality regulations and is designed to protect humans against the adverse health effects of air pollution. The U.S. Environmental Protection Agency (EPA) is charged with implementing the Clean Air Act and sets limits on the allowable concentrations of various pollutants through the National Ambient Air Quality Standards (NAAQS). The purpose of NAAQS is to establish quantitative pollutant concentrations that serve as thresholds above which detrimental effects to public health or welfare may result. State regulations add to the intricate web of interrelated laws and regulations addressing smoke.

The primary pollutant of concern for forest fire smoke is particulate matter (PM10 and PM2.5; particulate matter with an aerodynamic diameter less than or equal to 2.5 or 10 µm). Studies indicate that 70% of the smoke particles emitted by wildland fires are PM2.5 (Ottmar 2001). The most recent studies regarding the effects of particulate matter on human health indicate that PM2.5 are largely responsible for health effects including mortality, exacerbation of chronic disease, and increased hospital admissions.

Hotshots on Horseshoe 2 Fire. Coronado National Forest.
Credit: Jesse Hoellrich IHS

The regulations that established visibility protection and set national goals also comes from the Clean Air Act, which strives for “the prevention of any future, and the remedying of any existing, impairment of visibility resulting from man-made air pollution." Wildfires contribute to regional haze and visibility impairment, and thus covered by regional haze regulations.

While regional haze is considered a welfare issue, smoke can also reduce visibility to such low levels that it becomes a highway safety issue. Although smoke can present visibility problems anywhere in the country, highway safety is most at risk in southern states. This elevated risk is tied to the amount/frequency of prescribed fire in this region (roughly 6-8 million acres of southern forests are treated with prescribed fire each year, Wade et al. 2000), the generally humid climate, and the proximity of wildlands to population centers. This area is by far the largest acreage managed with prescribed fire in the country and fire treatment intervals are typically every 3 to 5 years. The combination of frequent fire and wildlands intermixed with homes and small towns crates an extensive and complex wildland-urban interface problem.

The potential link between smoke exposure of firefighters and impacted communities and related health effects is another growing concern. For instance, wildland fires subject firefighters to high enough smoke exposure to warrant occupational health concerns (see section above). At the community level, the relationships between smoke exposure and health effects are less certain, but given the large numbers of individuals exposed, are reasons for concern.

In addition to increasing regulation, public tolerance of smoke has diminished over time, and complaints are frequently received about smoke impacts from prescribed burning, wildland fire use fires, and wildfires. In some cases, lawsuits have affected regional prescribed burning programs.

Agencies considering management options for prescribed fire, wildland fire use, and even wildfire suppression routinely consider possible implications for and impacts from smoke. Smoke management is a process by which land managers can estimate the potential smoke impacts of a given fire. The process centers around answering two questions: how much smoke will be produced and where will the smoke go. Answering these questions involves estimating fuel loads, calculating fuel consumption and subsequent emissions, followed by determination of transport and diffusion of the smoke away from its source. The BlueSky Smoke Modeling Framework (Larkin et al. 2009) is one commonly used system designed to provide land managers with the ability to assess the potential smoke impacts of a wildland fire. The ability to predict smoke impacts enables managers to better quantify the potential consequences of their actions and communicate better information to regulators, local officials, and the public. Knowledge of smoke impacts can also allow managers to focus their tactics and fire management resources to control and minimize adverse effects from smoke.

Addressing questions such as these is accomplished by following a series of logical steps as outlined in O'Neill et al. (2009) that combine basic fire activity data such as fire size and location with atmospheric model data describing the full three- dimensional state of the atmosphere as it evolves over time. The result is an estimate of the ground level smoke concentration, typically in terms of PM2.5, that is both time and space dependent.

Conceptual Model

The conceptual model shown in Figure 16 provides a framework for assessing the impact of a set of strategic decisions relevant to wildland fire on values at risk due to smoke. These values, include regional haze, visibility hazards, and human health. Strategic decisions are choices available to land managers and others that may impact these values. These decisions fall into two general categories: those that impact smoke emissions and those that seek to mitigate smoke's impact.

Spot Fire erupted in Georgia Okefenokee National Wildlife Refuge. Credit: USFWS

The strategic decisions that impact smoke emissions include fire prevention efforts and fuels management programs. Fire prevention programs are direct efforts to reduce the number of unplanned, human-caused ignitions. While it may seem logical that any activity that reduces ignitions results in benefits for values at risk from smoke, the absence of fire or some other fuel treatment can lead to a larger impact at some future time when a natural ignition occurs.

Fuels management is the second strategic decision that impacts smoke emissions. As discussed above, managing the accumulation of fuels reduces the potential fire intensity and reduces the amount of smoke released by a fire. Using fire for fuels management requires making trade-offs between relatively frequent prescribed fires (every 3-5 years for southern forests) that release relatively small amounts of smoke versus an unplanned wildfire which depending on time since last burn could release significantly larger amounts of smoke in a single event.

The second group of strategic decisions are those that seek to mitigate the impact of smoke on the values at risk. These include communication, smoke outreach and air quality regulations, which seek to modify public behavior and perceptions in a way that reduces impact on the values at risk. Communication seeks to mitigate smoke impacts by informing the public of possible hazards, either health or visibility hazards, with the intention of changing public behavior to reduce the smoke impact (e.g., spending less time outside, evacuation, not driving a certain route, etc.)

Although similar to communication, smoke outreach is directed more at changing the social acceptability of smoke, particularly from prescribed fires. By improving the social acceptability of smoke, it is hoped that smoke from fuels management activities would not be overly restricted by air quality regulations, the third strategic decision that seeks to mitigate smoke impacts.

When examining social acceptability one important aspect often overlooked is cultural expectations. Historic tribal management practices have employed fire and smoke as a management tool for millennia. Many tribes today wish to restore these important management practices and the benefits they provide. Traditional Ecological Knowledge provides a foundation on which to build research and monitoring efforts to re-achieve a societal system of intergenerational cumulative observation in a contemporary context. In order for many tribal practices to achieve multiple benefits, they need to be coordinated with specific ecological indicators, such as a specific point in the lunar cycle, the first drop of acorns, or a short dry period prior to incoming migrations of nesting songbirds. Understanding and implementing these practices, followed by effective demonstration and communication of societal benefits, could lead to broader public support of certain practices within and adjacent to affected communities.

Most of the remainder of the conceptual model deals with determining the smoke concentrations that impact the values at risk as a result of various strategic decisions. Smoke concentrations are a complex function of fuel, how it is burning (fire behavior), and the subsequent transport and dispersion of the resulting emissions. The transport and diffusion stage adds considerable complexity to assessing smoke impacts. While some smoke impacts tend to be local such as visibility hazards and the most acute health impacts, smoke can have major impacts on the values at risk far away from the fire.

Predicting the smoke impacts of wildland fires requires knowledge of a range of processes. The first process is describing the emissions source in terms of both pollutants and heat release. The amount of fuel available to be consumed by a fire is a primary consideration in estimating the amount of smoke produced and also influences the chemical composition of the smoke through slight variations in emission factors for various compounds. Fire behavior is a function of fuels, weather and topography. Human actions can modify fire behavior, specifically prescribed fire. By altering the ignition plan for a prescribed fire, a burn boss can change the relative proportion of fuel consumed by head, flank and backing fires which directly alters the amount of smoke produced and heat release as each fire type differs in combustion efficiency.

The next process involves determination of plume rise through examination of the atmosphere's stability and wind profile as well as the fire-source rate of heat release. Again, fire behavior and human manipulation of fire behavior supply important information for determining plume rise. The third process, which overlaps with the plume rise process, is the actual movement of the smoke (transport and dispersion). During the rise and transport processes, pollutants may chemically react causing changes in the smoke composition. The final process relevant to assessing smoke impacts is deposition, or the removal of a pollutant from the transport process.

The ability to model potential smoke impacts across scales ranging from local to regional as well as global focuses on answering two questions: how much smoke is produced and where will that smoke go. The amount of smoke produced is determined by the amount and type of vegetation consumed by the fire as it moves across the landscape. Where the smoke goes is determined by the interaction of the smoke's buoyant rise with atmospheric flow patterns. Figure 17 shows the probability of smoke from a fire in Montana impacting other parts of the country. This map is based on the transport/dispersion resulting from 30 years of climatological conditions for one week in March. Incorporating both local (near-fire) and remote effects will require the development of a transfer function to get from the fire source region to the area of concern (sensitive receptor).

The last pieces of the conceptual model include knowledge of the ambient pollutant concentration along with the social acceptability of smoke. The ambient or background, pollutant concentration sets the baseline to which smoke's contribution will be added. The social acceptability component merges information regarding population density and demographics along with cultural expectations regarding fire on the landscape. Studies suggest that smoke does not appear to be a barrier to the use of prescribed fire for a majority of the population as the desire to improve forest health and/or reduce future fire risk tends to outweigh smoke concerns. However, for some segments of the population smoke is a major issue due to health concerns that needs to be considered.

Figure 16. Conceptual model of smoke impacts.

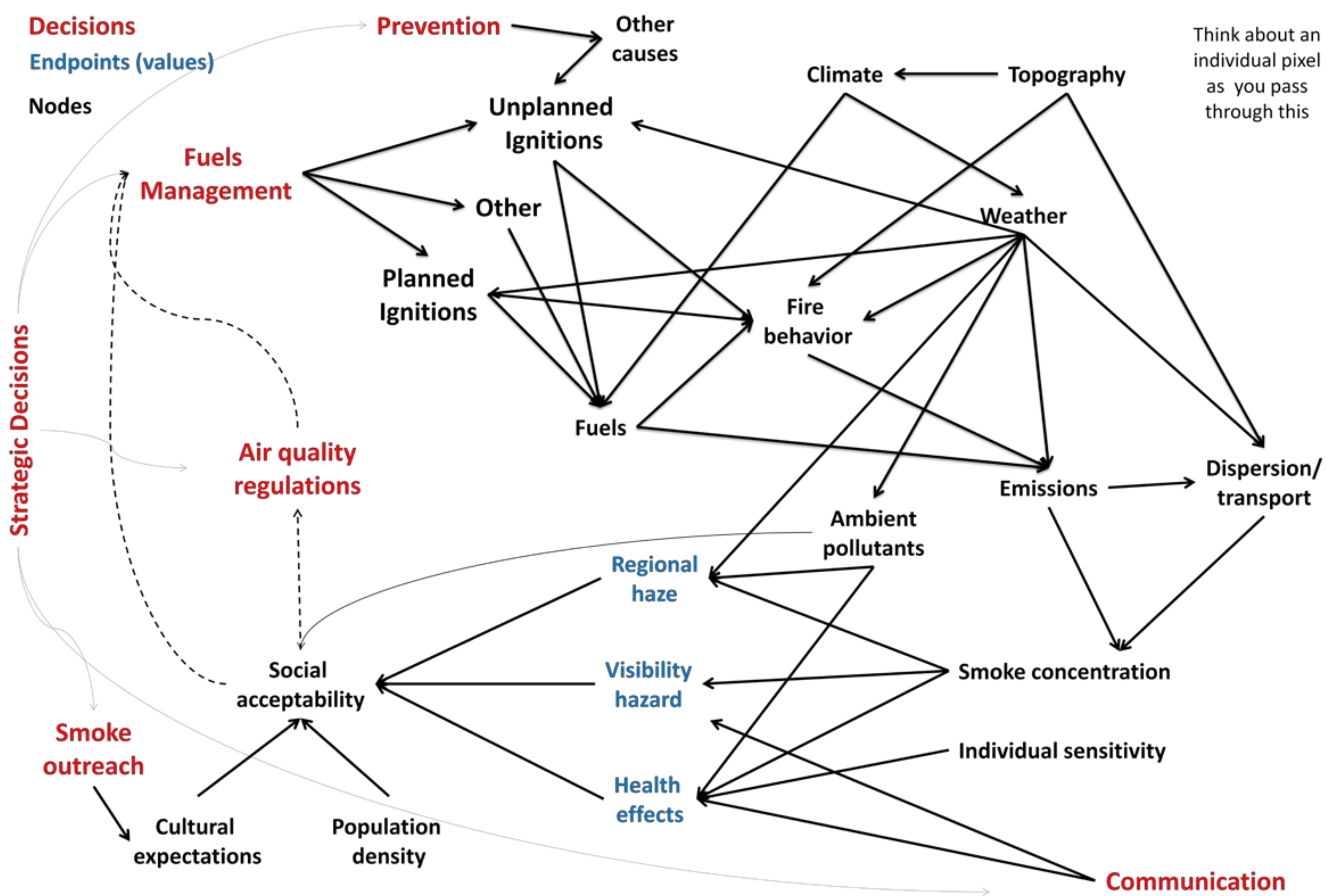
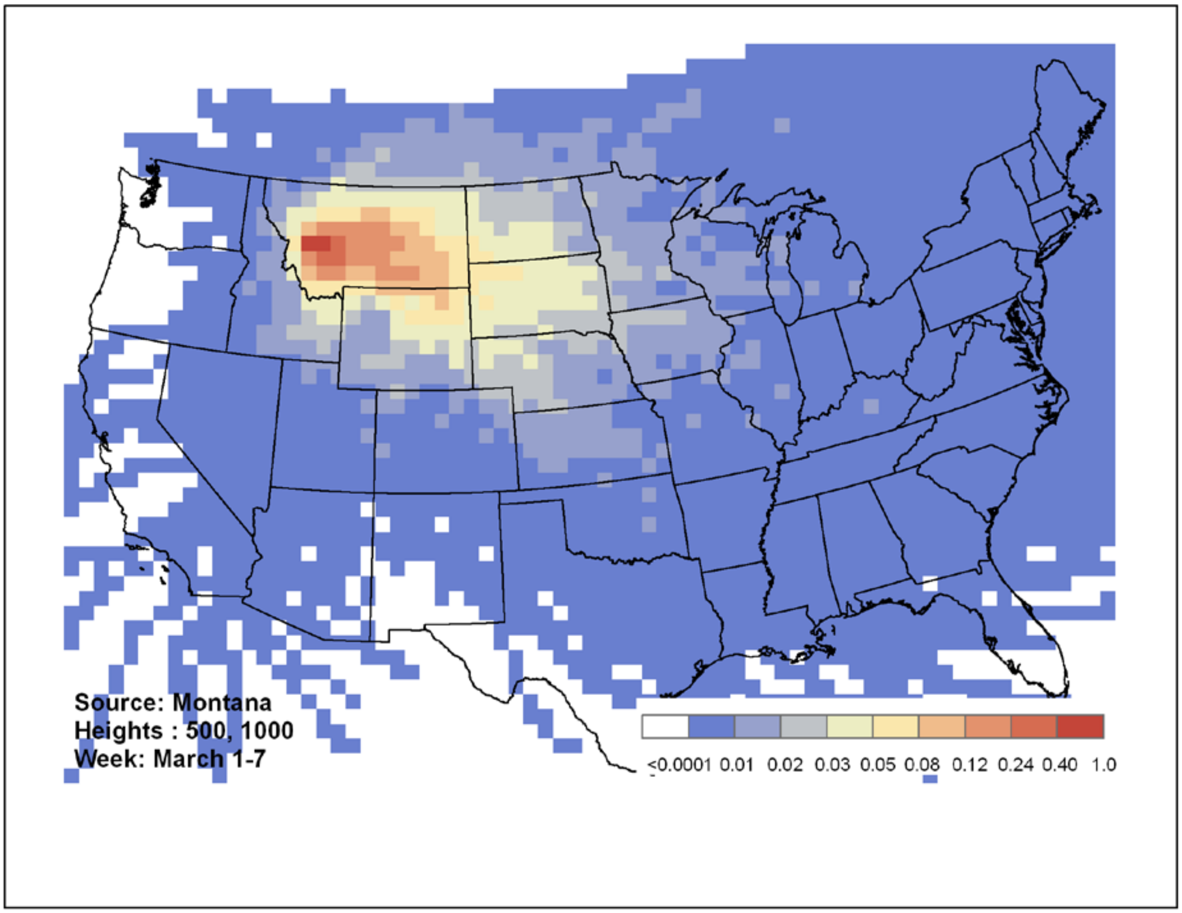


Figure 17. Potential smoke impact from a fire in Montana illustrating the need for a transfer function (Credit: Sim Larkin).



