USDA

The Public and Wildland Fire Management: Social Science Findings for Managers

Study Sites and Methods of Papers in This Report

Author(s)	Title	Study Sites	Methods
Public views and acceptance of fuels management			
Ryan *et al.*	Perceptions of wildfire threat and mitigation measures by residents of fire-prone communities in the Northeast: survey results and wildland fire management implications	Massachusetts, New York	Interviews, Mail survey
Winter *et al.*	Residents warming up to fuels management: homeowners' acceptance of wildfire and fuels management in the WUI	California, Florida, Michigan, Missouri	Focus groups, Mail survey
McCaffrey	What does "wildfire risk" mean to the public?	Arizona, California, Colorado, Montana, Nevada	Focus groups
Bright and Newman	How forest context influences the acceptability of prescribed burning and mechanical thinning	Colorado, Southern Illinois, Metropolitan Chicago	Mail survey
Daniel	Public preferences for future conditions in disturbed and undisturbed northern forest sites	Minnesota, Arizona	Computer visualizations
Merrick and Vining	Characteristics people consider when evaluating forest landscape attractiveness: fuel management implications	Minnesota, Illinois	Process tracing
Hull and Goldstein	Barriers to community-directed fire restoration	Southern California	Interviews, Document analysis
Ryan and Hamin	Engaging communities in post-fire restoration: forest treatments and community-agency relations after the Cerro Grande fire	New Mexico	Interviews, Focus groups
Working with homeowners and communities			
Monroe *et al.*	Communicating with homeowners in the interface about defensible space	Florida, Minnesota	Mail survey
Toman and Shindler	Wildland fire and fuel management: principles for effective communication	Arizona, California, Colorado, Idaho, Oregon, Utah	Mail survey
Sturtevant and McCaffrey	Encouraging wildland fire preparedness: lessons learned from three wildfire education programs	National	Interviews, Document analysis
Lang *et al.*	Working with community leadership to promote wildfire preparedness	Minnesota, New Jersey, South Dakota	Telephone interviews
Johnson Shiralipour *et al.*	Working with neighborhood organizations to promote wildfire preparedness	Alaska, Colorado, Florida, New Jersey, South Dakota, Texas	Interviews
Agrawal and Monroe	Using and improving social capital to increase community preparedness for wildfire	Florida	Mail survey
Fingerman Johnson *et al.*	Defensible space in the news: public discussion of a neglected topic	National	Newspaper text analysis
Tools that can help us understand social issues			
Weisshaupt *et al.*	Using focus groups to involve citizens in resource management— investigating perceptions of smoke as a barrier to prescribed forest burning	Montana, Washington	Focus groups
Orland and Ursavas	Using computer visualizations to help understand how forests change and develop	National	Computer visualizations
Stewart *et al.*	The wildland-urban interface in the United States	National	GIS mapping

The Public and Wildland Fire Management: Social Science Findings for Managers

Sarah McCaffrey, Technical Editor

Presents key social science findings from three National Fire Plan-sponsored research projects. Articles highlight information of likely interest to individuals working to decrease wildfire hazards on both private and public lands. Three general topic areas are addressed: (1) public views and acceptance of fuels management, (2) working with homeowners and communities, and (3) tools that can help us understand social issues.

KEY WORDS: Communication, fuels treatments, defensible space, wildfire management, social acceptance, education, wildland urban interface.

Foreword

This General Technical Report (GTR) provides information from social science research that grew out of three National Fire Plan-sponsored projects at the North Central Research Station. Our goal is to highlight some of the key research findings that have emerged from this research that we believe may be of interest to individuals working to decrease wildfire hazard on both private and public lands.

To make the information more accessible to practitioners, we have inverted the format of traditional academic articles in which the meat is found at the end in the discussion section and conclusions. Although the diversity of study methods and research topics addressed do not lend themselves to a completely consistent presentation, articles do follow a general format: a basic introduction, key findings for managers, and, where appropriate, more detailed findings. Study background, methods, and, in several cases, literature review follow at the end of the article. Abstracts are provided as a group at the beginning of this GTR to allow readers to quickly assess topics and key findings. All articles were double blind peer-reviewed for scientific quality and accessibility.

A table that summarizes the research methods and study locations of the papers and shows the range of methods and study sites is on the inside front cover. Where a study is done and who is interviewed or surveyed can influence how applicable the insights are for other locations.

Articles are grouped in three general topic areas:
Section 1.—Public views and acceptance of fuels management
Section 2.—Working with homeowners and communities
Section 3.—Tools that can help us understand social issues

Many of the papers contain findings relevant to more than one topic area. For instance, Weisshaupt *et al.* discuss how focus groups can be used to understand public preferences, but their paper also contains useful findings about what influences public acceptance of smoke from fires.

Some general patterns can be seen across papers. A significant portion of the population in the study areas supports both thinning and prescribed burning as management tools to reduce fire risk, and a majority engage in defensible space activities. The most consistent finding is that knowledge and familiarity with a management practice is associated with increased support for the practice. The most effective method of increasing public acceptance is an interactive one that engages affected individuals and communities in the management process.

Not all findings completely agree. For instance, Ryan *et al.* suggest that voluntary defensible space practices may be easier to implement than regulatory ones. However, their research was conducted in areas with no regulations. In contrast, Winter *et al.* found higher approval for defensible space ordinances

in California where such regulations were in place but lower approval in study sites where there were no ordinances. This suggests that in areas where homeowners are unfamiliar with a practice there will be initial resistance to regulatory approaches, but as knowledge increases the resistance can be overcome. It also highlights that, although a number of general patterns can be identified across studies, local context always matters and must be taken into account in any outreach effort.

Although outreach takes time, results indicate that the potential positive outcomes in terms of increased support for fuels management and for agency management are worth the effort. We hope the information in this document will facilitate these efforts and help save managers valuable time and resources.

Sarah McCaffrey, Technical Editor
Northern Research Station
USDA Forest Service

Acknowledgments

Contents

Abstracts

SECTION 1.—PUBLIC VIEWS AND ACCEPTANCE OF FUELS MANAGEMENT

Perceptions of Wildfire Threat and Mitigation Measures by Residents of Fire-Prone Communities in the Northeast: Survey Results and Wildland Fire Management Implications

Abstract.—We surveyed residents of fire-prone areas of the Central Pine Barrens of Long Island, New York, and the Plymouth Pine Barrens in Massachusetts to learn how they perceived wildland fire risk and management techniques for reducing fire hazard. We found that residents considered the fire threat to their own property to be relatively low in spite of first-hand experience with wildfires; support for fuel breaks and mechanical treatments was higher than support for prescribed fire; support for mitigation treatments increased with increased knowledge about those treatments; and residents showed a strong desire to be involved in forest planning to manage wildfire danger. Key points from the study for managing wildland-urban interface areas include the following: (1) Public education and outreach efforts about fuel-hazard reduction planning need to be increased well in advance of changing forest management. (2) Wildland-urban interface communities differ from each other—implementation strategies should be tailored to the particular area. (3) Voluntary defensible space programs will be easier to implement than mandatory ones. (4) The public needs to be involved early in fuel-hazard planning.

Robert L. Ryan, Brian P. Blanchard, and Mark B. Wamsley

Residents Warming Up to Fuels Management: Homeowners' Acceptance of Wildfire and Fuels Management in the Wildland-Urban Interface

Abstract.—Many wildland fire managers, concerned about public acceptance of local fuels management programs, want to better communicate with local residents about these programs. Research at diverse study sites shows wildland-urban interface (WUI) residents rely on common factors to decide whether or not to support particular fuels management approaches such as prescribed burning, mechanical fuels reduction, and defensible space. Our research leads us to several conclusions about wildland fuels management and communication programs. First, where fuels management approaches are established practices—and agency trust levels are not unusually low—acceptance among WUI residents tends to be high. Second, attitudes toward fuels management approaches are important predictors of acceptance. Third, low levels of trust in those responsible for wildland fuels management can significantly reduce acceptance of fuels management approaches. Fourth, beliefs about the likely outcome of an approach are associated with approval, but not consistently across sites or approaches. Finally, there are no easy shortcuts to predicting acceptance of fuel management.