Potential Data Sources

The conceptual model for smoke impacts overlaps in a number of places with the conceptual models of other sub-teams. Primary data areas shared with other sub-teams include those related to basic fire behavior (fuels, weather/climate and topography), ignitions and to some degree information regarding health impacts. The data areas that need to be specifically developed for assessing smoke impacts include smoke concentrations, ambient pollutant concentrations, and ancillary data required to translate the smoke concentration values into health and visibility hazard impacts.

One of the largest data needs is a method to identify the connection between a potential fire's nominal location and where it's remote smoke effects are likely to be. If a potential fire's timing is known, this can be modeled using smoke trajectory and/or dispersion models. When a fire's timing is uncertain, climatological patterns can be utilized to identify the likely overall transport and dispersal of the smoke downwind. With at least some knowledge of when during the year the fire is likely to occur (e.g. knowing the climatological peak of the fire season), such an approach can help winnow down where the smoke effects are likely to be felt based on the historic prevailing wind patterns during this portion of the year.

We propose utilizing transfer functions, one for each climatological month, to quantitatively describe the connection between the fire's location and the potential for remote smoke effects. Doing so allows the values at risk remotely to be linked back to the fire location for analysis within the cohesive strategy framework. Using the North American Regional Reanalysis for the period 1979-2008 and the HYSPLIT trajectory model, the USFS PNW AirFire Team has utilized a record of 107 smoke trajectories to identify how often during each climatological month the trajectories from a given location reach any other CONUS location. To accomplish this trajectories were released every six hours from every NARR grid cell (32-km resolution) for the 30 year period. Counts were then done to identify the percentage of trajectories from a given source location reaching a given remote location in a given analysis period (in this case per climatological month). The time required to reach the remote location is also tallied. The analysis is available for fire locations across CONUS. While this methodology can provide a simple and quick probabilistic approach to making the needed scale connection for identifying smoke impact risks, significant challenges remain, relating to knowing the plume injection height of the fire, and translating simple metrics of trajectories into the relative potential for smoke concentrations. Other issues include the sensitivity of the results to interannual and inter-month variability. These issues will need to be addressed more fully as the analysis continues.

For specific areas of special fire risk concern, an analogous, but more computationally expensive approach is available where a sample fire from that period is run through a full smoke dispersion model, such as CALPUFF or the HYSPLIT dispersion component. By running the fire for all possible starting days within a specific period of interest (e.g. every July day of the past 30 years), a probabilistic impact can be determined that reflects the overall climatological meteorological patterns as above, but with better ability to identify specific smoke ground concentration probabilities. This process is available through the USFS PNW AirFire AQUIPT system (http://aquipt.airfire.org), but as it takes 24-hours to process a single fire, its use must be targeted. One potential use is to process enough sample fires through AQUIPT to calibrate the faster trajectory approach described above.

Ambient pollution concentrations is another difficult topic. While observations of pollutant concentrations are readily available through the EPA's airnow web site (http://www.airnow.gov), these observations already include smoke in their measurement. Therefore these ambient pollutant values are not directly used in assessing any direct pollutant impact as this could lead to double counting smoke's impact. The role of ambient pollutants occurs as a factor in determining the social acceptability of smoke and how that feeds into air quality regulations and fuels management. Areas with high ambient pollutant concentrations generally have less tolerance of smoke due to the potential adverse consequences of violating the NAAQS.

The remaining data required for assessing health and visibility hazards are generally available from the census as they include population density and demographic information. Visibility hazard assessment requires information on road network density, easily determined from available GIS road layers which are readily available.

Smoke from North Carolina Pains Bay Fire - May 24. Credit: Chris Carlson, NCDFR

EXPECTATIONS FOR PHASE III

The NSAT roles in Phase III will be primarily to develop analytical models, interact with the regional strategy committees and workgroups to interpret the goals, objectives, and actions proposed in their respective Phase II reports, explore management options for each region, and interact with all Cohesive Strategy committees on potential outcomes associated with identified management options. These efforts will include:

9. Translate conceptual models developed in Phase II into quantitative or qualitative models, as appropriate.
10. Compile and integrate appropriate data needed to quantify and validate the relationships presented in the models.
11. Identify performance measures that can be used across all regions and within a given region.
12. Identify geographic variations in the quantitative models to reflect appropriate differences across the regions.
13. Interact with the RSCs and WGs to validate that the modeled relationships are reasonable.
14. Explore potential management options across the regions that reflect the decision space available for broad national and regional choices related to wildland fire management and policies.
15. Interact with the regional committees to iteratively identify and refine regional strategies to include in the comparative risk assessment – national tradeoff analysis.
16. Conduct and document the comparative risk analyses – national tradeoff analysis. Coordinate efforts with other committees to report on results of the national tradeoff analysis.

Each of these steps is briefly described below.

1. Translate Conceptual Models

During Phase II NSAT sub-teams developed conceptual models related to specific topics. Each topic is relevant to understanding potential consequences or outcomes associated with wildland fire management. The individual conceptual models describe potential information needed to model from inputs and drivers to potential outcomes and consequences. In many instances the desired data to drive the individual models overlap with information needed by other models. The challenge in Phase III will be threefold: first, integrate the individual conceptual models into an analytical framework that retains the essential elements of each model; second, remove redundant relationships without sacrificing accuracy; and third, simplify the resulting models to rely on available, derived, or estimated data for use in the current analytical cycle.

The expected outcome is likely to be a nationally consistent set of analytical models that can operate at regional scales using regionally specific data, relationships, and assumptions. This should allow a consistent analysis across the nation while retaining the individuality of the regions and recognizing regional differences.

2. Compile and Integrate Appropriate Data

The specific data, relationships, and information needed to run the analytical models will be brought together for initial tests. This testing process will validate that information is available for the analyses and that the models can consistently and accurately translate the inputs into outputs and outcomes.

3. Identify Performance Measures

While each of the RSCs and WGs have proposed performance measures, a challenge facing NSAT is to determine to what extent these and other performance measures can be modeled for comparison within the comparative risk assessment. The starting place will be to attempt to deliver the performance measures proposed in Phase II and Phase I. To the extent possible the analytical models will be designed to provide these measures or surrogates of these measures. Additional performance measures will be explored to help explain potential consequences of differing wildland fire management options and the underlying relationships between inputs, drivers, and outcomes.

4. Identify Geographic Variations

Variations in wildland fire and wildland fire management across the major regions of the country are readily apparent. It is important that the analytical models reflect appropriate variations so that reasonable and useful results can be brought forward for consideration. To some extent, the available data will drive the variations appropriately and regionally specific model parameters will be capable of capturing the variations of importance. It is possible that some variation in the models themselves will be necessary to capture the regional differences and regionally specific performance measures of interest.

5. Validate Modeled Relationships - Interact with RSCs and WGs

It is important validate that the analytical models, coupled with available information, yield reasonable results and performance measures. Through interactions with the RSCs and WGs this validation step will include explanations of relationships among potential actions/objectives and outcomes/drivers. The intent is to gain understanding of the models among the RSCs and WGs so that the resulting models will deliver reasonable results useful in making decisions regarding regional and national wildland fire management strategies.

Beginning in Step 5 and continuing through Step 8, the models will be in a continuous quality assurance process in which the NSAT and RSC partners will be assessing the accuracy and validity of the models and the reasonableness of the model projections. More importantly, there will be a growing understanding and recognition of the capabilities and limitations of the models and data so that the risk analyses can be appropriately and judiciously interpreted by all involved. Some modifications and adjustments in the models will be made along the way, but there also will be a point where the models will be finalized for ensuing analyses.

6. Explore Potential Management Options

Incident Commander (Charles Scripps) talks to Fire Camp tour participants. Idaho Saddle complex Fire. Credit: Robert MacGregor

In Phase II each region has described a minimal set of management options or scenarios they feel would be useful in understanding potential consequences or outcomes from the various objectives and actions in their Phase II reports. The intent of this step is to use these minimal sets of management options coupled with additional options to explore the potential decision space nationally and regionally. It is likely that certain options will be generally unappealing, but it may be important to understand how outcomes might vary across a wide spectrum of potential inputs. For instance, while few land managers are likely to be interested in curtailing prescribed fire programs, it will be very helpful to understand what outcomes are likely to happen under such a scenario. Likewise, it may not seem reasonable to assume that large increases in fuel treatments would be funded, but it will be very helpful to understand how much of an increase in fuel treatment will be needed to achieve a substantial reduction in wildfire risk. This stage is characterized with the term “explore” partly because there is no way to predict ahead of time what boundaries make sense to explore. The regions have provided a beginning minimal set of management options or scenarios. As a minimum these will be explored to the extent possible.

7. Interact with Cohesive Strategy Teams to Refine the Regional Strategies

This step is designed to allow interaction among the various Cohesive Strategy committees to gain understanding of the linkages among management options and potential consequences of actions and objectives. During this interaction, the regional strategies will be refined and narrowed as appropriate to the set of management options desired to include in the comparative risk assessment – national tradeoff analysis. While not resulting in a “preferred alternative” for each region, it is expected that the decision space will be narrowed to a smaller set of options that are practical and reasonable for each region.

8. Conduct the Comparative Risk Analysis – National Tradeoff Analysis

Given the refined and narrowed set of management options for each region, the analytical models will be used to project potential outcomes and consequences within each region and summarized nationally. The intent is to show the tradeoffs associated with management options. Tradeoffs will reflect how risk varies under each management option – thus, the inputs assumed for each management option and the projected outcomes/consequences are summarized at the regional and national level. The intent of the tradeoff analysis is not to make a final decision as to which management option will be selected for each region. Rather the intent is to derive information useful for further deliberations among stakeholders, partners, agencies, and policy makers as decision processes move forward. Some proposed actions within the regional strategies may be adopted for implementation without further deliberation – for instance, those actions requiring no new funding or policies and that have broad acceptance by partners and stakeholders. For some actions and objectives the Cohesive Strategy may be seen as providing a deliberative process involving transitions that require considerable discussion and debate. For these actions and objectives it may be appropriate to reveal the potential tradeoffs and initiate the discussion and debate rather than "decide" immediately. The NSAT report of the national tradeoff analysis is expected to consist of the description of the underlying models, data, assumptions, and relationships presented in the models as well as tables and graphics displaying and describing the tradeoffs associated with the regional and national management options.

Type 1 Helicopter responding to Duckett Fire in Colorado. Credit: USFS

CONCLUSIONS

In many ways the products from the subteam efforts reflect the state of knowledge about various aspects of wildland fire and the availability of existing models and data. Several trends are evident:

1. **Challenges increase with scale:** Fine-scale and short-term processes tend to be better understood than broad-scale or long-term processes or strategic issues. For example, there is an extensive literature on fire behavior and combustible properties of fuels; less is understood about the large-scale effectiveness over time of strategic fuel treatments.
2. **Imbalance among sciences:** There has been considerably more research focused on the biophysical aspects of wildland fire than has been directed at equally important socio-political issues. Thus we can assuredly state that fire-wise landscaping and construction materials will help reduce the incidence of homes lost to wildfire; we are less confident as to how to ensure such practices are implemented. Smoke is an archetypal issue—technically well-understood but socio-politically complex and difficult.
3. **Integrated research increasing:** Integrated research efforts that focus on interactions among human and physical factors are becoming more common and are highly promising. For example, there is a growing body of research into how socioeconomic, educational, regulatory and enforcement factors relate to wildfire ignition processes.
4. **Comprehensive data essential:** Understanding nationwide trends and patterns requires consistent, standardized data. Given the variation in data collection efforts among Federal agencies, States, and other entities, nationally consistent and comprehensive data sets are limited—with notable exceptions such as LANDFIRE and FIA. Considerable effort will be required to fully integrate data across all lands.

Each subteam has produced one or more conceptual model of the processes operating within their area of interest. Collectively, these conceptual models create a rich tapestry that illustrates the extensiveness, complexity and interconnectedness of wildland fire. Along with the information summarized on existing analytical models and data sources, the conceptual models provide a strong foundation for building more rigorous models in Phase III that can be used to compare and contrast alternative strategies for reducing risk.

Moving forward and building models that can provide quantitative estimates of risk to social values will not be easy. Each of the subteams identified limitations in available data and understanding that will pose challenges to overcome. Conversely, there is an extensive scientific literature covering the range of issues described here and multiple data sets that can be constructively applied. Some of the more information-limited issues are also the most important from a policy perspective, namely, strategic fuel treatments, large fire suppression effectiveness and costs, and public safety impacts of smoke. Our understanding of the social aspects of wildland fire management and potential impacts on communities is more advanced than generally recognized, but still far from complete and severely hampered by the lack of quantitative data. All of the aforementioned limitations notwithstanding, the general consensus of the NSAT is that we can provide substantive and meaningful information to help inform decisions at the conclusion of Phase III.

Finally, it is worth remembering that the work of the NSAT does not occur in isolation. All of the governing committees and advisory groups within the Cohesive Strategy have a continuing role in ensuring that the analyses are matched to the questions most important to the nation, utilize the best available understanding and data, and provide results that can be understood by all. Only then will the results from Phase III analyses be truly relevant and helpful.

Acknowledgements

This summary report represents the collective contributions of many NSAT members (Appendix A), but does not purport to be a consensus view of all members. The primary authors are Danny Lee and Thomas Quigley, NSAT co-leaders, and the leaders of the various subteams, including Jeff Prestemon, Matthew Thompson, Steve Norman, Jason Kreitler, Darek Nalle, Andy Kirsch, and Scott Goodrick. James Fox, Karin Rogers, Matthew Hutchins, and Serra Hoagland provided technical and editing support to the NSAT.

Lion Fire Sequoia National Forest, California. Credit: USFS

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APPENDIX A

The National Science and Analysis Team is lead by Danny Lee and Tom Quigley. Leaders of the topical subteams include John Freemuth (policy effectiveness), Scott Goodrick (smoke management), Andy Kirsch (landscape resiliency), Jason Kreitler (fire adapted human communities), Darek Nalle (wildfire response), Steve Norman (firefighter safety), Jeff Prestemon (ignitions and prevention), and Matthew Thompson (fuels management). The following individuals contributed to one or more of the subteams within the Phase II effort.

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The following text and comments are excerpted from the edits and comments provided by WGA via Anne Walker and Cheryl Renner. May of the suggested WGA edits have been accepted and incorporated into the NSAST report. The excerpts below include sections of the text where we have declined to directly incorporate the suggested edits and have provided comments offering our rationale.

Phase II Report of the National Science and Analysis Team

Executive Summary[AMW1][dcl2]

The National Science and Analysis Team (NSAT) was established and chartered by the Wildland Fire Executive Committee to support the development and implementation of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) through the application of proven scientific processes and analysis. To achieve this goal, the NSAT is charged with three primary tasks:

1. Assemble credible scientific information, data, and preexisting models that can be used by all teams working on the Cohesive Strategy.
2. Develop a conceptual framework that describes the relative effectiveness of proposed actions and activities on managing risks associated with wildland fire.
3. Construct an analytical system using the products developed in Tasks 1 and 2 to quantitatively and qualitatively [dcl3]analyze regional and national alternatives identified by regional and national strategy committees.

Tasks 1 and 2 were addressed within Phase II, and will continue. Task 3 is exclusively a Phase III effort.

A wide range of individual scientists and analysts have participated in the NSAT, representing federal, state, and tribal agencies, universities, and various non-governmental organizations. During Phase II, the NSAT worked as a series of eight subteams, with each subteam assigned to a specific topical area. The topical areas were chosen not only to span the range of issues and processes involved in wildland fire, but also to take advantage of the special interests and knowledge of NSAT members. The eight topical areas are: 1) landscape resilience, 2) wildfire ignitions, 3) fuels management, 4) wildfire response, 5) fire adapted[AMW4] ~~human~~ communities ~~(human~~[dcl5]~~)~~, 6) firefighter safety, 7) smoke management, and 8) policy effectiveness.

[….]

Each subteam has produced one or more conceptual models of the processes operating within their area of interest. Collectively, these conceptual models create a rich tapestry that illustrates the extensiveness, complexity and interconnectedness of wildland fire. Along with the information summarized on existing analytical models and data sources, the conceptual models provide a strong foundation for building more rigorous models in Phase III that can be used to compare and contrast alternative strategies for reducing risk[AMW6][dcl7].

[.....]

In this report, we have summarized and consolidated the efforts of the individual subteams. Subteam reports are available in their entirety at site to be determined[AMW8][dcl9].

Comparative Risk Assessment within the Cohesive Strategy

The Cohesive Strategy Phase I reports[AMW10][dcl11], *A National Cohesive Wildland Fire Management Strategy*, and *A Comparative Risk Assessment Framework for Wildland Fire Management: The 2010 Cohesive Strategy Science Report*, proposed comparative risk assessment as a structured process for evaluating the consequences of alternative wildland fire management strategies. As the Phase I report (p. 13) notes,

[.....]

Understanding Wildfire Ignitions and the Role of Prevention

All wildfires start with an ignition, so it is appropriate to begin there. Wildfire ignitions can be broadly classified into two major categories: natural and human-caused. The vast majority of natural ignitions are due to lightning, whereas human-caused ignitions arise from a wide range of accidental and intentional activities. The most complete and accessible records of wildfire locations and statistical causes are for lands administered by Federal agencies. Similar records exist for many states and localities~~,~~. Challenges exist with collecting, combining, and comparing data from all wildland protection entities. ~~but these records have not been consolidated with a degree of consistency that allows an accurate portrayal of trends across the United States.~~. [N][dcl12]Summary statistics of fire activity on federal lands indicate that lighting is the dominant source of ignition on these lands, many of which are located in western states (Table 1). Such statistics do not mirror fire activity on other government or private lands, particularly in eastern states where human-caused ignitions play a much larger role on the privately owned lands that comprise the bulk of the landscape.

[.....]

Prevention

There has been scant research published in the refereed literature on the effects of wildfire prevention efforts. The National Wildfire Coordinating Group (1998), in its Wildfire[AMW13] Prevention[dcl14] Strategies publication, defines wildfire prevention to consist of administrative, education, enforcement, and engineering activities. The administration portion of wildfire prevention could be classified as long-term efforts to reduce unwanted wildfire, including such activities as planning, development of early warning systems, and training of wildfire prevention personnel. Education includes 26 activities, ranging from public service announcements to signage. Engineering consists of eight activities, ranging from the establishment of building and land use codes to hazard fuel reduction. Enforcement is broken into seven activities, including fire investigations and compliance checks. With such a long list of prevention activities that could affect human-ignited wildfires, statistical analyses are hampered by a lack of accurate and complete reporting and by analytical (statistical) problems that might arise due to high numbers of potential variables that could influence ignitions. Fire management agencies have typically done a poor job of collecting and archiving consistent data on wildfire prevention activities over long time spans and large spatial scales. This lack of consistent and long-term reporting makes scientific analyses of the effects of prevention difficult.

Recommendations for Statistical Modeling of Ignitions

The conceptual model provides a framework and the pathways that could guide construction of a probabilistic ignition model or wildfire production function. A random ignition model is always a simple option, but available scientific literature documents that the spatial and temporal patterns of wildfire ignitions can be characterized through a wide variety of predictor variables. If[AMW15] a[dcl16] wildfire ignition production function endeavor is developed for the Cohesive Strategy, we provide these recommendations:

[…..]

Similarly, a comprehensive review of fuel treatment effectiveness found the following:

- Fire effects on the overstory trees are most effectively mitigated by treatments that address both surface and crown fuels through combination treatments such as thinning followed by a prescribed burn or by removing slash after harvesting of forested landscapes~~thinning~~[dcl17].

[…..]

Results of modeling studies provide insights that can guide future planning and implementation. Perhaps most important is the realization that while targeting high hazard stands may reduce severity within treated areas, the treatment may not affect broader landscape fire processes. That is, the benefit of the treatment might be limited only to the area treated. Strategically placing area treatments within a matrix of untreated areas can slow the spread of a large wildfire or cause a drop in intensity across a larger landscape, thus reducing severity in both treated and untreated areas. The synergist effect of a broader landscape strategy can outweigh the more direct benefits of treatments concentrated near values at risk in some circumstances. It is important to note that throughout development of both Phases I and II of the Cohesive Strategy, there was strong support for active forest and land management to achieve healthy and resilient landscapes and to reduce wildfire risk to firefighters[dcl18].

[……]

Response to Wildfire and Suppression Effectiveness

Nearly all wildfires in the Unites States elicit some form of active response. In the vast majority of cases, the intent of the response is to safely contain and extinguish the wildfire as quickly and effectively as possible. Existing legal responsibilities, authorities and roles of federal, state, local and tribal wildland fire protection organizations, with particular emphasis on the response to wildfires in the proximity of jurisdictional boundaries is explained in greater detail in the Cohesive Strategy—foundational document titled "**Wildland Fire Protection and Response in the United States. The Responsibilities, Authorities, and Roles of Federal, State, Local, and Tribal Government**." The focus of this report is on the jurisdictional and legal complexities of wildland fire protection including structure protection and structural fire suppression in the wildland-urban interface, the values at risk within jurisdictions, the implications on government's ability to deliver effective and cost efficient wildfire protection and suppression services[dcl19].

[……]

Coordination of resources

Implicit in the conceptual model is coordination between Local, State, Tribal, and Federal resources. Across the nation, a range of formal agreements between organizations have been established. Because threat levels, ownership patterns, and asset mixtures are different from one geography to the next, so too are the arrays of agreements. Although federal in focus[dcl20], p~~P~~reliminary analyses using the initial response model of the Fire Program Analysis (FPA) system clearly demonstrates that multiagency coordination and sharing of resources can lead to reduced response time, bring more resources to bear on individual fires, and substantially improve initial response success rates. Similar[AMW21][dcl22] efficiencies might be expected for extended attack on larger fires, although the increased complexity of such events compounds the difficulty of modeling large fire responses.

Quantitative Modeling of Wildfire Response

Analyzing investments in wildfire response can be very complicated. In addition to the complexities of fire behavior, one has to address interactions among the distribution of available resources, their performance on the fire, the dispatch logic used to send resources to a fire, and multiple operational constraints. FPA includes a highly detailed Initial Response Simulator which addresses many of these issues, but is designed to only simulate responses in the first 18 hours following discovery of a wildfire. Although 18 hours may seem brief, in reality the vast majority of wildfires are suppressed during this initial window. Extending FPA modeling capacities beyond the federal resources is challenging due to the very large number of local and state resources involved in wildland fire response, and does not clearly represent the multiple management goals of the private landowner and states[dcl23]. Thus it is likely impractical to expect to use FPA models directly. A more promising route may be use combinations of FPA modeling results, empirical fire occurrence data from all localities, and expert opinion to build simpler models that capture the essential elements of initial response.

[…..]

Fire Adapted ~~Human~~ Communities

The significant social and economic costs of recent wildfires draw attention to the need to understand society's exposure to wildfire impacts. Wildfire impacts are thought to be increasing as a result of ~~for a number of reasons, including~~reduced forest and land management due to political and social policies and pressures[dcl24], decades of fire suppression, climate-induced stresses, and increased residential development in the wildland urban interface (WUI). These factors contribute to devastating losses of lives, homes, and infrastructure, as well as tremendous expenditures by the members of the fire management community.

Here we concisely document our understanding of the various characteristics, relationships, and factors that affect a community's vulnerability and resilience to wildland fire threats. This summary is necessarily brief and general, recognizing that various issues or topics that are regionally important have been omitted, yet can be addressed in more specific analyses. The intent is to capture the primary drivers affecting communities' exposure to risk from wildfire. A secondary objective is to conceptualize the problem so that it can be appropriately modeled in Phase III. Potential data sources are identified as a suggestion or starting point of how to implement a Phase III FAC model.

Background

In biology, adaptation is defined as adjustment or changes in behavior, physiology, and structure of an organism to become more suited to its environment. Like a living organism, communities can adapt to be more suited to a fire prone environment, but this will not happen naturally through evolution. It will take deliberate actions on their part[dcl25].

A fire adapted ~~human~~ community (FAC) is a [CR26]knowledgeable and engaged community in which the awareness and actions of residents regarding infrastructure, buildings, landscaping, and the surrounding ecosystem lessens the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape. The goal is to reduce risk from wildfire in at-risk communities, reduce damage due to wildfire, and reduce fire suppression and structural protection costs without compromising firefighter or civilian safety.

~~one where the population, natural capital, and built infrastructure can withstand a wildland fire without loss of life or significant damage; and where the community can assess their wildfire risk, share responsibility for mitigating threats, and accept the consequences according to their risk tolerance.~~ Similarly, communities adapt to fire~~'foster a fire resilient landscape'~~ and acknowledge that their community actions play a role in affecting the larger socio-ecological systems in which they are embedded. To describe the elements of a fire adapted ~~human~~ human community, we use specific terms from the vulnerability literature (ecological and social), including:

Exposure: the nature and degree to which a community, individuals, assets, or other values are threatened by a hazard, (i.e., proximity to fire prone areas such as large tracts of private or public lands).~~.~~

Vulnerability: (both social and community) the culmination of social factors and forces that create the susceptibility or exposure of various groups to a hazard (Cutter et al. 2003); (physical and ecological) the degree to which a system is susceptible to, or unable to cope with, adverse effects of wildland fire (i.e., lack of defensible space, inappropriate building materials, unfounded community expectations of responders).

Preparedness:[CR27] Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination (i.e., land managers are treating fuels near communities, fire department has knowledge and capacity to prepare the community, the larger community has accepted individual responsibility).

Community partners prepare for wildland fire through a continuous cycle of planning, organizing, training, and equipping firefighting forces, and through fire adapted community activities such as: educating residents about wildfire risk and taking action to mitigate those risks, managing fuels on public and private lands, developing and maintaining a firebreak around the community, and designating and protecting evacuation routes or establishing a safety zone. Preparing a Community Wildfire Protection Plan (CWPP), becoming a Firewise Communities/USA or Firesafe Council/Chapter community, and participating in the Ready! Set! Go! program are three important actions that help a community adapt to fire. Individual homeowners and families prepare for wildland fire by reducing fuels around their homes (creating defensible space), building/retrofitting and maintaining their homes with ignition-resistant building materials, and preparing for evacuation[dcl28].~~,~~ ~~at risk~~

~~, while providing forandexercising, evaluating, and taking corrective action in an effort to ensure potential losses are minimized.~~

[The suggested edits above were incorporated as below]

A fire adapted community is one where the population, natural capital, and built infrastructure can withstand a wildland fire without loss of life or significant damage; and where the community can assess their wildfire risk, share responsibility for mitigating threats, and accept the consequences according to their risk tolerance. Similarly, communities foster a fire resilient landscape and acknowledge that their community actions play a role in affecting the larger socio-ecological systems in which they are embedded. For example, the USDA Forest Service's FAC Program fosters knowledgeable and engaged communities in which the awareness and actions of residents regarding infrastructure, buildings, landscaping, and the surrounding ecosystem lessens the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape. The overall goal is to reduce risk from wildfire in at-risk communities, reduce damage due to wildfire, and reduce fire suppression and structural protection costs without compromising firefighter or civilian safety.

To describe the elements of a fire adapted community, we use specific terms from the vulnerability literature (ecological and social), including:

Exposure: the nature and degree to which a community, individuals, assets, or other values are threatened by a hazard. Exposure is often quantified as the probability of loss.

Vulnerability: (social and community) the culmination of social factors and forces that create the susceptibility or exposure of various groups to a hazard (Cutter et al. 2003); (physical and ecological) the degree to which a system is susceptible to, or unable to cope with, adverse effects of wildland fire. As defined, vulnerability can be viewed as either increasing the probability of loss, or increasing the consequences of loss. Both have the net effect of increasing risk.

Preparedness: a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action in an effort to ensure potential losses are minimized.

____

Research from the fields of wildland fire social and behavioral science can inform our understanding of fire adapted ~~human~~ communities, their response to, and mitigation of, wildfire threats. Yet much remains unclear in this relatively young area attempting to understand complex human behavior and actions. For example, an important question is what motivates~~y~~ individuals to~~choose to~~ undertake~~participate or not in~~ wildfire mitigation activities on their property. Using fire-safe landscaping, construction materials and techniques, and developing and maintaining defensible space are actions that significantly improve the chance of a structure surviving a fire, yet t[AMW29]~~t~~he reported responses of individuals is mixed, ~~in the literature~~ with varying levels of participation. Common elements influencing homeowner decisions include risk perception, ecological or amenity values, the cost and time of creating defensible space, and social pressures (McCaffrey et al. 2011).

At the community level, there are examples of apparent trends in community vulnerability and participation in wildfire risk mitigation programs. Studies in Arizona and the Southeast indicate that vulnerability and exposure to wildfire hazards are positively related ~~based on a comparison~~

~~of indices of vulnerability and wildfire threat~~ with participation in Community Wildfire Protection Plans (CWPP),~~ or~~ Firewise Community/USA, and/or Firewise Council/Chapter designations (Gaither et al. 2011; Ojerio et al. 2011). These analyses provide methods that could be used in Cohesive Strategy Phase III to highlight areas needing increased education, outreach, or other program actions, or to address potential equity or environmental justice issues.

On the threat side, many advances in wildfire modeling can provide important data to determine the risk facing communities from wildfire. Fire behavior models (described above) can simulate the burn probability, direction, and conditional flame length, for example, at a national extent for any given pixel on the landscape. These data can then be used to identify structures, population, and other values at risk. Operation decision support systems like the Wildland Fire Decision Support System (WFDSS) already have this capability at the landscape scale and are used to strategically deploy fire response and suppression resources. Our understanding of FA~~H~~Cs and the proposed methods to be developed in Phase III will ~~hopefully~~ aid wildland fire management by illustrating how programs and actions can reduce the exposure of human communities to wildfire threats, thereby making them more fire adapted.