Greg Winter, Christine Vogt, and Sarah McCaffrey

What Does "Wildfire Risk" Mean to the Public?

Abstract.—Public risk perception that managers may see as inappropriately low may not necessarily be a result of poor understanding but instead may be a result of self-selection and of mental balancing of

benefits and risk. This study highlights the complexity of factors considered when members of the public assess wildfire risk including environmental preconditions, ignition sources, possible negative outcomes, risk tolerance, and benefits associated with exposure. Although findings indicate that fire risk information is being communicated effectively, they also suggest that efforts focused only on raising risk perception may be misdirected. Rather than emphasizing risk, managers may instead want to focus on changing the perceived balance of risk and benefits—showing how efforts to decrease wildfire risk add to rather than subtract from the perceived benefits of living in fire-prone environments. In addition, given the variability in what individuals consider in determining "wildfire risk," managers may want to clearly define the definition of wildfire risk they are using, including timeframe, area extent, and specific type of damage.

Sarah McCaffrey

How Forest Context Influences the Acceptability of Prescribed Burning and Mechanical Thinning

Abstract.—We examined how forest factors influenced public perceptions of three fuels management alternatives: prescribed burns, mechanical thinning, or no artificial fire management. The factors included the forest's proximity to urban areas, primary use, wildfire history, and current fire conditions. Surveying three study strata with different wildfire histories and experiences—the Colorado Front Range, southern Illinois, and Metropolitan Chicago—we found that current forest conditions was the most important factor influencing how residents feel about the three treatments. Proximity of the forest to urban areas and wildfire history also significantly influenced perceptions of wildfire management techniques, although less strongly. Notably, few differences were found in the relative effects of contextual factors on perceptions across the three geographic regions.

Alan D. Bright and Peter Newman

Public Preferences for Future Conditions in Disturbed and Undisturbed Northern Forest Sites

Abstract.—This study presented computer visualizations (pictures) of projected changes over an 80-year period to conditions in a northern forest that had been hit by a major blowdown. Study participants included local residents and forest visitors who were asked to choose between visualizations of projected-outcome scenarios for 10 pairs of treatment versus no-treatment options for representative forest sites. Visitors and residents both generally preferred salvage-and-plant treatment scenarios for disturbed sites (where virtually all trees had been blown over) over no-treatment (natural regeneration) alternatives. In contrast, both residents and visitors consistently preferred no-treatment alternatives over treatments (thin, or thin and plant) for undisturbed sites. These preferences were also consistent with frequently expressed opinions that forest managers should "fix broken sites," but "leave unbroken sites alone." Because respondents based their preferences only on how a forest would look as depicted in the computer visualizations and not on the treatments that could produce a particular look, the study provides

a systematic confirmation of publicly expressed predispositions. The study also shows that realistic and biologically accurate visualizations of future forest conditions can help translate complex biophysical data into a format that concerned citizens can understand. Such carefully created visualizations can aid manager-public communication in a number of contexts including informal "what-do-you-think-about-this" conversations, formal public meetings, research focus groups, and systematic national surveys of public opinion.

Terry C. Daniel

Characteristics People Consider when Evaluating Forest Landscape Attractiveness: Fuel Management Implications

Abstract.—In this study, we were able to gain a better understanding of which elements people observe when they are making decisions about the relative attractiveness of a forest. Of primary consideration to participants were the specific characteristics of the vegetation, especially forest health, and the experiential potential for the forest scenes. Participants fairly often considered human/environment interactions and understory characteristics. By understanding these elements, forest managers can consider the importance of people's perceptions of forest attractiveness when implementing strategies for fuel management. The identification of elements people consider important in forested environments can lead to a more productive relationship between forest managers and the general public.

Melinda Merrick and Joanne Vining

Barriers to Community-Directed Fire Restoration

Abstract.—Wild fire disasters create novel situations and challenges for natural resource managers, including working with emergent community groups that have a great deal of motivation for change, little familiarity with agency protocol, and strong preferences for the goals and methods of forest fire restoration, some of which may run counter to agency norms. After a fire, managers thus have a unique, but challenging, opportunity to foster collaborative efforts with these groups. A qualitative study based on interviews, e-mail discussions, and publications examines one such situation following the 2003 wildfires near San Diego. A group of highly trained, capable, conservation-minded citizens organized to advance their vision for regional restoration. The enormous collaborative potential of the emergent group was not realized, in part because they had difficulties interacting with natural resource managers attempting to implement established agency programs.

R. Bruce Hull and Bruce E. Goldstein

Engaging Communities in Post-Fire Restoration: Forest Treatments and Community-Agency Relations after the Cerro Grande Fire

Abstract.—Our research provides advice to managers in their work in post-fire forest rehabilitation based on focus groups and interviews in the Los Alamos, New Mexico, community after the Cerro

Grande fire of 2000. We address two key issues: how different restoration efforts compare to natural revegetation from the public's perspective, and how to effectively communicate with and engage the public in the rehabilitation process. Overall, resident perceptions of the USDA Forest Service were reported to be better after the fire than before, and acceptance of hazard mitigation measures had also increased significantly. Not surprisingly the key aspect to residents' perceptions of the Forest Service was the amount and quality of communication, and the availability of a clear person to go to with questions. A second important aspect was supporting volunteers in rehabilitation efforts, which both aids the forest and helps the community heal from the trauma of the fire. Such fires create an opportunity to increase networks of collaboration and cooperation, both with residents and with other agencies. The study found strong support for rehabilitation techniques that stabilized soils and minimized flood damage near developed areas. One point of near consensus was the need to remove hazard trees from trails and to re-open trails and other popular recreation areas as quickly as possible. However, residents' perceptions varied about how many dead and dying trees should have been removed after the fire as well as how much area should be seeded.

Robert L. Ryan and Elisabeth M. Hamin

SECTION 2.—WORKING WITH HOMEOWNERS AND COMMUNITIES

Communicating with Homeowners in the Interface about Defensible Space

Abstract.—Although resource managers encourage residents to create defensible space, many report that homeowners still live in risky landscapes. This study explores the perceptions and attitudes of Minnesota and Florida interface homeowners toward their local landscape. By using in-depth interviews, we gained a better understanding of landscape values, preferences, and activities related to defensible space, vegetation management, and willingness to reduce wildfire risk. We believe that emphasizing relevant values (wildlife, naturalness, privacy, and recreation opportunities); acknowledging the complexity of wildfire; and suggesting a number of benefits to creating defensible space could be helpful communication techniques to motivate residents. It is crucial that managers listen to residents to understand what they care about, what information is missing in their perception of the risk, and what type of support will best encourage change.

Martha C. Monroe, Kristen C. Nelson, and Michelle Payton

Wildland Fire and Fuel Management: Principles for Effective Communication

Abstract.—In this paper we discuss four principles identified through recent research for effective citizen-agency communication and examine their use in accomplishing fire management objectives. Principles include the following: (1) effective communication is a product of effective planning; (2) both unidirectional (one-way) and interactive approaches are part of successful outreach programs; (3) communication

activities that focus on local conditions and concerns can decrease citizen uncertainty and build their capacity to participate in solutions; (4) a comprehensive communication strategy will emphasize meaningful interaction among participants and build trust along the way. Ultimately, a long-term commitment to outreach and education will yield positive outcomes for resource professionals and citizen stakeholders.

Eric Toman and Bruce Shindler

Encouraging Wildland Fire Preparedness: Lessons Learned from Three Wildfire Education Programs

Abstract.—Managers may often wonder why some people do not choose to adopt defensible space practices despite understanding the benefits of doing so. Research has sought to understand why a new practice or innovation is or is not adopted. This paper will briefly discuss factors found to influence adoption rates and describe how three different fire education programs—Firewise Communities/USA, FireFree, and Fire Safe Councils—address them. Some key lessons/findings for managers working with homeowners to create defensible space and reduce hazardous fuels across ownership boundaries are the importance of tailoring efforts to local values, promoting programs that foster neighbor contact, and making the practices more accessible via checklists, demonstration sites, and highlighting the social advantages of adoption.

Victoria Sturtevant and Sarah McCaffrey

Working with Community Leadership to Promote Wildfire Preparedness

Abstract.—This study provides insights into the role of local leaders in wildfire preparedness, specifically, how leaders motivate residents to work together. We found that community leaders become involved in wildfire preparedness for a number of reasons and bring important skills with them from past experiences. The majority of leaders were involved in multiple leadership roles, from identifying key issues to developing a wildfire preparedness strategy to mobilizing needed resources. To get things started, managers may need to be more active in the critical stages of identifying the issue and creating a vision, but community leaders will take over in later stages. Land managers also can assist leaders by helping identify key preparedness and mitigation issues, supplying information, providing training to improve leaders' skills, mobilizing resources, and rewarding commitment by sharing ownership or providing funding for future efforts.

Erika A. Lang, Kristen C. Nelson, and Pamela Jakes

Working with Neighborhood Organizations to Promote Wildfire Preparedness

Abstract.—Several government agencies and other natural resource managers have instituted outreach programs to promote wildfire preparedness in wildland-urban interface (WUI) neighborhoods that complement community-wide efforts. To help these programs become more effective, research was

undertaken to gain a better understanding of the role that neighbors and neighborhood organizations play in assisting people to reduce their wildfire risk. Research was conducted in six U.S. communities where State forestry agencies or fire departments had engaged in wildfire education and outreach in a number of local neighborhoods, although the amount of wildfire prevention education received varied from none to considerable. Results show that neighborhood organizations are a readymade physical, social, and political entity capable of playing an important role in helping people reduce their wildfire risk. A series of recommendations geared to resource managers who want to work with neighborhood organizations was developed from research findings.

Holly Johnson Shiralipour, Martha C. Monroe, Kristen C. Nelson, and Michelle Payton

Using and Improving Social Capital to Increase Community Preparedness for Wildfire

Abstract.—Communities with more social capital are better able to work together to cope with problems such as a wildfire threat. This study found a positive relationship between perceiving greater social capital and participating in wildfire preparedness educational programs. Results suggest that managers can take advantage of existing social capital in communities to improve the effectiveness of community outreach education and they can, in turn, use wildfire preparedness education to increase social capital. Because people who perceived higher social capital also were found to be more likely to take action around their homes to reduce their wildfire risk, educational programs that emphasize building social capital may help managers achieve better community preparedness.

Shruti Agrawal and Martha C. Monroe

Defensible Space in the News: Public Discussion of a Neglected Topic

Abstract.—Managers have an opportunity during times of peak media coverage of wildfire to expand the discussion about defensible space from the current focus on vegetation clearing to include the full range of activities a homeowner can undertake to mitigate damage. Currently, news media discussion of wildfire is overwhelmingly dominated by firefighting, and discussion of defensible space is a minute fraction of the total. Coverage of defensible space focuses on vegetation clearing around homes to the exclusion of other practices such as maintenance and fire-resistant building materials. Only 20 percent of all defensible space media coverage mentions defensible space around communities.

Jayne Fingerman Johnson, David N. Bengston, Kristen C. Nelson, and David P. Fan

SECTION 3.—TOOLS THAT CAN HELP US UNDERSTAND SOCIAL ISSUES

Using Focus Groups to Involve Citizens in Resource Management—Investigating Perceptions of Smoke as a Barrier to Prescribed Forest Burning

Abstract.—Participants in a series of focus groups discussed how their tolerance for smoke varied by the source of the smoke and found their opinions changing as they talked with other participants.

Even those opposed to smoke from agricultural burning eventually found smoke from prescribed forest burning would be acceptable under appropriate circumstances. Observations of the development of smoke acceptance among participants suggest the focus group process itself could be a useful tool for managers wishing to engage communities in collaborative efforts to plan and implement fuels management projects in the wildland-urban interface.

Brad R. Weisshaupt, Matthew S. Carroll, Keith A. Blatner, and Pamela J. Jakes

Using Computer Visualizations to Help Understand How Forests Change and Develop

Abstract.—Probably a first question people ask when they hear about proposed forest management actions to address fire hazard or forest health concerns is "what will the forest look like?" The recent advent of powerful computer visualization tools has provided one means of answering that question. The resultant images can be a powerful tool for communicating the implications of management programs, especially to groups from diverse backgrounds where the visualization can serve as a common meeting ground. However, managers need to consider several factors when contemplating use of computer visualizations. This article will discuss these considerations in the context of visualizations created for a specific site. Some guidance is offered for making the power of the visual world a valid and reliable surrogate for the real world we manage.

Brian Orland and Cenk Ursavas

The Wildland-Urban Interface in the United States

Abstract.—This paper presents a map of the wildland-urban interface (WUI) in 2000 for the lower 48 States of the United States. The WUI was extensive, covering 9 percent of the land area in the lower 48 States and encompassing 38 percent of all homes. Major WUI areas are located along the west coast, the Colorado Front Range, southeast Texas, the Great Lakes States, and across the Southeast; it is common at the fringe of major metropolitan centers and is found in rural areas without major metropolitan centers that are rich in natural amenities. The WUI data and maps can be used in fire planning and management when there is a need to know where housing and wildland vegetation coincide.

Susan I. Stewart, Volker C. Radeloff, and Roger B. Hammer

SECTION 1

PUBLIC VIEWS AND ACCEPTANCE OF FUELS MANAGEMENT

Photo credit: Sarah McCaffrey

Photo credit: Sarah McCaffrey

Photo credit: Ryan Gordon

Perceptions of Wildfire Threat and Mitigation Measures by Residents of Fire-Prone Communities in the Northeast: Survey Results and Wildland Fire Management Implications

Robert L. Ryan and Mark B. Wamsley
Department of Landscape Architecture and Regional Planning
University of Massachusetts-Amherst (rlryan@larp.umass.edu)

Brian P. Blanchard
Coconino National Forest, AZ

Introduction

Wildland fires are often associated with the arid regions of the Western United States. However, other regions of the country, including the densely populated Northeast, also have a history of wildland fires. In particular, the pitch-pine and scrub oak ecosystem of the region's coastal pine barrens is extremely fire-dependent (Irland 1999). Local land managers want to increase prescribed fire and other forest treatments to reduce fire danger and promote rare and endangered species. However, the barrens' close proximity to urban and suburban areas requires managers to better understand local attitudes and opinions before making widespread changes in forest management.

To help land managers in their efforts, we surveyed local residents living near fire-prone areas of the Central Pine Barrens of Long Island, New York, and the Plymouth Pine Barrens of Massachusetts to learn how they perceive wildland fire risk and management techniques to reduce fire hazard. The study found several valuable lessons for forest managers interested in reducing fire danger and promoting fire-dependent ecosystems. These lessons include the importance of experience and knowledge about wildland fire and fuel hazard reduction treatments in local residents' support for management strategies.