Characteristics of FA~~H~~C and mitigation actions[dcl30]

A FA~~H~~C is comprised of~~can decomposed into the primary components of~~ individuals (residents), and the larger community~~household elements, community elements~~ (fire department, planning organizations, schools, businesses, landowners), land managers (federal, state, local public property owners and private property owners), ~~,~~ and physical and environmental elements (defensible space, building methods and materials, fuels and fuels mitigation efforts) (Figure 9). The combination of these elements and their interactions leads to a community being more or less fire adapted. Household preparedness is the level of knowledge,~~ and~~ planning and~~ in~~ preparation for a~~ potential~~ wildfire. Social vulnerability refers to the factors influencing individuals that may make them more susceptible to adverse effects of wildfire, such as poverty, physical disabilities, or lack of knowledge about risk. Community~~ Community~~ vulnerability may include~~ describes~~ ~~emergent vulnerabilities at the community level, which may be affected by~~ economic resilience and community social capital, such as the work of voluntary organizations~~, for example~~. Institutions and governance addresses~~describe government~~ policies,~~ and~~ programs, or informal social norms that influence actions pertaining to exposure to wildfire threats. Neighborhood characteristics describe the spatial pattern and arrangement of structures on the landscape in relation to wildfire threats, while structure characteristics depict the construction materials used. The health and resiliency of the surrounding forest is a factor that may be ~~Ecosystem services are the benefits to society from natural capital, and~~ ~~[CR31]may~~[dcl32]~~ be affected positively or ~~affected~~negatively~~ by wildfire and mitigation activities.

Not shown, but implied, are the complex interactions among elements, and the motivations of the people who live in the community at large.

Mitigation and management actions ~~affect the characteristics of FAHCs by~~ push communities ~~ing them~~toward a ~~in the direction of a~~ more fire adapted state. This can occur, generally, in three phases. Similar to McCool et al. (2006), we describe actions affecting communities by time horizon, and classify actions as occurring pre, during, and post wildfire event (Figure 10). As in the previous figure, actions listed are broad and may include multiple specific actions or existing programs. Examples include development of community wide partnerships with a stake in adapting the community to fire (residents, businesses, fire departments, public and private landowners), education and outreach, communication and information management, or post-fire assessment of fuel treatments. These actions do not constitute the entire suite of potential wildfire mitigation possibilities, but rather a representative set of primary actions used to affect the characteristics of FA~~H~~C and their exposure to wildfire hazards.

The more activities the community engages in, the greater the fire resistance of the community. Studies have shown that there is a synergistic effect of multiple activities to protect homes and communities from wildfire (Renner et al. 2010). A community is fire adapted if it has taken action to reduce risk. The more actions the community and individual members of the community have taken, the more fire adapted it becomes.[dcl33]

The specific characteristics these actions affect are outlined in the Fire Adapted ~~Human~~ Communities Phase II Cohesive Strategy r~~R~~eport, and are organized according to the groups in Figure 9. ~~Actions and programs affect individual, community, and physical and ecological elements, though not all~~ [CR34]~~characteristics can be changed within the timeframe or by wildfire programs. Understanding social vulnerability, for example, can influence evacuation planning, but wildfire programs do not address the underlying causes of social vulnerability. Figures 11 and 12~~ Figure 11 shows the actions that an existing community can take to become fire adapted, or suited to the fire prone environment in which it exists[CR35]. ~~clarify~~[dcl36] ~~which characteristics can be altered by wildfire programs by pre, during, and post event period.~~

The following are elements of a Fire Adapted Community, as depicted in Figure 11:

Residents possess the knowledge, skills, and willingness to properly prepare their homes before a wildfire threatens, prepare to evacuate and safely evacuate when necessary.

-Local fire suppression assets~~forces~~ have the needed skills, equipment and capacity.

-Residents and the local fire agencies have met and understand the local fire suppression capability and related response expectations.

Communities have risk maps showing areas of extreme, high, and moderate risk.

-Land owners are aware of hazardous fuels threats on their property and have taken action to mitigate the danger.

Communities have programs to assist homeowners with reducing and disposing of hazardous fuels.

-Structures are designed, constructed, retrofitted, and maintained in a manner that is ignition resistant.

-The community has embraced the need for defensible space by creating fuel reduction zones and internal safety zones, where treatments have been properly spaced, sequenced, and maintained over the long term.

-Local government has implemented effective land use planning and regulation, including building codes to reduce structural vulnerability and local ordinances.

-Property owners have an understanding of their responsibilities before, during, and after a fire.

-Public expectations are realistic about ~~and are not based on reliance onon~~ the ability of government entities to provide ~~all of the answers.~~protection

--Individuals accept personal responsibility for their property.

--The public understands that fire authorities cannot provide protection for every structure affected during a wildfire; and understands that it is dangerous for firefighters to attempt to protect a structure where owners have not taken the appropriate measures to make it defensible.

Not all communities at risk need to do all of these actions, but the more actions they do, the more fire adapted they become. Actions are voluntary, and can be entered into by individuals or the community by their own choice. ~~Not all communities at risk need to do all of these actions, but the more actions they do, the more fire adapted they become. Actions are voluntary, and can be entered into by individuals or the community by their own choice, except Ii~~in ~~those~~ areas where regulations concerning defensible space, maintenance, and building materials exist, such as California, Oregon, and Utah,~~. F~~federal, state, and local land managers who are primarily responsible for fuels on large tracts of land where most wildfires start, or which contribute to risk, must take an active and motivational role. Without this component of support, community action is incomplete in adapting to fire.

Phase III Modeling

The FA~~H~~C model will likely be most useful as an exposure assessment using our conceptualization of a FA~~H~~C and wildfire hazard data from other subgroups and sources.

Bayesian belief networks will describe the conditional probability of the intersection of FA~~H~~C elements and wildfire threats, illustrating the location and heterogeneity in risk across the nation. Quantifying the diagrams with comprehensive and current data in a tradeoff analysis or influence diagram will be challenging, as humans do not act in ways that are easily predicted by quantifiable models[dcl37]. A flexible, semi-quantitative modeling environment will likely be required as deterministic causal relationships will be difficult or unrealistic to establish. Expert knowledge could be used to judge the potential impact of programs or actions on FA~~H~~C characteristics. Though research assessing the social aspects of communities' risk to wildfire is scarce~~ at the landscape or national level~~, the creation a FA~~H~~C model in Phase III will be aided by several efforts, including Haas et al. (in review) who demonstrate a method to assess the risk of wildland fire to populated places, and FEMA's HAZUS[AMW38] program which estimates potential hazard losses from earthquakes, hurricanes, and floods. Several potential data sources include:

- Landfire, Finney et al. (2011), and data and output from other sub-teams;
- Census 2010 for demographic information;
- ESRI Community Analyst and Tapestry Segmentation products;
- Landscan & Haas et al. (in review);
- WFDSS data on various values and infrastructure at risk;
- FS data/methods to determine the natural resource dependence of a community;
- State Forest Action Plans, Regional and State fire assessments, Communities at Risk data,
- Tribal communities, fire, and land management data sources
- Insurance data: ratio of insured/total in a community, possibly from IBHS;
- Location of CWPPs, Firewise designations, State Fire Assistance grants, and NFP actions;
- HAZUS data and methods for physical damages, economic losses, and social impacts from hurricanes, earthquakes, and floods. FEMA Loss Avoidance Study: Wildfire Methodology Report;
- Ecosystem services: Carbon stocks from Land Carbon project, Woods Hole Research Center, methods from (Hurteau et al. 2008; Hurteau & North 2009; Ager et al. 2010a); InVEST models to determine the value of other services (InVEST user's manual or website).

Additional references for the FAC section

~~Office of Inspector General Western Region, *Forest Service Large Fire Suppression Costs*, Report No. 08601-44-SF, Department of Agriculture, November 2006, p. 7, http://www.usda.gov/oig/webdocs/08601-44-SF.pdf.~~

Renner, C. R., Haines[dcl39], and Reams, *Better Building Blocks*, Wildfire Magazine, International Association of Wildland Fire, Penton Media Inc., March/April, 2010, pp. 10-16, http://wildfiremag.com/pub-ed/wildfire-mitigation-results-201003/.

[……]

Expectations for Phase III

The NSAT roles in Phase III will be primarily to develop analytical models, interact with the regional strategy committees and workgroups to interpret the goals, objectives, and actions proposed in their respective Phase II reports, explore management options for each region, and interact with all Cohesive Strategy committees on potential outcomes associated with identified management options. These efforts will include:

1. Translate conceptual models developed in Phase II into quantitative or qualitative models, as appropriate.
2. Compile and integrate appropriate data needed to quantify and validate the relationships presented in the models.
3. Identify performance measures that can be used across all regions and within a given region.
4. Identify geographic variations in the quantitative models to reflect appropriate differences across the regions.
5. Interact with the RSCs and WGs to validate that the modeled relationships are reasonable.
6. Explore potential management options across the regions that reflect the decision space available for broad national and regional choices related to wildland fire management and policies.
7. Interact with the regional committees to iteratively identify and refine regional strategies to include in the comparative risk assessment – national tradeoff analysis.
8. Conduct and document the comparative risk analyses – national tradeoff analysis. Coordinate efforts with other committees to report on results of the national tradeoff analysis.

[…..]

FINAL DRAFT
01/03/12

2012 GUIDANCE TO WILDLAND FIRE AND LAND MANAGEMENT STAKEHOLDERS FOR IMPLEMENTATION OF THE NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY

The WFLC has developed this summary document in an effort to provide guidance to the agencies and organizations it represents, in crafting and implementing policies and actions needed to strategically approach the issue of effective wildland fire mitigation and response. Addressing the requirements of the Federal Land Assistance, Management and Enhancement Act of 2009 (FLAME Act) and subsequent reports, the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) identifies the following three primary factors as presenting the greatest challenges and opportunities for making a positive difference in addressing this complex issue.

- ***Restoring and maintaining resilient landscapes***
- ***Creating fire-adapted communities***
- ***Responding to wildfires***

Addressing wildland fire is not simply a fire management, fire operations or wildland-urban interface problem – it is much larger and more complex. Each agency and organization represented by the WFLC has the authority, responsibility, and autonomy to develop and implement their own policy. But long-term success can only be achieved through a unified, collaborative and focused effort of all.

Commitment to addressing the greatest needs and achieving our common goals with the Cohesive Strategy is essential. Diversity of organizational and agency missions does not preclude, but rather can strengthen achievement toward the collaboratively developed goals. Agencies, organizations, and stakeholders represented on the WFLC must take timely, decisive and effective steps to follow the Cohesive Strategy's Guiding Principles and Core Values. These principles reflect foundational values and should be considered throughout our fire and land management programs and our day to day activities.

- ✓ 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.
- ✓ Federal agencies, local, state, tribal governments 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.

Our shared vision is to safely and effectively extinguish fire when needed; use fire when allowable; manage our natural resources; and as a nation, live with wildland fire.

Collaboration is key. As opportunities arise, we encourage you to take the initiative to continue to work with your existing partners as well as reach out to other stakeholders on developing cohesive actions that will leverage resources and reduce risk. The completion of regional assessments in Phase II resulted in the identification of some common objectives that will move us closer to achieving our goals in addressing the nation's wildland fire problem. We can build upon successful actions that are already occurring in some areas, including:

- ✓ *Supporting collaborative efforts*, including Land Management Plans, Hazard Mitigation Plans and Community Wildfire Protection Plans, or their equivalent. Keep all parties informed and involved throughout the process.
- ✓ *Conducting effective education and outreach* to empower citizen engagement in, and support for, wildland fire management activities.
- ✓ *Proactively use active vegetation management tools and techniques*, including prescribed fire, to achieve local and large landscape objectives, including the communication of benefits to stakeholders.
- ✓ *Supporting working forests and wildlands, local economies and job creation, and diverse products and markets*. Communicate the need and the resultant benefits of actively managing our lands.

WFLC agencies and organizations are collectively committed to recognizing the differences among the diverse areas of the Nation, while jointly achieving the goals of the Cohesive Strategy through distinctive regional approaches. The WFLC remains committed to continuing to involve stakeholders to ensure that the Cohesive Strategy reflects the values, concerns, and needs of the public and all governments. The WFLC requests your commitment and involvement with the final phase of the process as we identify solutions together, and we urge you to support our vision as detailed in the Cohesive Strategy and supporting documents.

We encourage you to review reports and documents developed as a part of the Cohesive Strategy, including the FLAME Report to Congress, Phase I report of the Cohesive Strategy, Phase II regional assessments, and once approved, the Phase II Cohesive Strategy report and National Science and Analysis Team report, all of which can be found at www.forestsandrangelands.gov.

Wildland Fire Leadership Council Agencies

U.S. Department of Interior, U.S. Department of Agriculture, Forest Service, National Park Service, Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, U.S. Geological Survey, U.S. Department of Homeland Security/U.S. Fire Administration, Western Governors' Association, National Governors' Association, National Association of Counties, Intertribal Timber Council, National League of Cities, National Association of State Foresters, International Association of Fire Chiefs

WILDLAND FIRE EXECUTIVE COUNCIL

Proposal

Date: 12/29/11

Subcommittee: N/A

Description of Issue or Assignment:

At the December 16, 2011 WFEC meeting, the CSSC presented a WFLC guidance document that was developed following discussion by the WFLC at their November meeting. The WFEC was asked to develop a guidance document for their review that would summarize the support the WFLC has for the Cohesive Strategy and the principles behind it, while also calling attention to the successes achieved to date. It was envisioned that such a document could be distributed within the agencies and organizations represented by WFLC members in order to further support continued participation in the process, as well as develop individual policies and strategies that support the Cohesive Strategy.

After some discussion of the WFEC members, Mary Jacobs was assigned to work with primary CSSC author Ann Walker on shortening the document to a more concise summary.

Discussion of Proposed Recommendation(s):

The document was shortened to about a page and a half. Ann indicated that there was considerable interest in wanting to keep the Guiding Principles from the Cohesive Strategy verbatim due to considerable discussion and strong feelings on this issue previously. The final version is ready for discussion and WFEC approval.

Identify Considerations:

N/A.

Rationale for Recommendation(s):

The final version meets the intent of the WFLC.

Recommendation(s):

Recommend the final version be approved as submitted, or with minor adjustments as directed by WFEC.

WILDLAND FIRE EXECUTIVE COUNCIL

Proposal

Decision Method used:

- X Subcommittee Consensus
- [ ] Modified Consensus (explain, i.e. majority, super-majority)
- [ ] Chair Decision

Contact Information:

Mary Jacobs, National League of Cities Representative to WFEC
Assistant City Manager, City of Sierra Vista
Mary.Jacobs@SierraVistaAZ.gov
520-458-3315

WFEC Decision:

- [ ] WFEC Approves
- [ ] WFEC Approves with Modifications (not required to resubmit for WFEC approval)
- [ ] Need More Information (required to come back to WFEC for approval)
- [ ] WFEC Does Not Approve

Roy Johnson, DFO   Date

Notes regarding decision:

A National Cohesive Wildland Fire Management Strategy

Credits (top to bottom): NIFC, Kari Greer; NIFC; NIFC, Scott M. Bolle.