View of firebreak, Myles Standish State Forest, Plymouth, MA

Photo credit: Brian Blanchard

Key Findings

This study, along with a research study we are conducting in the Western United States, gives us confidence the following four recommendations

for managers can be applied in other regions where higher density urban and suburban interface communities abut high fuel-hazard forests.

Public education and outreach efforts about fuel-hazard reduction planning need to be increased well in advance of changing forest management. Because our study found that those who were more familiar with techniques, such as prescribed fire, supported them more strongly, managers need to get the word out early about the benefits and risks associated with each technique. Multiple strategies for reaching the public should be considered, including newspapers, television, and radio. After the initial outreach, demonstration projects, such as a small-scale prescribed burn, can be used to increase the public's experience with new management techniques. Demonstration projects are the perfect setting for teaching the public about the need to manage the forest.

Wildland-urban interface communities are different, even in the same region, so managers need to tailor implementation strategies to the particular area. For example, in higher density, less natural resource-based communities, residents may be less familiar with and more resistant to both prescribed fire and forest thinning. In that case, managed fuelbreaks may be the best strategy until public outreach increases acceptance for more controversial strategies like prescribed fire. More rural communities with longer histories of forest management may be more familiar with and more accepting of forest practices like thinning and burning.

Home located in subdivision adjacent to Myles Standish State Forest, MA

Photo credit: Brian Blanchard

Voluntary defensible space programs will be easier to implement than mandatory regulations. In wildland-urban interface communities that are just beginning fuel- hazard planning, managers should consider promoting voluntary programs that encourage private landowners to create more defensible space around their homes. In the future, with more political support, mandatory programs that regulate buffer zones on new development could be one strategy to create more widespread defensible communities.

The public needs to be involved early in fuel-hazard planning. The controversial nature of fuel-hazard treatments, such as prescribed fire or major forest thinning projects on public land, requires the public to be involved early in the planning

process. Rather than simply having public meetings, it may be more efficient and useful for managers to create an advisory committee of concerned citizens from nearby neighborhoods, local government and fire officials, environmental groups, recreation groups, and business leaders. This advisory committee can help managers reach a wider segment of the community and can be the first step in public education efforts.

Detailed Findings

The following section outlines the specific research findings from our study that inform the above management implications.

Residents perceived the risk of wildfire damage to their homes or property to be between "unlikely" and "somewhat likely."

The study area was identified by local fire officials to be at risk from wildland fire. More than half of the residents had directly experienced a wildland fire in the region. Many said they had seen smoke or fires from their property. Local residents thus appeared to be aware that wildland fires do occur in the nearby pine forests. Nevertheless, the perception that "it won't happen to me" was widespread: our survey found that local residents were not overly concerned about potential damage to their homes or property. Local fire departments also may be hampered by their own positive reputation in the community. We found that local residents, especially in higher density Long Island, were convinced that local fire departments would respond quickly to protect their homes. These perceptions may hinder the ability of fire managers either to convince local residents in the pine barrens to create defensible space around their homes or to support other fuel-hazard reduction strategies on adjacent public forest land.

In general, support for fire-hazard mitigation strategies was moderate, but those who knew more about a particular treatment—such as prescribed fire—also were more supportive of that type of management.

Our study found midlevels of support for fire-hazard reduction strategies, including prescribed fire, mechanical removal of trees and brush, and construction of firebreaks. Mechanical treatments had the strongest support, especially constructed firebreaks, and prescribed fire had somewhat less support. In particular, creating managed fuel zones or firebreaks around public forest land received strong support in both communities. This suggests that land managers need to consider not only the type of treatment, but also the location (see Bright, this volume). There was much less support from local residents for using prescribed fire close to homes, especially in the higher density Long Island study area. Finally, the "no action" alternative received very little support: participants saw a need for land managers to take some action to reduce the wildfire threat in nearby forests.

An important result we found was that local residents who knew more about a particular treatment, such as prescribed fire, also more strongly supported that type of management. But we don't know whether learning more about a treatment led to greater support or whether individuals predisposed to support a treatment sought out information on the method. In either case, the results suggest that land managers should not underestimate the importance of providing specific information on fuels management as an essential part of building support for fuel-hazard reduction work.

Concerns expressed about fuels treatments included the following:
- Worry that prescribed fires would escape and burn out of control was the number one concern.
- There also was concern that prescribed fire and mechanical treatments would harm wildlife and habitats and that mechanical treatment would cause soil erosion.
- There was very little concern about the impact of smoke on nearby residents or driving conditions.

Despite these concerns, many residents agreed that prescribed fire can help reduce the severity of wildfires and improve forest health. The emphasis, though, seems to be foremost on reducing fire risk. Improving wildlife habitat is a slightly less important outcome. Intentionally starting fires in the forest solely to improve habitat may not be reason enough for nearby residents of the wildland-urban interface to support prescribed fire, especially considering their concerns about the escape of controlled burns and burning near homes.

Demonstrating that prescribed fire can be used safely is critical to gaining the support of local residents. Land managers need to have examples of areas where these treatments have improved habitat, and they need to be realistic about the timeframe for forest regeneration after different treatments. In addition, showing examples of the impact of severe wildland fires on different forest types may also be helpful. In talking about mechanical fuels treatments, managers need to demonstrate how forest thinning and brush clearing will be done and demonstrate how soil erosion will be addressed, such as by contour felling, maintaining buffer areas along drainage swales, and minimizing clearing on steep slopes.

There is very little support for implementing local regulations that require homeowners to remove vegetation from their property. Residents are more open to voluntary efforts to create defensible space than to mandatory regulation.

The acceptability of regulation varies widely from community to community. California enforces strict regulations for managing vegetation in a 100-foot zone around structures. Zoning and other regulation is supported by the Firewise program and other wildland-urban interface programs including the National Fire Plan. Neither of our study areas currently has defensible space regulations for private landowners. In fact, the Central Pine Barrens Commission on Long Island requires that new subdivisions

preserve at least a third of the existing forest to protect the local aquifer and native plant habitats. Our findings suggest that land managers and fire officials should consider promoting voluntary programs for clearing vegetation before trying to implement mandatory regulations that could be highly unpopular with local residents. At least initially, fire managers should avoid seeking regulations and restrictions to mitigate fire hazards in communities and rely instead on education and outreach campaigns designed to encourage voluntary adoption of mitigation. Such programs have been successful when based on well-established principles of innovation diffusion and social marketing (see Monroe *et al.* 2005).

Photo credit: Brian Blanchard

Untreated pitch pine forest, Plymouth, MA

There is overwhelming support for involving the public in developing fire-hazard reduction plans, serving on advisory committees, and taking part in focus groups.

One strategy for promoting voluntary defensible space programs is to involve the public in developing these programs as well as other fire-hazard reduction planning. Thus, we were interested in learning how much local residents wanted to be involved in fuel-hazard planning. To our surprise, there was overwhelming support for involving the public in developing fire-hazard reduction plans, serving on advisory committees, and taking part in focus groups. In addition, local residents strongly felt that public education and outreach should be part of any program. In fact, these topics received the most positive ratings of any in our study.

The public strongly desires to be involved in fuel-hazard planning. Land managers interested in changing forest management practices need to find a meaningful way to involve the public more deeply in the planning process—beyond traditional means used in the NEPA planning process. The National Fire Plan and the Healthy Forests Restoration Act both emphasize community collaboration. The collaborative process has been used successfully in fields such as community development and has recently been applied to natural resources and fire management (Sturtevant *et al.* 2005).

The residents of at-risk communities we studied are a likely subset of the public to involve in forest planning because they are directly at risk from the adjacent forests that need thinning. Other important groups would be local government officials, environmental groups, business leaders, and, if applicable,

natural resource industry representatives. Preparing Community Wildfire Protection Plans and other fuels management plans would provide excellent opportunities for community residents to learn on the job.