Communication Framework

for

A National Cohesive Wildland Fire Management Strategy

The vision for the next century is to

"Safely and effectively extinguish fire when needed; use fire where allowable; manage our natural resources; and as a nation, live with wildland fire."

November 2011

Table of Contents

References

- Wildland Fire Leadership Council (Refer to the Memorandum of Understanding)
- Wildland Fire Executive Council (Refer to the charter)
- Federal Land Assistance, Management and Enhancement Act of 2009
- A National Cohesive Wildland Fire Management Strategy
- The Federal Land Assistance, Management and Enhancement Act of 2009, Report to Congress
- The 1995 Federal Wildland Fire Policy and Program Review
- A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Strategy
- Quadrennial Fire and Fuel Report (2006)
- Quadrennial Fire Review (2009)
- Mutual Expectations for Preparedness and Suppression in the Interface; A Call to Action; and Wildland Fire Protection and Response in the United States, The Responsibilities, Authorities, and Roles of Federal, State, Local and Tribal Governments.

Regrowth on the Cascade Complex, Idaho, 2007. Credit: NIFC, Kari Greer.

Purpose and Intent of this Document

The purpose of this document is to address the Tasking Memorandum (reference Appendix A) for the Cohesive Strategy Communication Workgroup (CS-CW) approved by the Wildland Fire Executive Council (WFEC) on September 2, 2011 which stated that:

> *In order to effectively implement the National Cohesive Wildland Fire Management Strategy process (hereafter referred to as the Cohesive Strategy) the development of a unified communication guidance and direction document is critical.*

The Communication Framework for A National Cohesive Wildland Fire Management Strategy is targeted for use by individuals, agencies, organizations, governmental bodies, and interested stakeholders to use as a roadmap for effective communication and collaboration activities related to the Cohesive Strategy. The intent is to provide timely information, implementation updates and feedback opportunities to enable all stakeholders to understand and support the vision the Cohesive Strategy.

The National Cohesive Wildland Fire Management Strategy is an all-lands policy that reaches across jurisdictional lines. Traditionally, organizations involved in wildland and structural fire work together as cohesive and collaborative partners, focused on the objectives at hand regardless of their home unit or organization. This guidance is intended to support, simplify and facilitate communication efforts while recognizing and respecting that each organization has its own unique protocol, information distribution methods and communication systems.

Communications among the many organizations involved in the Cohesive Strategy must be consistent, clear, continual, and encourage discussion and an exchange of ideas. This Communication Framework highlights goals, objectives, core principles, provides overarching messages, suggests a number of actions and products, and concludes with potential methods to evaluate success.

Effective communication is an on-going process. It is anticipated that while the Framework will endure, updates on the messages will be adapted to meet the current situation.

Elements of a National Cohesive Wildland Fire Management Strategy

Methodology

The WFEC Tasking designated an interagency communications group, with members from the Department of the Interior, USDA Forest Service, the National Association of State Foresters and the International Association of Fire Chiefs to serve as the Cohesive Strategy Communications Workgroup. A WFEC member served as a liaison to the group providing guidance and assistance.

Initial group discussions focused on the best practices and procedures in communications and defined strategic and tactical outcomes. Subsequently, the group researched volumes of background material, reached out to WFEC members and the various committees involved in the Cohesive Strategy simulating mini listening sessions, gleaned lessons learned from documents addressing public perception and from existing national level communication plans which facilitated interagency and intergovernmental communications efforts.

Background information about the Cohesive Strategy is provided in Appendix B.

A National Cohesive Wildfire Management Strategy discusses the importance of engaging the public.

Community meeting for the Castle Rock Fire, Ketchum, ID, 2007. Credit: NIFC, Kari Greer.

Goals, Objectives and Principles for the Communication Framework

Goals

As defined in the tasking, the Framework is designed to meet three overarching communication goals: Information, Organizational Communication and Collaboration, and Implementation. The intent of these goals is briefly outlined below.

- **Information:** To keep stakeholders, interested parties, and the public informed of progress in the development of the Cohesive Strategy.
- **Organizational Communication and Collaboration:** Facilitate development and implementation of organizational communication processes that enhance and sustain collaboration among stakeholders toward development and implementation of the Cohesive Strategy.
- **Implementation:** Provide management and oversight options for communication efforts during implementation of the Cohesive Strategy.

Objectives

The strategic communication objectives are focused on:

- Creating a climate where key audiences are thoroughly informed about the basic tenants of the Cohesive Strategy in order to be aware of the benefits and relevance to their program and;
- Providing stakeholders the opportunity to engage in ongoing dialogue in order to be included in the process to the maximum extent possible.

Principles

Such a climate will be created through commitment to the following core principles:

- Leaders at all levels will participate in communications efforts during all phases of the Cohesive Strategy.
- Participating individuals and organizations will utilize recommended best practices for communication and collaboration.
- Process transparency will serve as the "golden rule."
- Aggressive distribution of information will be on-going.
- Meaningful and timely opportunities for stakeholder involvement will occur during all phases in order to sustain collaboration among individuals and organizations.
- Decision-making will be empowered by active participation of the diverse communities across the landscape of fire management.

Full success of this effort will only be accomplished through the combined efforts of leaders, subject-matter experts, and stakeholders. While the process must respect established roles and responsibilities for decision-making, it is imperative that the entire community of stakeholders be given a voice in the process.

To maintain consistent messaging and to ensure that stakeholders have equal opportunity to participate, communicators will be provided with the core principles of communication, overarching messages and a number of suggested actions and products that can be easily adapted to their unique communication environments. Long-term tactics are discussed under Implementation of the Communication Framework below.

Protecting stuctures in the Wildland Urban Interface. Castle Rock Fire, Ketchum, ID, 2007. Credit: NIFC, Kari Greer.

Roles and Responsibilities

Communication is the responsibility of every employee or individual involved. This responsibility extends beyond senior managers and officials, those designated to serve as official spokespeople, or subject matter experts who have been recognized as effective communicators. By virtue of association with the Cohesive Strategy, individuals will serve as ambassadors for the overall goals.

The following positions have critical roles and responsibilities:

- **WFLC Representatives and / or their designees:** Serve as key contacts for agency leadership, overseeing and coordinating communication, collaboration, and stakeholder activities within their respective agencies. WFLC members also serve as the decision-making body.
- **WFEC Representatives:** Provide advice for coordinated national-level wildland fire leadership, direction, and program oversight in support of the Wildland Fire Leadership Council.
- **Agency or Organization Communication Points of Contact:** Typically, this will be an individual(s) in External Affairs, Public Affairs or a group's Communication Director. It is critical that there be designated point(s) of contact to facilitate organizational specific communications, serve as communication consultants for designated spokespersons for the Cohesive Strategy, and to coordinate with senior level officials within the home organization about progress in the communications and collaboration arena. (For example: tracking presentations and delivery to key audiences.) Organizational Point of Contacts, in accordance with their specific guidelines will assist and facilitate designates spokesperson along with informing key audiences, including media and elected officials as appropriate.
- **Designated spokesperson(s):** Credible spokespersons will be chosen by respective agencies, organizations, and groups and these individuals should be well versed in the Cohesive Strategy, the principles of wildland and structural fire, communication strategies and techniques, and the overriding need for safety for firefighters, communities and the public at large.
- **Participants in the Cohesive Strategy Process:** Regardless of their individual or group role, all participants in the CS process are established leaders known for their expertise and commitment to the CS. As such, participants are requested to assist in the cohesive communications effort by recognizing and supporting that communications is the responsibility of all individuals locally, regionally and nationally.

As the Cohesive Strategy continues to evolve it is anticipated that the will become a part of our daily conversations.

Messages

The cornerstone of any communication effort is a set of consistent, compelling messages for use in all proactive and reactive communication. Following are the overarching messages for the Cohesive Strategy. These messages are designed to meet the following criteria:

- **Coincide with and not contradict agency, interagency, intergovernmental, or organization's messages.** It is critical that the communities involved in the Cohesive Strategy speak with one voice. The CS messages are designed to complement existing messages.
- **Allow for customization.** These messages are a guide, not a script. Users are encouraged to provide additional, local detail to ensure the messages touch audiences in a relevant, credible way.

Messages are not intended to be a script, but are to serve as a guide for communicators to focus on the key themes of the Cohesive Strategy. Message are general concepts that can be incorporated into discussions, print materials, and other resources used in communication, education, information and collaborative discussions.

Supporting points provide detail for the messages and enable individuals to further explain the identified topic and reach audiences on a personal level.

- **Include a call to action.** In addition to educating, messages should motivate the audiences to act on what they have learned.
- **Answer the questions what, why, and how.** Categorizing messages in this way will help users recall the messages during appropriate situations. The messages below are presented in the traditional format of a Key Message followed by Supporting Points.
  - Spokespeople are reminded to use clear text and language and to explain the Cohesive Strategy using the "five w's and the h" of journalism (who, what, when, where, why and how), with particular emphasis on the "why" and the "how" for this project. Tell the story of the Cohesive Strategy, of what's happening. We do not need to define everything that is going on.

Firefighters talk to a home owner in the wildland urban interface on the Cascade Complex, Idaho, 2007. Credit: NIFC, Kari Greer.

Messages for the National Cohesive Wildland Fire Management Strategy

What is the Cohesive Strategy?

The National Cohesive Wildland Fire Management Strategy is an ongoing effort by federal, tribal, state and local governments and non-government organizations to address growing wildfire challenges in the United States.

Firefighters ignite a prescribed fire near homes near the Petit Manann National Wildlife Refuge in Maine. Credit: FWS.

Wildland fire is a dynamic process.

Fire seasons, in general, are becoming longer, with larger wildfires that are more difficult to put out. The Cohesive Strategy represents the kind of creative thinking and cooperation that will be needed to meet the challenges of a new kind of fire season. The Strategy promotes safely and effectively extinguishing fire, when needed; using fire where allowable; managing natural resources; and as a nation, living with wildland fire. Wildland fire must be managed across appropriate fire landscapes, which are often fragmented into many land ownerships and political jurisdictions. An "all-lands" approach is needed and the Cohesive Strategy addresses wildland fire challenges by restoring fire-resilient landscapes.

The Cohesive Strategy is about more than fire suppression.

Wildland fire is more than a fire management and operations problem, it is a larger land management and societal issue. To achieve workable solutions, a cohesive strategy must ensure the human dimension is accorded equal weight with the physical and ecological science dimensions of fire. The Cohesive Strategy emphasizes restoring resilient landscapes and promoting fire-adapted communities and encourages private landowners and communities to assume responsibilities for making their properties fire-resistant.

No one strategy can solve all the problems faced by the nation's fire community.

The Cohesive Strategy will provide a common basis for thoughtfully approaching the complexities of wildland fire in the United States and determining the best course of action. A key to a cohesive strategy is its inclusiveness – its ability to accommodate the wide diversity of the United States, recognizing a 'one-size-fits-all' approach does not work across the Nation. It is better to have one cohesive strategy developed with the participation of state and local fire organizations, tribes and the federal fire agencies rather than different strategies from different organizations. The Cohesive Strategy will build on past efforts to direct wildland fire management in the United States.

The Cohesive Strategy relies on people working together.

A workable strategy must include and define the varying roles and responsibilities of fire managers at all levels and determine how those levels blend and work together. Wildland fighting agencies need to cooperate and be respectful of each others' process to work collaboratively for the good of all. A national Cohesive Strategy must recognize the differences and tensions that exist among partners and stake-holders and why those differences exist. Success depends on stronger relationships. An effective cohesive strategy must guide all organizations to recognize and accept each others' management differences and promote a cohesive response to the wildland fire management challenges across all jurisdictions.

The Cohesive Strategy seeks to reflect the values and concerns of the public and all governments.

The problems created by wildland fires affect all lands and all levels of govern¬ment. Therefore, the solutions must be a collective, shared and strategic. The Cohesive Strategy must engage the public, a 'from-the-ground-up' effort. Wildland fire management officials, the public and all levels of government will be actively involved. Solutions will come from all stakeholders, including the legisla¬tive branch of the United States government. The strategy is designed to better align national level decision-making with regional and local interests.

Effective communication is an on-going process. It is anticipated that as Phase II and Phase III unfold the Communication Framework is expected to adapt and expand to accommodate new or revised messages, themes and tactics.

Audiences

The overriding need for safety—for firefighters, communities and the public at large—results in a vast potential stakeholder audience. With regard to this project, the traditional breakdown between internal and external audiences is marginal.

The internal audiences (as defined by the respective groups) are critical, as the internal participants will serve as primary messengers. Most stakeholders for this project consist of organizations, whether they are non-government or representing local, state, tribal, or federal government agencies. These internal stakeholders often have widely different organizational focus and individual professional roles and responsibilities. The size of this stakeholder population means that the intensity of participation will vary considerably based on roles in their respective formal organizations.

While media and elected officials may rightly be considered external audiences, members of the public are identified as important stakeholders. Consequently, interested citizens or citizen groups will be provided an appropriate opportunity to participate. Participating agencies and organizations are encouraged to manage media contacts and to inform elected officials in accordance with individual agency protocol and procedures.

Audiences are those people, groups, organizations, agencies or other levels of government who affect, are affected by, or have a relationship to the issue at hand. Knowing and understanding that relationship will help in customizing messages and strategies for reaching each audience.

Information Officers and fire managers conduct a community information session in northern California, 2008. Credit: NIFC, Kari Greer.

This initiative considers both internal and external audiences, as well as the people who influence those audiences. Audiences for the Cohesive Strategy are defined as follows:

- Local, state, tribal, and federal government agencies.

  Examples: Other cabinet agencies, State and municipal governments

- Nongovernmental organizations and constituent groups.

  Examples: Associations, conservation groups, professional forestry and natural resources organizations, landowner organizations and news media (national, state, local, trade, etc)

- Elected officials.

  Examples: Congressional, State and Municipal

- Citizens from communities across the nation.
- Academia

  Examples: Resource Centers, Universities and Colleges

For the partners involved in the crafting of the Cohesive Strategy it is critical that messaging to their members and employees is direct and effective because to have consistent communication with external audiences, those involved in the Cohesive Strategy must be sure to communicate effectively with the internal audiences. At the same time it must be recognized that several of the internal groups have peers that are external and should not be overlooked – the external distribution of information should not be limited to the elective officials and the citizens but to others we work with.

Lighting a prescribed burn at dusk at Wind Cave National Monument, South Dakota, 2009.
Credit: NPS, Mike Johnson.

Collaboration Tips and Resources

Collaborative participation must be as inclusive and equitable as possible. In addition to resources from the participating agencies, organizations and groups, there are multiple resources about effectively collaborating with partners.

The International Association for Public Participation (IAP2, http://www.iap2.org/ see practitioner tools) offers a wealth of suggestions for effective collaboration with stakeholders. One way to view collaboration may be to view the following participatory steps:

- **Inform:** Receives objective information to assist in understanding the problem and alternatives.
- **Consult:** Contributes ideas and comments.
- **Involve:** Participates at key times throughout the process to ensure concerns and aspirations are consistently heard and understood.
- **Collaborate:** Participation in every aspect of the process, including development of alternatives and identification of the preferred alternative.
- **Empower:** Participation in the final decision

The steps noted above are further defined as "Spectrum of Public Participation" and is a suggested method to organize a strategy to accommodate the diverse stakeholders interested in this project.