Fire managers should consider incorporating instruction in fire ecology, fire behavior, and other relevant subjects into collaborative planning projects. The additional educational components of the planning process may draw many local residents who have the relevant education and skills to help in fuels planning. It is not uncommon to find local experts in biology, construction, landscaping, and even GIS. Given the talent pool, resource managers should consider including community and other stakeholders with appropriate skills on the planning team, addressing not only the private lands but also the public lands. They should be included from the beginning in data collection, analysis, report preparation, and public meetings.

Recently control burned pitch pine forest, Plymouth, MA

Study Site

Local land managers in the Northeast are interested in promoting the pine barren ecosystem because it is home to many rare and endangered plant and insect species and has been heavily impacted by development. In addition, the region has many wildland-urban interface communities that are considered at danger from wildland fire, as listed under the National Fire Plan (USDA and USDI 2001). We wanted to learn where the public in the pitch pine barrens of the Northeast stood on different types of management. A written survey was sent to residents of the towns of Brookhaven and Southampton, New York, in the Central Pine Barrens of Long Island and to residents of Plymouth and Carver, Massachusetts, in the Plymouth Pine Barrens. The two study areas are similar in having rapidly growing populations, yet still containing large areas of state-owned forest land. The Central Pine Barrens, twice as large as the Plymouth Pine Barrens, covers approximately 102,500 acres.

Like many areas in the Northeast, there is no USDA national forest land in the study areas, although the Federal government owns significant acreage in New York at the Brookhaven National Laboratory. There is some commercial logging in the Plymouth region on private and State lands, but almost none on Long Island. Fuel-hazard reduction management is increasing in both study areas; State officials are beginning to conduct prescribed burns in conjunction with local environmental groups.

Methods

We worked with local, State, and Federal land managers, as well as environmental groups to develop a survey to learn about local residents' perceptions of wildand fire danger and attitudes toward fuel-hazard reduction techniques that land managers are considering using in these study area. In Massachusetts, 497 surveys were mailed to seasonal and year-round residents and landowners living within a 2-mile radius of Myles Standish State Forest in Plymouth and Carver, Massachusetts. This sample included seasonal residents who leased cottages in the State forest. A total of 153 completed surveys were returned for a response rate of 35 percent.

The Long Island sample included year-round residents of Brookhaven and Southampton, New York, who lived in subdivisions within two blocks of large forested tracts of land. A total of 135 completed surveys were returned from a sample of 503 residents for a 27-percent response rate. Both study areas were identified by local fire officials as being at risk from wildland fire. Thus, a total of 288 local residents of the two Northeast pine barrens participated in this survey. The data from the surveys were entered into a statistical software package and analyzed using several data analysis techniques. The survey results were also compared to those found in other regions of the country.

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Residents Warming Up to Fuels Management: Homeowners' Acceptance of Wildfire and Fuels Management in the Wildland-Urban Interface

Greg Winter
Cornerstone Strategies
Bellingham, WA (gregw@cstonestrategies.vom)

Christine Vogt
Michigan State University
East Lansing, MI (vogtc@carrs.msu.edu)

Sarah McCaffrey
Northern Research Station
USDA Forest Service, Evanston, IL (smccaffrey@fs.fed.us)

Introduction

Understanding how wildland-urban interface (WUI) residents perceive fire and specific fuels management approaches is essential to land managers' success in coordinating mutually acceptable fire management plans (Lichtman 1998, Manfredo *et al*. 1990). Successful implementation of fuels management necessarily involves two types of behavior change among WUI residents. Land managers want residents to invest in fire-safe landscaping and building practices and other Firewise activities. Land managers also seek support for fuels management efforts on public lands from those who may not currently be supporters. In these respects, our study suggests that wildland fire managers have reason to be optimistic.

Our research found that WUI residents relied on common factors to make decisions about whether or not to support particular fuels management approaches such as prescribed burning, mechanical fuels reduction, and defensible space. The study was also designed to create a standardized, yet locally adaptable, fuels management acceptance assessment tool for wildland fuels managers to use in their own neighboring communities. Our findings and survey methods should be useful to wildland fire managers and fire information officers who are eager to engage WUI residents in dialogues about and educational outreach in fuels management.

Key Findings

We used focus groups and surveys in diverse communities in four States (California, Florida, Michigan, and Missouri) to understand what variables were associated with approval of three fuels management approaches. Listening to WUI residents who live in diverse forest settings and analyzing their views and preferences within a social scientific framework lead us to several conclusions that can provide information for wildland fuels management and communication programs.

Where a fuels management approach is an established practice—and agency trust levels are not unusually low—public acceptance among WUI residents tends to be high. For defensible space ordinances, there was a strong contrast between the quite positive attitude and approval found at our California site—where defensible space ordinances are established—and the much less positive responses from the Michigan and Missouri sites—where defensible space is not regulated. Perhaps more importantly, compared to residents of the other study sites, WUI residents in California showed high levels of compliance with defensible space practices. Prescribed burning, a well-established practice in Florida and Missouri, enjoyed the most support at those two study sites. Mechanical fuels reduction was most frequently accepted in California where WUI residents were more likely to have experienced this practice near their homes.

Attitudes toward a fuels management approach are important predictors of acceptance. Regression analysis performed on our data suggests that an increase in attitudes in a positive direction is associated with a similar increase in acceptance. Further, there is strong circumstantial evidence indicating positive attitudes are more widespread where the public is highly familiar with successful fuels management implementated over the long term.

Low levels of trust in those responsible for wildland fuels management can significantly reduce acceptance of fuels management approaches. Along with attitude, trust had a consistently positive association with acceptance at all four sites. Although social science researchers do not completely agree about what constitutes trust, evidence suggests that with respect to different fuels management approaches, homeowners will place more trust in land managers who are *competent*, *credible*, and *share their values* that relate to natural resource management (see Winter *et al.* 2004).

Outcomes beliefs are associated with approval, but not consistently across sites or fuels management approaches. Managers need to consider local variability when developing their communication strategies. We found WUI residents' beliefs about likely outcomes (such as a burn escaping, smoke, and effect on wildlife conditions) of a fuels management approach often were linked with attitude toward the associated practice. This finding provides useful guidance for public communication and outreach programs. In forming their attitudes, and, in turn, their acceptance decision, the local public needs to know how proposed fuels management approaches will affect them and their forest community (e.g., cost effectiveness, wildlife and scenery impacts, chance of escaped fire). However, there was a reasonable level of variability between fuels management approaches as well as between study sites. For instance, belief that a prescribed burn improved wildlife conditions had a positive association with approval in California and Michigan but no effect in Florida and Missouri. Ultimately, the only way to fully learn how local WUI residents view a fuels management approach is to ask them.

Demographic characteristics and wildland fire experience were not directly associated with acceptance, particularly when other factors such as personal importance, trust, and attitudes are held constant. Still, it is possible that some of these variables indirectly affect acceptance by moderating attitudes or personal importance—both important influences on acceptance.

Detailed Findings

The research for this study was done in two phases. The first phase involved focus groups of WUI residents. To ensure that our findings would be broadly applicable, we conducted the focus groups in diverse communities in four States (California, Florida, Michigan, and Missouri). From these discussions, we developed a model of factors that were likely influential in approval levels. To test our model, we then surveyed a broader range of WUI residents in each site.

Based on what we heard, we hypothesized WUI residents' acceptance of fuels management approaches is largely related to three factors:

- **Trust in the responsible agency**, a complex factor that may be further divided into several types of trust, including *perceived agency competence*, *credibility*, and the degree to which residents and the agency *share common values* (Winter *et al.* 2004).

- **Attitudes[1] toward individual fuels management approaches**—whether an individual's evaluation of an approach is favorable or unfavorable. Attitudes are largely determined by **perceived forest management outcomes**, which are the results they believe are likely to happen as a result of each fuels management strategy.

- **Personal importance** of fuels management approaches. Personal importance accounts for WUI residents' perceptions of how a fuels management approach will affect them or the degree to which they are personally invested in the approach. Research has shown personal importance is positively associated with attitudes—whether an object (e.g., a fuels management approach) is seen as positive or negative (Bright and Manfredo 1995, 1997; Liberman and Chaiken 1996; Sorrentino *et al.* 1988)—and attitudes are, in turn, strongly associated with intentions to support that object.

We also suspected certain personal characteristics of WUI residents were related to attitudes toward and acceptance of fuels management approaches. For example, residents with more wildland fire experiences

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[1] Note that our model treats attitudes (positive or negative feelings toward a fuels management approach) and personal importance (an indirect measure of the perceived degree to which an approach will affect a respondent or that they are involved/invested in a fuels management approach) as associated but separate acceptance factors.

(Vogt *et al.* 2003), longer term residents, permanent (as opposed to seasonal) residents (Vogt 2003), and those who have worked in natural resource-related fields would be more apt to have high acceptance levels.

Respondent Demographics

The California and Michigan samples were similar in several demographic characteristics (table 1). For both samples, approximately 7 out of 10 respondents were male, one-third of the respondents had college degrees, 3 out of 10 respondents earned $80,000 or more for an annual household income, and 3 out of 10 households had someone with a respiratory ailment. Michigan homeowners were more likely to be seasonal residents. Florida respondents were the most likely to be female, and a greater proportion (35%) of Florida households had someone with a respiratory ailment. Missouri respondents were notable for having lower levels of formal education and income and tended to be long-term residents who had lived in small towns and rural areas most of their lives.

Table 1.—Respondent demographics by study site

	CA site N=544 (percent)	FL site N=357 (percent)	MI site N=1,244 (percent)	MO site N=715 (percent)
Male	70	60	71	75
College graduate	36	16	32	20
$80,000+ household income	32	18	29	9
Respiratory ailment	30	35	28	31
Long-term resident (over 10 years)	60	67	68	74
Seasonal resident	7	1	38	2
Lived most of life in medium to large city	46	38	36	13

Wildland Fire Experiences and Actions

WUI residents' wildland fire experiences and actions are indicative of a region's wildland fire history and management policies. Of residents at the four sites, California respondents were the most informed about fire, more involved in protecting their own homes, more likely to have participated in community fire protection activities, and more familiar with mechanical treatment (fig. 1). Florida respondents were the most familiar with prescribed burning and the most likely to have experienced a road closure due to wildland fire. Michigan respondents were more likely to know someone who suffered damages to property and more likely to have been evacuated due to wildland fire.[2] Overall, Missouri respondents

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[2] The three counties surveyed in Michigan contained the area where the Mack Lake fire (an escaped prescribed fire that killed a firefighter and destroyed 44 houses) had occurred. This fire was often discussed in focus groups as if it had just occurred.

were the least likely to have experienced negative wildland fire effects: feeling fear or anxiety, experiencing a road closure, or suffering discomfort from smoke.

Compared to respondents from the other sites, California WUI residents have been involved more frequently in wildland fire-related actions (fig. 2). They were at least twice as likely to have practiced

Figure 1.—Respondent wildland fire experiences
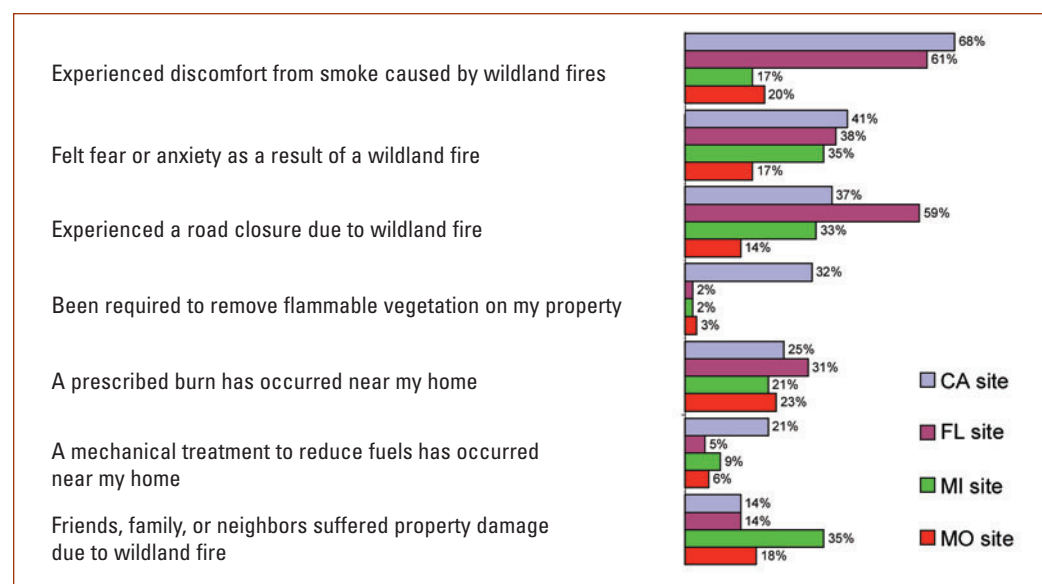
Figure 2.—Respondent wildland fire actions
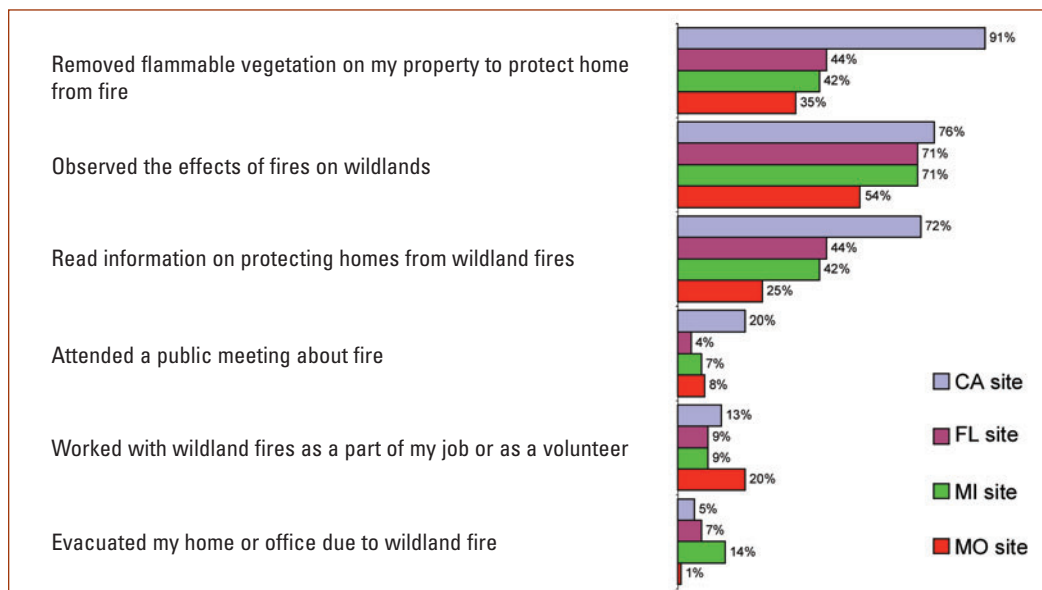
defensible space landscaping and were significantly more likely than WUI residents at one or more of the other sites to have observed the effects of fire on wildlands, read information on defensible space practices, or attended a public meeting about wildland fire. Respondents at the Missouri site, on the other hand, were among the least likely to have engaged in those activities, yet they were the most likely to have worked with wildland fire as part of a job or as a volunteer.