"Branding" the Cohesive Strategy

The Cohesive Strategy will benefit from communications efforts that exhibit a unifying set of messages, symbols, and overall "look and feel." This will allow the diverse Cohesive Strategy messengers and stakeholders (particularly agencies and organizations) to speak with a unified voice, supported by consistent products and materials (templates, logo, color scheme, slogan, etc.) The Cohesive Strategy is a concept and as such it is suggested that graphic branding be considered and samples provided in a communications toolbox.

Tactical Tools

Recognizing and respecting that each organization has its own unique protocol and information distribution methods, the Communication Framework can serve as a model for integrating Cohesive Strategy messages and priorities within existing communications systems

The following tactical tools are recommended for any communications professional, public affairs officer, organizations as a whole or any appropriate messenger to use when communicating about wildland fire in their daily work. They are divided into "internal" and "external" categories, but many of the tools may be appropriate for both. While some items are merely recommended tactics, a number of these items will be produced and compiled into a Cohesive Strategy Communications Toolkit to offer template materials and tools that are easy to use and customize while providing a consistent national messaging platform.

INTERNAL AUDIENCES

Resources and Collaterals

- Briefing papers
- Fact sheets
- Frequently Asked Questions
- Key messages and Message Map
- Key congressional contacts
- "Elevator speech"
- PowerPoint presentation template/slides
- Detailed list of stakeholders by organization
- Sample tweets (Twitter)
- Sample Facebook posts

Outreach

- E-mail blasts
- Podcasts
- Webcast for communicators to introduce collateral tools
- Legislative Outreach
- Local elected official outreach
- Chief's Chat – Forest Service Chief video
- Establish a "My Fire Community Cohesive Strategy" working group neighborhood.
- Articles & reports submitted to agency publications (internal/external; federal, state, tribal, local)
- Articles/blurbs written for field-level awareness published in applicable publications and electronic mediums.

EXTERNAL AUDIENCES

Media Relations, Resources and Events

- Webcast press conference
- Face-to-face briefings of key officials
- News releases
- Podcasts
- One-pager on key points of Cohesive Strategy
- Presentations based on template

Social Media and Public Relations

- Regular (weekly) Twitter/Facebook posts around stakeholder channels
- Coordination with fire prevention/awareness weeks/months throughout calendar year

Smoke billows on the horizon, 2010.
Credit: USDA Forest Service, Manti LaSalle.

Implementation Strategy

For sustainability of the Cohesive Strategy over time, current communication operating procedures in place within all agencies and organizations will be utilized to provide information to employees and members. Federal and state agencies and other collaborators are expected to create and implement their own communication plans to disseminate Cohesive Strategy information (see Roles and Responsibilities section). To the extent possible, communication with stakeholders will be through established stakeholder organizations' sources and channels.

Appendix E offers a list of identified communications contacts at various agencies and organizations that are in a position to effectively broadcast meaningful Cohesive Strategy conversations. While this list is not exhaustive, it is meant to serve as a foundational network of messengers that can reach out through various groups and channels, creating a ripple effect and extending the reach of this framework.

A more formal group of communication professionals (from a cross-section of appropriate agencies, organizations and groups) is needed to work on communications during Phase II and Phase III of the Cohesive Strategy. Key messages from Phase II and Phase III products will need to be developed and disseminated. The group will support and facilitate communication originated by stakeholders with communication tools, information, and technical assistance. It will work with the three regional committees who will be responsible for their own outreach to their stakeholders within their regions. This level of technical assistance will be important to support stakeholder organization communication efforts.

A range of implementation scenarios will be presented to the Wildland Fire Leadership Council for discussion and decision, and follow-up actions at the WFLC meeting November 9-10, 2011.

Healthy landscapes can decrease the fire risk to communities.
Credit: NIFC, Kari Greer.

Conclusion

The Cohesive Strategy Communication Workgroup was created by the Wildland Fire Executive Council (WFEC) on September 2, 2011. The purpose of the workgroup is expressed by the following quotation from the tasking memorandum:

> *In order to effectively implement the National Cohesive Wildland Fire Management Strategy process (hereafter referred to as the Cohesive Strategy) the development of a unified communication guidance and direction document is critical.*

With that direction this framework was created to support the Cohesive Strategy process with a focus on the conclusion of Phase II and the implementation of Phase III. The framework acts as a guide, to support three overarching communication outcomes: Information dissemination, Organizational Communication and Collaboration, and Implementation. The guiding principle of the communication framework approach is that different stakeholder groups can best communicate about the Cohesive Strategy to their own constituents using their own established communication systems. Leveraging this is key to successfully communicating the Cohesive Strategy to the impacted stakeholders, both external and internal.

Communications and the directions set by this document is a critical part of the Cohesive Strategy efforts – without it there will not be an understanding or buy in by the people who fund these efforts, support these efforts, implement these efforts or are the ultimate customer of these efforts, the citizens of the United State of America.

Fire managers and personnel collaborate to discuss the best strategies. Credit: NIFC

APPENDICES

Appendix A: Wildland Fire Executive Council Tasking Memorandum dated September 2, 2011, reference Cohesive Strategy Communication Workgroup

Appendix B: Background on A National Cohesive Wildland Fire Management Strategy

Appendix C: Message Map

Appendix D: Using the Message Map

Appendix E: Points of Contact

Appendix A: Tasking Memorandum - Cohesive Strategy Communication Working Group

September 2, 2011

Subject: Cohesive Strategy Communication Workgroup (CS-CW)

Background:

In order to effectively implement the National Cohesive Wildland Fire Management Strategy process (hereafter referred to as the Cohesive Strategy) the development of a unified communication guidance and direction document is critical.

On July 15, 2011 the Wildland Fire Executive Council (WFEC) recognized this need and accepted a proposal to develop a cohesive communication document which will complement the overall Cohesive Strategy process. The Lead Coordinator and group members are listed below.

Tasking:

The WFEC is requesting that an interagency communications group, with members from the Department of the Interior, US Forest Service, and state and local government serve as the Cohesive Strategy Communications Workgroup. The group comes together and functions as a group of peers.

Cohesive Strategy Communication Workgroup (CS-CW) Members:

- Roberta D'Amico, Lead Coordinator, Department of the Interior (NPS)
- Judith Downing, US Forest Service (FS)
- Sarah McCreary, National Association of State Foresters (NASF)
- Shawn Stokes, International Association of Fire Chiefs (IAFC)
- WFEC Liaison: Mary Jacobs, Assistant City Manager, Sierra Vista, AZ National League of Cities.

Outcome / Deliverable:

The group is tasked with developing a communication framework which will serve as communication guidance and direction for agencies, organizations, individuals and interested stakeholders involved in the Cohesive Strategy communications effort. The document will address three critical communication goals.

1. Keeping stakeholders, interested parties, and the public informed of progress in the development of the Cohesive Strategy. (Information)
2. Developing and implementing organizational communication processes that enhance and sustain collaboration among stakeholders toward development and implementation of the Cohesive Strategy. (Organizational Communication and Collaboration)

3. Future Implementation, management and oversight options for communication efforts. (Implementation)

Information

- Establish the overarching message/themes for collective use.
- Determine various audiences, prioritize information needs for identified audiences, and establish a minimum level of success for outreach and engagement activities for each audience while seeking maximum contact.
- Provide various methods and mediums to effectively communicate the messages.
- Develop practices, policies and other key procedural aspects of the unified Cohesive Strategy communication effort.
- Identify a specific time table indicating milestones, due dates and action items and present to WFEC no later than 4 weeks after the initial meeting of the CS-CW.
- Recommend documentation and evaluation methods for all users.

Organizational Communication and Collaboration

- Create and maintain an active exchange of ideas and information among stakeholders leading to shared ideas and understandings contributing to the Cohesive Strategy.
- Disseminate the results of collaborative efforts back to stakeholders and other interested parties. For example, disseminate the themes resulting from content analysis of the focus groups and related processes used in Phase 2.
- Listen to stakeholder ideas through continuation of the focus groups used in Phase 2 or other improved processes as appropriate. Inform Cohesive Strategy Framers of the emerging ideas and issues identified by these processes.
- Encourage energetic and constructive conversations and exchanges about the Cohesive Strategy among stakeholders and improve the capacity of communication networks linking stakeholder groups and other interested parties. This will involve establishing bridges and liaisons between different stakeholder networks and motivating exchanges across boundaries among stakeholder groups and interests.

Implementation

- Recommend to the WFEC future implementation, management and oversight options for the final communications strategy for the duration of the plan, up to and including the initial five years following adoption of Phase 3 of the Cohesive Strategy to ensure continued input, involvement and relevance nationwide.
- Establish designated point of contacts that will facilitate knowledge and implementation practices established in the of the communication framework, i.e. guidance and direction.

Operating, Meeting and Reporting Procedures for the CS-CW

- The committee reports directly to WFEC and the Lead Coordinator will organize and facilitate response to WFEC.
- The Lead Coordinator or a designated member will represent the committee and provide a progress report at the bi-weekly WFEC meetings until the task is completed.
- The CS-CW shall meet as necessary to conduct business.

- Reports will be submitted to WFEC and will be public documents available to the public.

Roles and Responsibilities:

CS-CW Lead Coordinator:

- Ensures interagency and collaborative process.
- Ensures committee completes task on established timeline.
- Communicate progress and status to WFEC on a regular basis.
- Identify and troubleshoot emerging issues.
- Develop and implement interim methods of communicating with various committees and subcommittees in order to keep groups positively engaged in the process.

Team Members:

- Address tasking using their expertise and professional judgment.
- Participate in CS-CW telephonic meetings at a 90% participation rate.
- Complete or facilitate tasks as assigned.
- Communicate progress and status to Lead Coordinator on a regular basis.

Participants in the Cohesive Strategy Process:

- Regardless of their individual or group role, all participants in the CS process are established leaders known for their expertise and commitment to the CS process. As such, participants are requested to assist in the cohesive communications effort by recognizing and supporting that communications is the responsibility of all individuals locally, regionally and nationally.
- Recognize and respect diverse organizational missions, cultures, and opinions.
- Facilitate effective working relationships within and outside of the CS-CW in order to meet the defined task.

Timeline:

- Status reports will be provided to WFEC at their bi-weekly meetings.
- Final draft document will be shared with WFEC members prior to the presentation of the final document. A working draft will be ready for review and at the full WFLC meeting in November 2011, requiring a draft to WFEC at the October 2011 meeting.
- Final document is due on December 9, 2011.

Approval:

This tasking is in effect on the date of approval (noted above) by the Designated Federal Official. This task shall sunset by January 6, 2012.

Contact Information:

- Roberta D'Amico, Email: roberta_d'amico@nps.gov
- Judith Downing, Email: jldowning@fs.fed.us
- Sarah McCreary, Email: smccreary@stateforesters.org
- Shawn Stokes, Email: sstokes@iafc.org
- Mary Jacobs, Email: mary.jacobs@sierravistaaz.gov

Appendix B: Background on A National Cohesive Wildland Fire Management Strategy

In recognition of the variety of backgrounds and knowledge levels by the readers of this Framework, this section is intended to provide a basic overview of the Cohesive Strategy. Readers are encouraged to cross-reference the foundational documents listed via the Appendixes and web-based links referenced throughout this document along with supplemental materials and current project information prior to embarking on activities intended to reach a broader audience.

The Federal Land Assistance, Management, and Enhancement (FLAME) Act was passed on October 29, 2009. It required the Secretaries of the United States Department of Agriculture (USDA) and the Department of the Interior (DOI) to submit to Congress a report that contains a "cohesive wildfire management strategy" consistent with the recommendations described in recent reports of the Government Accountability Office (GAO) by November of 2010.

Several principles guided development of the Cohesive Strategy.

- The National Cohesive Wildland Fire Management Strategy will be based on the best available science and identify different ways to ensure resilient landscapes, promote fire-adapted communities, and more effectively respond to wildfires.
- Development of the National Cohesive Wildland Fire Management Strategy will build on existing analyses, strategies, and reports as well as incorporate new scientific information and perspectives.
- Representatives of local, state, regional, federal, and tribal governments with roles and responsibilities in wildland fire management will work together to develop the Cohesive Wildland Fire Management Strategy through the Wildland Fire Leadership Council. To succeed, the Cohesive Strategy must be a united, coordinated effort.

The Cohesive Strategy is defined by three Phases. This phased approach allows stakeholders to both systematically and thoroughly develop a dynamic approach to planning for, responding to, and recovering from a wildland fire incident. The three phases include:

Phase I: National Cohesive Wildland Fire Management Strategy

Phase II: Development of Regional Strategies and Assessments

Phase III: National Trade-Off Analysis and Execution

Phase I: National Cohesive Wildland Fire Management Strategy

In response to the request from Congress, two separate complimentary documents were developed collaboratively in 2010. Together, these two reports respond to Phase I and were completed in 2010.

A National Cohesive Wildland Fire Management Strategy presents a collaborative approach to a national strategy and provides a foundation from which to build a local and regional actions and direction. This report outlines a path toward development of a national cohesive wildland fire management strategy that will provide a foundation from which to build local and regional actions and direction. Additionally, it notes that addressing wildfire is not simply a fire management, fire operations or wildland-urban interface problem — it is a larger, more complex land management and societal issue. The Strategy presents a vision for the next century, which is to:

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

The Federal Land Assistance, Management Act of 2009 Report to Congress, the companion document addresses the seven specific elements requested by Congress in the FLAME Act. The seven areas that were addressed are:

4. Identification of the most cost-effective means for allocating fire management budget resources
5. Reinvestment in non-fire programs by the two Secretaries
6. Employing appropriate management response to wildfires
7. Assessing the level of risk to communities
8. Allocation of hazardous fuels reduction funds
9. Assessing the impacts of climate change on the frequency and severity of wildfire, and,
10. Studying the effects of invasive species on wildfire risk

Both reports identify three primary factors which present the greatest challenges and opportunities for making a positive difference in addressing the wildland fire problems to achieve the vision noted above. They are:

Restoring and maintaining resilient landscapes. The strategy must recognize the current lack of ecosystem health and variability of this issue from geographic area to geographic area. Because landscape conditions and needs vary depending on local climate and fuel conditions, among other elements, the strategy will address landscapes on a regional and sub-regional scale.

Creating fire-adapted communities. The strategy will offer options and opportunities to engage communities and work with them to become more resistant to wildfire threats.

Responding to Wildfires. This element will consider the full spectrum of fire management activities and will recognize the differences in missions among local, state, tribal and federal agencies. The strategy will offer collaboratively developed methodologies to move forward.

Phase II: Development of Regional Strategies and Assessments

Regional strategies will be developed and analyzed using a collaborative process that cycle between analysis and engagement with stakeholders. The process will include the following steps:

a. WFEC identifies the national science/analysis team;

b. WFEC adopts guidance for Regional Strategy Committees;

c. Regional Strategy Committees are identified and will develop an understanding of the governance/oversight roles.

d. Each Regional Strategy Committee will include representatives identified and selected by WFEC;

e. Regional analytical teams are identified.

f. Timeframes for the following four steps will be determined by the Regional Strategy Committees:

   i. Define the analysis process. This will include identifying the information available; the analytical tools that can be employed; and who is available to engage in the analysis.

   ii. Define and analyze initial alternatives. This will involve describing an initial set of broad alternatives, including understanding the goals of each alternative, the components that are needed for the analysis of each alternative and the bounds of the analysis and problem to be addressed. Analysis of these alternatives will help test the analytical methods, and ultimately provide information that will be needed by the regional technical and stakeholder groups to help refine specific regional alternatives.

   iii. Collaboratively identify the regional alternatives. Relying on local and regional knowledge and insights, describe a small set of regional alternatives. This exercise draws from the understanding gained from analysis of the initial alternatives. These alternatives would be shared with and shaped by regional stakeholders.

   iv. Analyze the regional alternatives and share the results with stakeholders. Update content based on regional feedback.

g. Submit results of the regional analyses for national analysis.

Phase III: National Trade-Off Analysis and Execution

During Phase III, the following steps will occur:

1. Conduct the national analysis. Develop a draft national summary of the regional alternatives. The summary will include a description of the decision space available, a description of the activities and priorities associated with the regional alternatives, and a description of the tradeoffs associated among the alternatives.
2. Share the results of the national results and summarization with stakeholders.
3. Update and conclude the analysis based on feedback from the stakeholders.
4. Establish a five-year review cycle to provide updates to Congress.

Overall Governance of the Cohesive Strategy

The Secretaries of USDA and DOI of the United States Department of Agriculture (USDA) and the Department of the Interior (DOI) ultimately govern the development and implementation of the Cohesive Strategy; Congress exercises oversight. The Secretaries delegated the responsibility of overseeing development of the Cohesive Strategy to the Wildland Fire Leadership Council (WFLC). WFLC is an intergovernmental council of federal, state, tribal, county, local and municipal government officials convened by the Secretaries of the Interior, Agriculture and Homeland Security to ensure consistent implementation of wildland fire policies, goals and management activities. WFLC will remain as the body with oversight and decision-making authority through all phases of the cohesive strategy process.

NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY

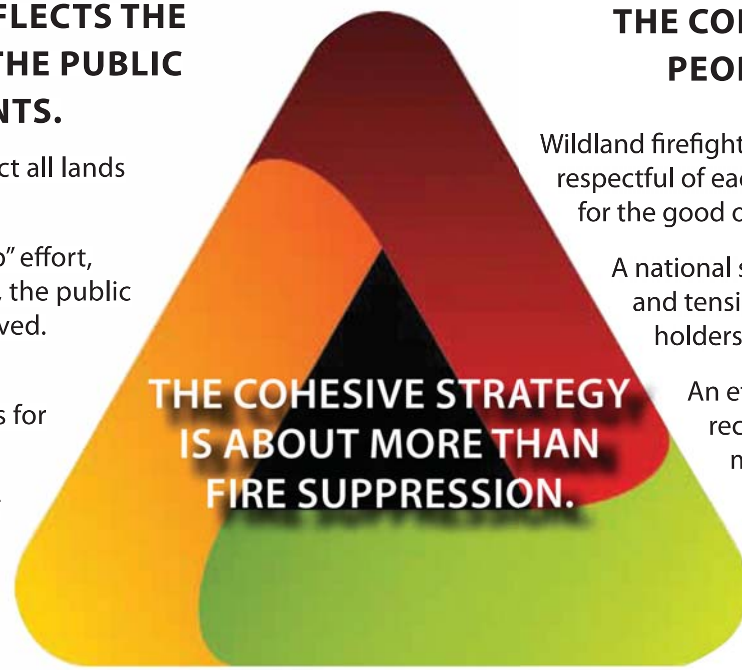
THE COHESIVE STRATEGY REFLECTS THE VALUES AND CONCERNS OF THE PUBLIC AND ALL GOVERNMENTS.

The problems created by wildland fire affect all lands and all levels of government.

An effective strategy must be a "ground-up" effort, with wildland fire management personnel, the public and all levels of government actively involved.

There is no "one-size-fits-all " approach. A national strategy provides a common basis for determining the best course of action.

The Cohesive Strategy is designed to better align national level decision-making with regional and local interests.



THE COHESIVE STRATEGY RELIES ON PEOPLE WORKING TOGETHER.

Wildland firefighting agencies need to cooperate and be respectful of each others' process to work collaboratively for the good of all.

A national strategy must recognize the differences and tensions that exist among partners and stake-holders and why hose differences exist.

An effective strategy guides all organizations to recognize and accept each others' manage-ment differences and promote a cohesive response across all jurisdictions.

WILDLAND FIRE IS A DYNAMIC PROCESS.

Today's longer fire seasons produce larger wildfires that are more difficult to put out. The Cohesive Strategy represents the creative thinking and cooperation needed to meet the challenges of a new kind of fire season.

Fire-adapted landscapes can become out of balance and vulnerable to fire, insects, and climate change. The Cohesive Strategy addresses these challenges by restoring fire-resilient landscapes.

The Cohesive Strategy is based on the best available science.

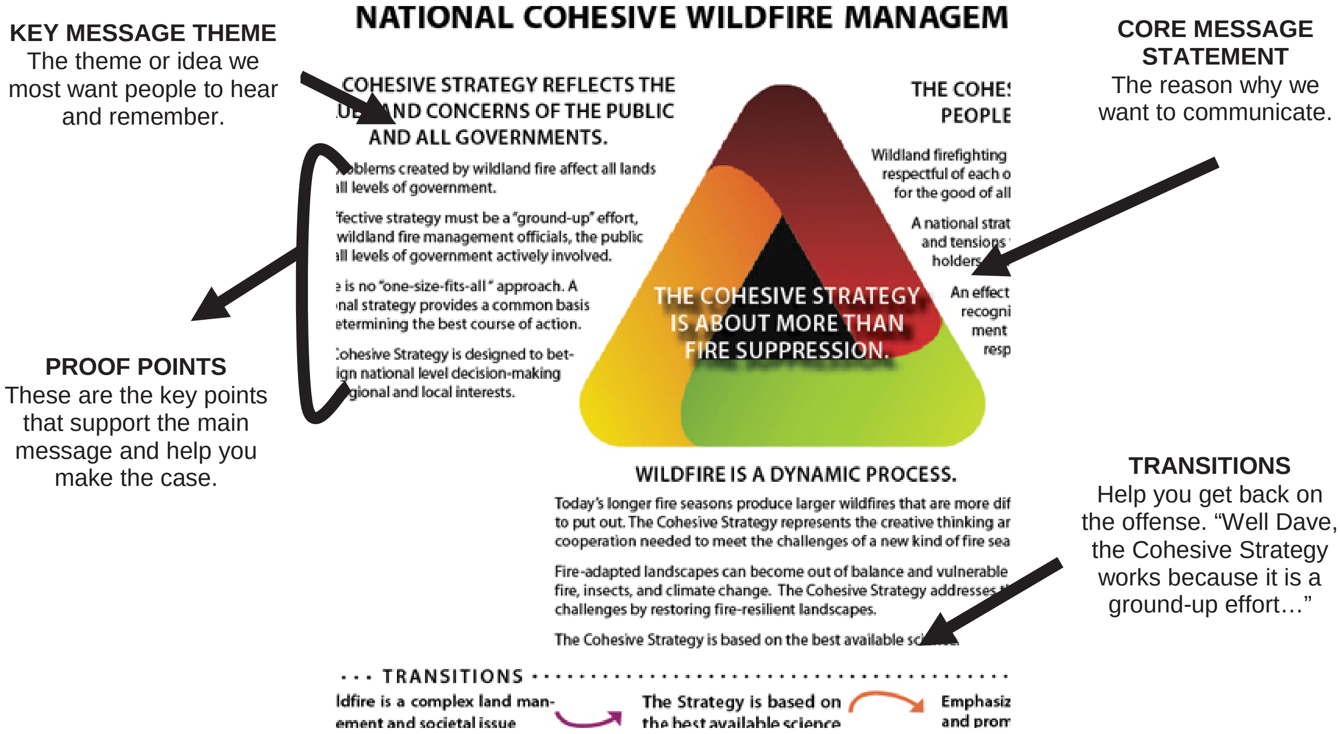
TRANSITIONS

Works because it is a ground-up, inclusive effort → **Based on the best available science** → **Focused on resilient landscapes and fire-adapted communities**

Using the Message Map

The most important part of any communications project is making sure every party to it is saying the same thing. With so many stakeholders and potential messengers in the wildland fire community, common messages are critical. The MESSAGE MAP is a message-structuring tool that recognizes the complexity of communication in our crowded communications environment. Rather than a one-sentence "message" that leaves you sounding and feeling like a broken record, a triangle sets up three consistent key message themes—lenses that focus attention on specific themes—and provides supporting points to build your case. Transitions bridge the themes and provide a quick way to get back on message when needed.

The three parts of the triangle essentially follow a progression; a description of our core message statement in the center, with a directed progression of the key message themes and their proof points. The map does not include every single statement that every single messenger is ever going to say. It does provide an exclusive list of the key message themes that every messenger needs to be using, and the key support points s/he needs to make on the themes' behalf. Finally, along the bottom are transition lines. These can help you get back on message when you get off track or when it is hard to get people's attention in the first place.



Not every situation or question requires equal use of all the sides of the triangle, but it is important that you know and understand them all, and that as communicators we are saying the same messages with enough clarity and frequency. While some re-enforcing points of the message will change from audience to audience—based on the level of public policy knowledge, for example—the general themes and message points will stay the same, no matter what.

When you have a message opportunity—whether a speech, dinner party, or media interview—you need to decide on your communication goal and anticipate the best pro-active message and which proof points will best help establish the validity of your message.

Using the Message Map

Here are three important steps:

> **(1) Identify your audience** – Consider what message they are likely to respond best to and what they might have questions about or take issue with.
> **(2) Identify your purpose** – Think of why you are communicating in the first place. What do you want people to leave the room thinking or ready to do?
> **(3) Identify your Message** – Think of which statements on the map will be most persuasive to your audience.

Then anticipate some tough or tricky questions that might get you off track. Practice using transitions to help you steer the conversation back to your message backed up by the proof points.

This advance preparation with the map is even more necessary if you are going to appear on a broadcast medium like radio or television. In a format where the final edited version of what you say could be less that 30 seconds you must keep it simple and make a few key points over and over again. Even a 10-minute phone interview with a newspaper reporter might result in one quote showing up in print. We must fight the urge to cover the whole map in one sitting because the time available to make the point is so limited and targeting the message to the audience is so important.

Appendix E: Points of Contact

Wildland Fire Leadership Council Organization	Wildland Fire Executive Council (Connect to WFLC organization)	Point of Contact(s), Email and Phone Number
USDA: Undersecretary and Deputy Undersecretary for Natural Resources and Environment	USDA FS Director, Fire and Aviation Management	TBD
Chief, USFS	USDA FS Director, Fire and Aviation Management	TBD
DOI: Assistant Secretary for Policy Management and Budget	Director, DOI Office of Wildland Fire Coordination	TBD
DOI Bureau Director, BIA	Director, DOI Office of Wildland Fire Coordination	TBD
DOI Bureau Director, BLM	Director, DOI Office of Wildland Fire Coordination	TBD
DOI Bureau Director, FWS	Director, DOI Office of Wildland Fire Coordination	TBD
DOI Bureau Director, NPS	Director, DOI Office of Wildland Fire Coordination	TBD
DOI Bureau Director, USGS	Director, DOI Office of Wildland Fire Coordination	TBD
DHS – Administrator of the US Fire Administration	US Fire Administration	TBD
National Governors' Association	National Governors' Association	TBD
Western Governors' Association	National Governors' Association	TBD
Intertribal Timber Council	Intertribal Timber Council	TBD
National Association of Counties	National Association of Counties	TBD
National League of Cities	National League of Cities	TBD
I-Chiefs Wildland Fire Policy Committee	IAFC Liaison to the Wildland Fire Policy Committee	TBD
NASF Fire committee	NASF Forest Fire Protection Committee	TBD
	National Wildfire Coordinating Group	TBD

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Communication Framework for a National Cohesive Wildland Fire Management Strategy

Scenarios for Implementation

Background: At the Wildland Fire Executive Council (WFEC) meeting in October the Cohesive Strategy Communication Workgroup (CS-CW) was tasked with providing scenarios for implementation to be provided to the Wildlland Fire Leadership Council (WFLC) at their November meeting. These scenarios for implementation are being provided as an addendum to the Communication Framework for a National Cohesive Wildland Fire Management Strategy.

Regardless of the scenario selected, or if a new scenario is established from selecting options within the proposed scenarios listed, the CS-CW recommends that a *Cohesive Wildland Fire Management Communication Steering Group* (CSG) be established similar to the group tasked by the WFEC in September 2011.

The core positions for the CSG would remain the same, this being:

- WFEC Liaison
- Lead Coordinator (to be designated)
- One representative from the following:
  - Department of the Interior (BIA, BLM, FWS, NPS)
  - US Forest Service (FS)
  - National Association of State Foresters (NASF)
  - International Association of Fire Chiefs (IAFC)

Additionally one individual from each of the following groups would be designated to serve as a liaison to the *Cohesive Wildland Fire Management Communication Steering Group:*

- Cohesive Strategy Sub-Committee (1)
  - National Science Team (1)
- Regional Strategy Committee (Northeast) (1)
- Regional Strategy Committee (Southeast) (1)
- Regional Strategy Committee (West) (1)

Implementation Scenarios

The coordination of communication and collaboration activities, from the development of collateral materials to advice and direction to different agencies on how information should be shared within their organizations, can be approached in several ways. The broadest and most comprehensive focus requires a higher level of resources to be assigned.

For sustainability of the Cohesive Strategy over time, current communication operating procedures in place within all agencies and organizations will be utilized to provide information to employees and members. Federal and state agencies and other collaborators are expected to create and implement their own communication and collaboration plans to disseminate Cohesive Strategy information and engage stakeholders. To the extent possible, communication with stakeholders will be through established stakeholder organizations' sources and channels.

The following options for implementation and oversight of the communications framework are offered for consideration by the WFLC:

Scenario One:

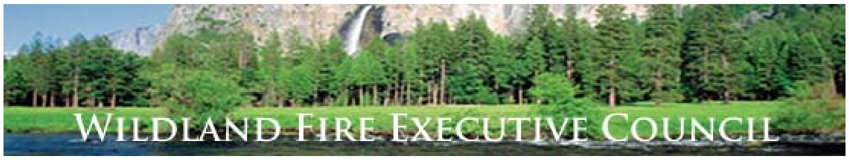
Retain Outside Professional Communications Firm or Utilize Specialized Agency Resource Group. Top notch communications firms/groups typically consist of a broad range of professionals who specialize in different areas. Graphics experts, writers, strategists and others could take the lead in developing the collateral materials identified within the communications framework, identifying groups and agencies that need to be included in the outreach plan, and making personal contact with information officers and agency/organization leadership in helping to pave the way for short and long term sustained communications on the Cohesive Strategy. The contracted firm could liaison with the existing Communications Workgroup, or similar group as identified by WFEC. Estimated cost: $300-500,000.

Scenario Two:

Dedication of 60-80 Hours per Week of Agency/Organization Staff Time at the Communications Professional Level for Full Year or More. Participating agencies and organizations in the Cohesive Strategy have a vested interest in insuring that the process is successful. Most have access to, or retain on staff, quality communications professionals who have experience in virtually all aspects of tasks identified in the communications framework. Success of the outreach effort will hinge upon having the hours necessary to develop materials, make contacts, identify other individuals and organizations who need to be pulled into the process, and monitoring how the word is getting out the Cohesive Strategy. The work done to date has been developed with such professionals, but continued dedication of theirs, or any other staff time, must be evaluated against other agency/organization priorities.