These wildland fire action results are consistent with local wildland fire laws and custom. The California site residents are required by law to maintain defensible space. Homeowner education and enforcement practices by State and local jurisdictions and Fire Safe Councils in California are familiar to most WUI homeowners. In areas lacking these institutions, defensible space experiences and actions are much less evident.

Trust

It may come as a surprise to some that, generally speaking, the proportions of WUI residents at two of the four sites (FL and MO) who trust the government to make decisions about the use of prescribed burning are larger than the proportions who say the same for mechanical fuels reduction (fig. 3). At the California site, the proportions are essentially equal. Michigan was an obvious anomaly among these sites; WUI residents there exhibit significantly lower proportions of trust for each of the three fuels management approaches. Missouri respondents showed the highest trust for the two fuels management approaches examined there: prescribed burning and mechanical fuels reduction.

Figure 3.—Percentage of respondents who agree with trust component statements
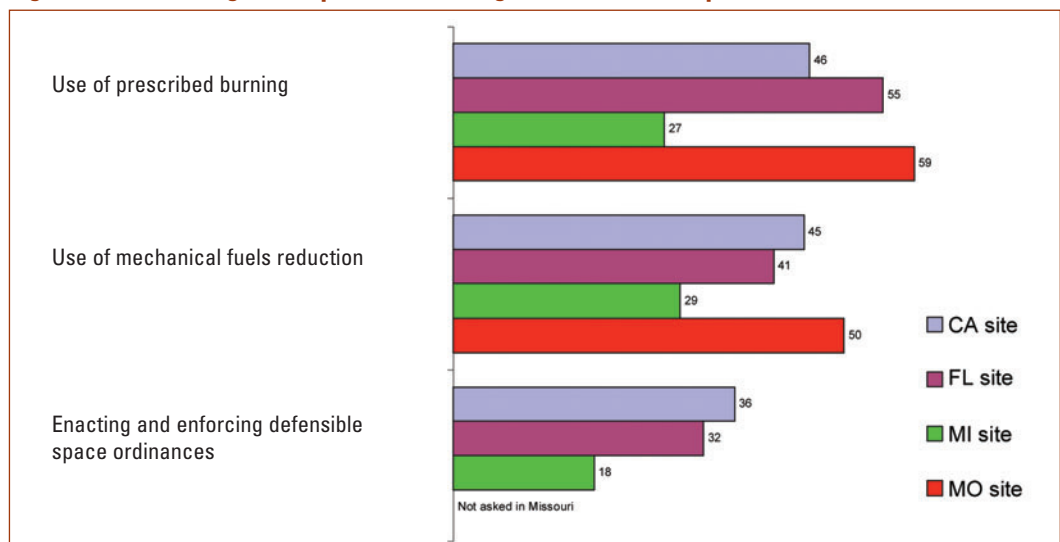
Fuels Management Approach Attitude

Attitude toward a fuels management approach varied widely among and within communities. The proportion of WUI residents with a positive attitude toward prescribed burning ranged from 42 percent in Michigan to nearly twice that many in Florida (78%). Positive attitude toward mechanical fuels reduction ranged from 52 percent in Missouri to 78 percent in California. Nearly twice as many California WUI residents (79%) held positive attitudes toward defensible space ordinances as residents in either Florida (42%) or Michigan (42%).

Personal Importance

California and Florida WUI residents assigned high levels of personal importance to mechanical fuels reduction and prescribed burning. Compared to Florida and Michigan WUI residents, those from the California site were much more likely to assign a high level of personal importance to defensible space ordinances, a finding consistent with their familiarity with defensible space practices through experiences and actions and with the region's defensible space laws.

Perceived Forest Management Outcomes

Although the strength of WUI residents' beliefs about probable fuels management approach outcomes likely influences acceptance, cost-benefit analyses used to evaluate fuels management approaches often do not consider public opinion (Kline 2004). In an effort to introduce public opinion to fuels planning, we began our research with focus groups to uncover salient beliefs about expectations of fuels management outcomes or impacts. We discerned from the focus groups that particular outcomes are associated with certain, but not always all, fuels management approaches.

Prescribed burning

California, Florida, and Missouri respondents are similar in the strength of several beliefs about prescribed burning outcomes (fig. 4). Large proportions of WUI residents from each site believed it highly likely that prescribed burning results in reduced costs of future firefighting, less smoke over the long term, and that it improves conditions for wildlife and helps restore forests to a more natural condition. Michigan WUI residents believed most strongly that negative prescribed burning outcomes (i.e., escaped fires) will occur, and they believed least strongly that positive outcomes will occur.
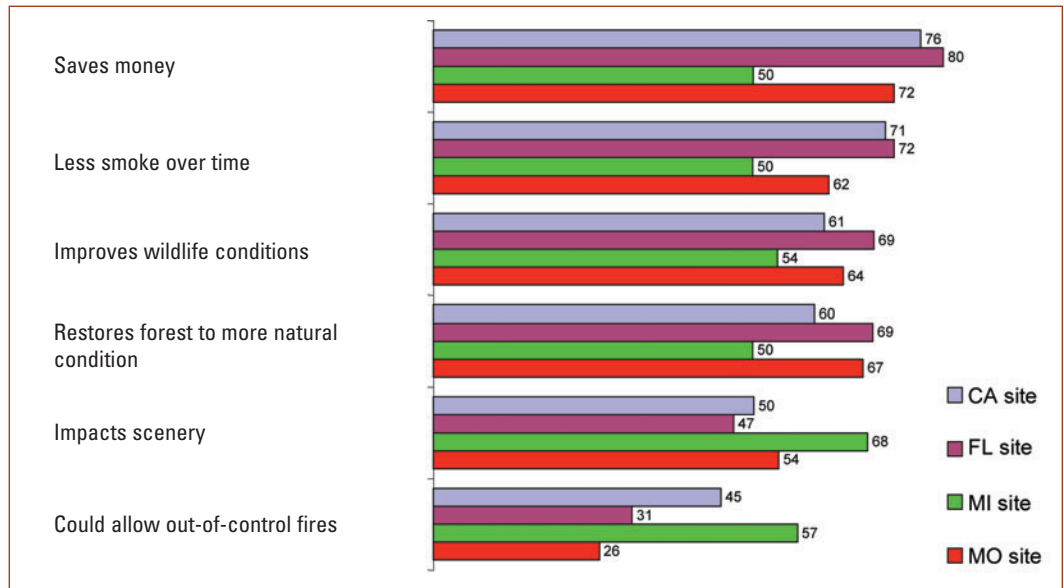
Mechanical fuels reduction

Of respondents at the four sites, Californians held the strongest beliefs about each of the four positive mechanical fuels reduction outcomes: saves money on future firefighting, extracts usable wood products, improves wildlife conditions, and restores the forest to a more natural condition (fig. 5). As with prescribed burning, Michigan respondents were the most likely to believe mechanical fuels reduction will have negative scenery impacts and the least likely to believe that this fuels management approach will have three of the four positive outcomes.

Defensible space ordinance.[3]

More than two-thirds (71%) of California WUI residents believed a defensible space ordinance saves money by reducing the cost of fighting a future wildfire (fig. 6), a proportion much higher than at the Florida (46%) and Michigan (39%) sites. California respondents were also the most likely to believe that other positive outcomes will follow from such an ordinance, and they were least likely to believe negative scenery impacts will result.

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[3] Note that Missouri residents were not asked about defensible space ordinances. Phase I focus group research at this site showed little history of wildland fire causing home loss and little outreach about defensible space in this region. Focus group respondents were nearly universally against an enforced ordinance for which they saw no need.