Scenario Three:

Continue to Use Limited Time of Staff Assigned to Communications Workgroup to Oversee Implementation. Since mid August, communications professionals from the Forest Service, DOI, NASF and IAFC have worked cooperatively to develop the Communications Framework within their time allowed, with a liaison from the WFEC. The quality of the group is excellent, but without dedicated resources, the implementation of the framework is likely to take longer with less robust results.



Status Report

Date: January 3, 2012

Subcommittee: Western RSC

Accomplishments Since Last Report:

The Western Region has developed a program of work for 2012 (attached), additionally two Western Region updates have been shared with Stakeholders, and utilizing the Western Web Portal have shared the western assessment with all stakeholder with specific request for feedback on the objectives, sub-objectives, actions and management scenarios.

Planned Activities for Next Reporting Period:

The West plans to gather all input/feedback to the western assessment and develop an errata sheet. The West also will schedule a webinar/conference call for stakeholders for any additional feedback with the intentions of sharing any new information to the Science Team during the tradeoff analysis. Prior to sharing with Science Team the Western RSC and Work Group will review and approve any changes.

Issues Identified:

The West has developed a comprehensive program of work for 2012, it will be important for the WFEC and CSSC to approve both the plan and associated costs so the west can proceed. We estimate the costs to be approximately $340K to accomplish everything. If WFEC and CSSC will approve the concept and activities and give the RSC the decision space to implement, knowing that the $340K is the amount not to exceed, the RSC will both effectively and efficiently manage the program of work using existing personnel resources and contractual assistance.

WFEC Decisions/Approvals Needed:

References:

Western Program of Work

Contact Information:

Joe Stutler, Alan Quan or Joe Freeland

Western Region
Program of Work
2012

It is clear from the completion of the Phase II report, the efforts of Communications Framework and the National Science Team there are high expectations of the respective Regional Strategy Committees and Work Group to stay engaged, active and continue to contribute to the overall completion of the Cohesive Strategy through Phase III and beyond. Accordingly, the Western Region proposes the following Program of Work for 2012 along with a Communication and Outreach Assistance Strategy for the West.

The major program items are identified as follows:

I. Identify Specific Regional Alternatives

- Review and build on the portfolio of actions and activities identified in Phase II.
- Identify regional alternative management strategies.
- Engage the Science Team to provide feedback and stakeholder involvement with the tradeoff analysis as the analysis is being developed.
- Identify with stakeholder involvement, metrics or performance measures. Answer the question, if the Cohesive Strategy is successful in 2017, what was accomplished?
- Complete a Regional Implementation Plan and assist with development of a National Implementation Plan.

II. Expand Outreach Within the Region Utilizing the Communications Framework

- Share the Regional Assessment, solicit and exchange new information in an effort to better understand the complexities and challenges that exist within the West.
- Expand outreach efforts to identify additional stakeholders to involve now and in the future within the fire management community.
- Utilize the Communications Framework in completing communication and outreach activities.
- Using the Communications/Implementations Framework, stylize that for the west and continue that effort.
- Create a Communications Strategy Work Group within the Region to implement a communication and outreach strategy which is consistent with the Communications Framework.
- Create sub-regions, or organize around the three overarching goals, or utilize existing organizations i.e. State Foresters/Regional Foresters, NGO's, Fire Chiefs to specifically "take on an issue" and either resolve or develop a path for resolution an objective, sub-objective or activity that can be achieved during the short term.
- Continue engaging and add to the current stakeholder support. We would share our assessment, continue the dialog and by using an errata sheet, continue to improve our assessment for the West.
- Continue the every 2-3 week updates to stakeholders.

- Continue engagement with CSSC, WFEC, NST, Communications Group and WFLC with our efforts, along with the other regions.

III. Continue to Identify Immediate Opportunities

- Through regional dialogs, identify existing activities that have been successful in making progress toward achieving the three national goals.
- Discuss opportunities within the region to continue investments in these successes.
- Utilize existing authorities to implement immediate opportunities for success, as appropriate.
- Continue to locate Immediate Opportunities for Success in the West including areas where the 3 overarching goals are being met, how do we continue to make investments in that success.
- Identify opportunities to streamline processes and utilize existing authorities with agencies and organizations to streamline processes which create immediate success with accomplishments on the ground.

Specific timelines for each program item will be forthcoming. Additionally, working with METI, we have developed a Communications and Outreach Strategy for the west and included in the program of work. Additionally an example of a Western Update is included.

Proposed METI Communication and Outreach Assistance
to the Western Regional Strategy Committee
During Phase III of the National Cohesive Wildland Fire Management Strategy

12/14/2011

Outreach and communication efforts during Phase II provided the Western Regional Strategy Committee (WRSC) and Working Group (WG) with valuable information used to develop the Western Assessment. Efforts by the WRSC/WG to fully engage all stakeholder groups across the West were hampered by a combination of the time of year outreach was conducted and time limitations established by WFLC. As a result there are opportunities to strengthen and expand stakeholder engagement during Phase III and set the stage for successful implementation of the Cohesive Strategy.

The WRSC desires to continue an emphasis on stakeholder communication and outreach during Phase III of the National Cohesive Wildland Fire Management Strategy. Communication and outreach objectives identified in the Western Region's Phase II Outreach Communication Plan will persist and be expanded upon during Phase III. Phase III communication and outreach objectives include:

1. Engaging people affected by this strategy in its development within the timeframes identified by the Wildland Fire Leadership Council (WFLC).
2. Following a collaborative, rigorous, transparent development path.
3. Collecting data representing interests and opinions of stakeholders.
4. Using local, regional, and traditional knowledge and insights to frame the western strategy assessment.
5. Disseminating clear and current information to stakeholders using multiple media on a routine basis.
6. Identifying and sharing immediate success stories and "ingredients" to success.
7. Seeking input from stakeholders to develop metrics and performance measures for Cohesive Strategy implementation and applying key metrics associated with successful projects.
8. Engaging with stakeholders interested in pursuing expanded use of existing authorities to achieve the national Cohesive Strategy goals.

Working with WRSC and Working Group leadership, members of the METI Outreach and Communications Team identified the following desired outcomes and preliminary activities for Phase III.

Phase III Communication and Outreach Outcomes and Actions

The WRSC has identified the following seven preliminary communication and collaboration outcomes and supporting activities to be achieved during Phase III:

1. Create an effective organizational framework for Western Region Phase III outreach and communication efforts.
   a) Establish a Communications/Implementation Work Group for the Western Region, including the METI Outreach and Communication Team, to serve as a focal point for collaboration and outreach efforts.

b) Update the Western Region Outreach and Communication Plan, using elements of the National Communication Framework. The update should include activities leading up to and through Strategy implementation, slated to begin in December 2012.

2. **Involve stakeholders though out the West on an on-going basis using multiple media and expanded networks.**
   a) Improve elements of the Western Assessment by providing opportunity for stakeholder comment, seeking specific input to the Goals, Objectives, Sub-Objectives, Actions and broad policy questions described in the Western Assessment.
   b) Expand the dialog and stakeholder participation and continue to identify and add good ideas.
   c) Distribute accurate, timely information regarding Phase III objectives, progress, and participation opportunities.
   d) Continue bi-weekly or monthly stakeholder updates using newsletters, website, social media, etc.).
   e) Expand stakeholder support beyond that developed in Phase II.
3. **Identify performance measures or measures of success.**
   a) Seek ideas on measures of success/performance.
   b) Identify elements or factors that should drive the investigation of management options and selection of national strategy components.
4. **Emphasize elements and tools for successful implementation that do not require completion of the National Cohesive Strategy.**
   a) Continue to identify "Immediate Opportunities for Success" in the West focused on those examples where the three national goals are being met.
   b) Identify and describe "ingredients for success," including performance measures and metrics, which can be shared with those at the operational level focused on accomplishing work on the ground.
   c) Actively share and expand the application of successful techniques with willing stakeholder groups.
5. **Facilitate efforts with agencies to streamline processes and increase production by taking full advantage of existing authorities to accomplish goals outlined in the Strategy.**
   a) Solicit ideas from successful collaborative efforts to cut through process and achieve results.
   b) Identify perceived and actual procedural barriers to accomplishment of work and provide materials that clarify procedural options and/or identify options to improve procedures.
   c) Provide tools and materials to assist the WRSC/WG in communicating with stakeholders regarding available procedural options.
6. **Actively engage with the Science Team during the Phase III effort.**
   a) Keep western stakeholders updated on progress, products, and opportunities to provide input.
   b) Clarify what the Phase III trade off analysis is, and provide tangible descriptions of Phase III's expected outcomes to western stakeholders.

7. **Continue to keep the CSSC, WFEC and other Regions appraised of Western Region communication and outreach efforts. Coordinate west-wide efforts with the national communication strategy and team.**

Western Region Phase III Outreach and Communication Action Examples

The Communications/Implementation Work Group, working in conjunction the WRSC/WG, would develop and implement an action plan to support the updated Western Region Outreach Communication Plan. The following actions are not intended to be all-inclusive, but to illustrate the range of actions that could be taken during Phase III. In some instances, actions can achieve more than one of the desired outcomes described above:

A. Establish the Western Region Communications/Implementation Working Group.

1) Develop a Communications and Outreach Plan for Phase III.
2) Clearly state the relationship of the Working Group's role and charter this effort within the scope of responsibilities for the WRSC.

Timeframe: Complete by mid-January.

B. Provide stakeholders the opportunity to review and comment on the Western Assessment using the UNC website and a comment form/written letter option (similar to the NE Region's Phase II approach).

1) Analyze comments to provide the WRSC a portrait of stakeholder response.
2) Sustain and expand stakeholder engagement established in Phase II.
3) Identify additional improvements and "gems" that should be added to the Western Assessment.
4) Identify potential performance metrics or factors that should drive investigation of management options by the Science Team (e.g., number of established collaborative groups, acres of fire resilient acres treated or maintained, number of fire adapted communities added, number of communities meeting FireWise standards, etc.)

Timeframe: Comment period open in January, with Content Analysis completed by mid-February and presented to the WRSC.

C. Assess WRSC/WG member perspectives regarding the collaborative engagement and support within the communities they represent.

1) Interview and compile an assessment of the "strength" of WRSC/WG connections to stakeholder communities of interest <u>at the sub-regional scale</u>.
2) Identify sub-regions and communities of interest that require more complete engagement, and develop plans to expand stakeholder understanding and buy-in within those sub-regions/stakeholder groups, including internal to the federal, state, and local agencies involved in the Cohesive Strategy effort.
3) Assist WRSC/WG members assigned to pursue stakeholder engagement with these groups by providing communication tools and outreach materials.

Timeframe: Begin interviews in January and present to the WRSC in early March. WRSC engagement with communities of interest will begin in March, with ongoing emphasis on strengthening and building relationships throughout Phase III.

D. Identify stakeholder groups that were not engaged at all in Phase II, and expand outreach to connect with these groups.

1) Identify sub-regions and communities of interest not engaged (e.g., some environmental groups and organizations, and urban stakeholders)

2) Develop tactics and best methods for attracting and retaining these groups' attentions. Stimulate understanding of and buy-in to the Western Assessment and the Cohesive Strategy.

Timeframe: Beginning in mid to late February following the Content Analysis and continuing throughout Phase III.

E. Use diverse media to sustain and expand stakeholder outreach and communication, creating the social connection and traction needed for successful collaborative foundation in the West during strategy implementation. Use these communication methods to enhance the human dimension or "face" of the Western RSC by filling in the picture of who we are, what we are doing and why.

1) Expand and enhance communication outreach networks using methods and messages optimized for multiple communication media, leveraging current media to appeal to targeted sets of constituents by location, culture, and other pertinent factors. One targeted audience may be those who were not contacted at all during Phase II.
2) WRSC/WG members interact in public mediated settings by blogging, podcasting, using social media and other forms of interactive engagement to add value to the Western effort in a format accessible to and used by the majority of stakeholders and citizens, including those not engaged in Phase II.

Timeframe: Beginning in January and continuing throughout Phase III.

Cohesive Wildland Fire Management Strategy - Phase II
Western Regional Strategy Committee (WRSC) Update – 12/05/11

Help us make the transition to Phase III

The WRSC would like to take this opportunity in the spirit and intent of the iterative stakeholder process to solicit focused feedback on the *Western Regional Assessment and Strategy*. To strengthen the overall effort, we are asking all stakeholders – those who have already participated and those who may be new to the process – to focus on the West's current objectives, actions, and policy questions that have been identified to support the three national goals. We are looking to strengthen and add to this outline in order to identify as accurately as possible a suite of potential solutions best meets the West's needs.

The content to focus on is pages 20-34 of the *Western Regional Assessment and Strategy*.

- **The policy questions** that have been identified are the bullets in the shaded descriptions for each goal area and address the policy context within which the objectives and actions have been developed. *Are there key ideas missing? Can issues be framed more effectively?*
- **The objectives and actions** were developed through an iterative process and informed by stakeholder outreach. They address decision-making and planning efforts that are local, regional, and national in scope and are to be used in Phase III to construct and analyze different management scenarios. *Are there key ideas missing? Can issues be framed more effectively?*

Although there are many ways to phrase the complex challenges and opportunities in the West, we have a fairly high level of consensus on much of the text in the *Western Regional Assessment and Strategy* and are not soliciting general editorial suggestions.

Please visit the western outreach website to access the *Western Regional Assessment and Strategy.*
http://sites.nemac.org/westcohesivefire/updates/

Your comments and questions may be submitted to either of the Western regional leads, identified below.

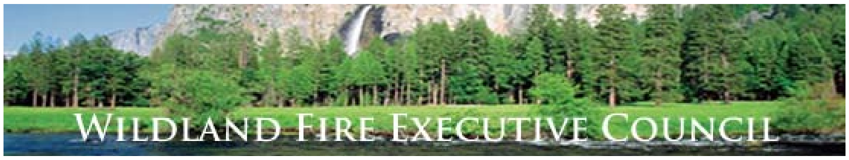
Points of Contact:

Western Regional Strategy Committee (WRSC) Lead
Joe Stutler
Deschutes County Forester
joest@co.deschutes.or.us
(541) 322-7117

Western Working Group (WWG) Lead
Joe Freeland
BLM - Management and Program Analyst
jfreeland@blm.gov
(208) 387-5163

For More Information:

On the Cohesive Strategy, please visit
http://www.forestsandrangelands.gov/
On the Western Regional Strategy Committee, please visit:
http://sites.nemac.org/westcohesivefire/



Status Report

Date: 01/03/2011

Subcommittee: Northeast RSC

Accomplishments Since Last Report:

NE RSC had a conference call on 12/08/2011 to discuss:

-RSC members that will not be serving in Phase III and who to replace them with
-Engaging the whole working group for Phase III.
-Announce new RSC Chairperson, Brad Simpkins
-New members on the RSC or WG to represent groups that were not represented in Phase II (e.g., TNC, Prescribed Fire Councils, State Compacts, Industry)

Planned Activities for Next Reporting Period:

Conference call and planning of meeting to develop “alternatives”
Identify contacts to broaden our outreach in Phase III

Issues Identified:

WFEC Decisions/Approvals Needed:

References:

Contact Information:

Gus Smith for Brad Simpkins (brad.simpkins@dred.state.nh.us)