Figure 5.—Percentage of respondents who believe mechanical fuels reduction outcomes are very likely to certain

Saves money	CA site	76
	FL site	68
	MI site	53
	MO site	58
Extracts usable wood products	CA site	74
	FL site	58
	MI site	66
	MO site	52
Improves wildlife conditions	CA site	54
	FL site	49
	MI site	44
	MO site	49
Restores forest to more natural condition	CA site	49
	FL site	44
	MI site	37
	MO site	44
Impact scenery	CA site	42
	FL site	43
	MI site	53
	MO site	42

Legend: CA site, FL site, MI site, MO site
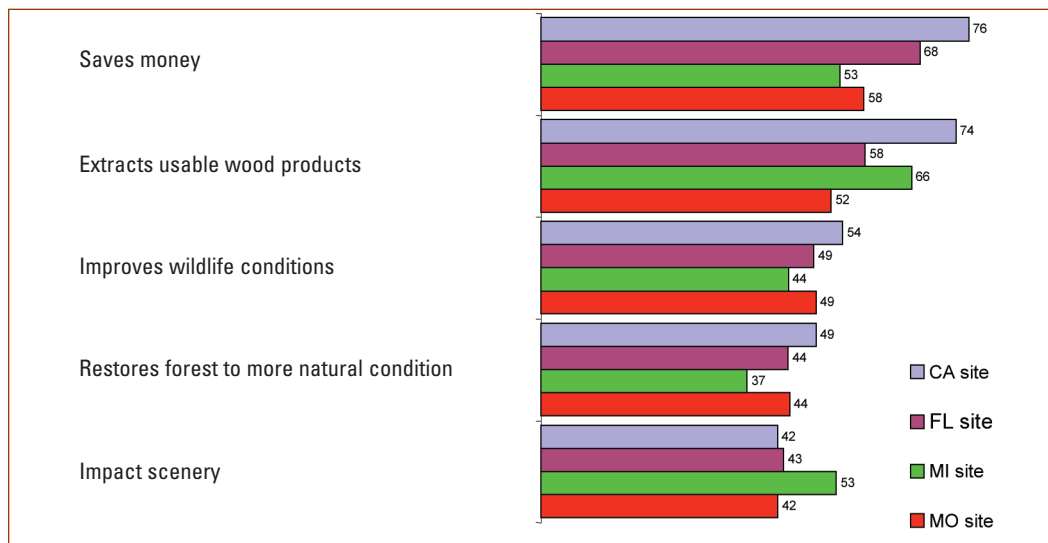
Figure 6.—Percentage of respondents who believe defensible space ordinance outcomes are very likely to certain

Saves money	CA site	71
	FL site	46
	MI site	39
Impact scenery	CA site	40
	FL site	51
	MI site	53
Extracts usable wood products	CA site	34
	FL site	29
	MI site	29
Improves wildlife conditions	CA site	29
	FL site	26
	MI site	20

Legend: CA site, FL site, MI site
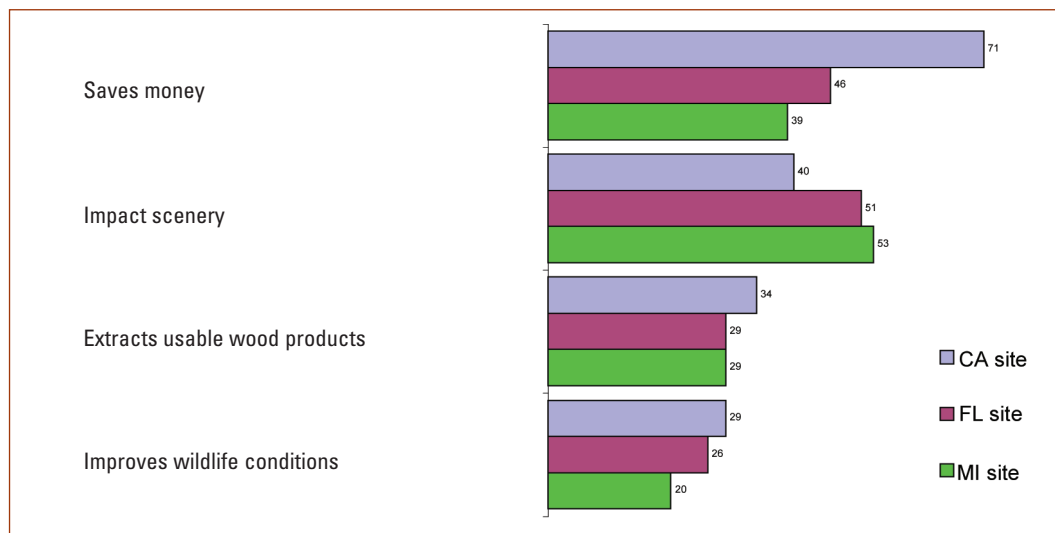
Approval

Approval varied considerably among study sites (fig. 7). The proportions of WUI residents who approved of particular approaches were very similar to the proportions with positive attitudes toward that approach. At the Florida site, where prescribed burning on privately held timber land was a common practice, approval of this approach was significantly higher than at the other sites (the next highest is the Missouri site where prescribed burning is also a longstanding practice). Mechanical fuels reduction had a high approval rating in California where residents were significantly more likely to have experienced a mechanical treatment near their homes. Compared to Michigan and Missouri respondents, twice as many California WUI residents approved of defensible space where it is an established and mandatory practice.

Figure 7.—Percentage of respondents who approve of fuels management approach in their local area
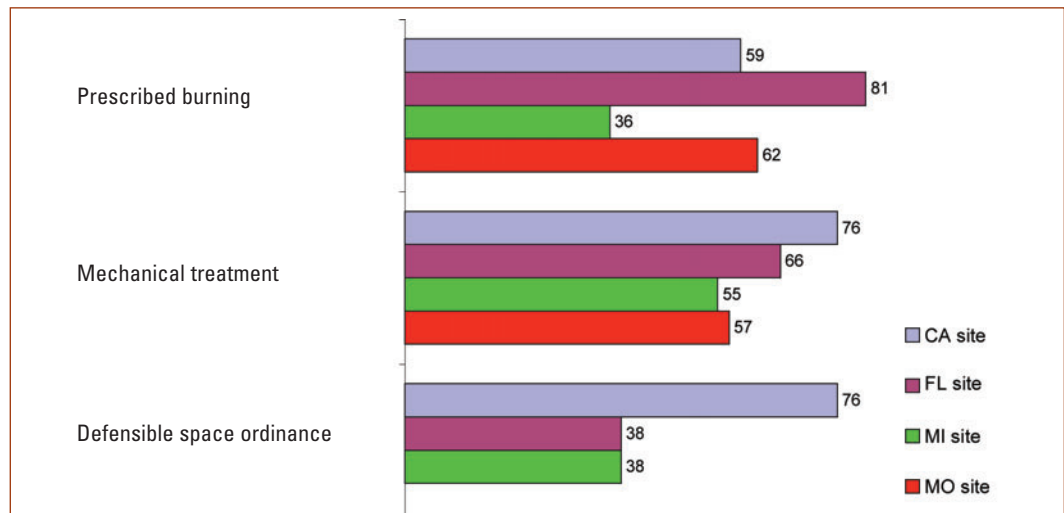
Predictive Acceptance Factors

Earlier, we reviewed the proposed conceptual model for explaining acceptance of different fuels management approaches. Multivariate analysis was used to determine which model variables (e.g., agency trust, fuels management approach outcome beliefs) explain the approval level for each approach when controlling for all other model variables. Separate models were tested for each fuels management approach at each study site. The summary results are shown in table 2.

Attitude and trust are strong predictors of individuals' intentions to approve of all three fuels management approaches at each applicable site. WUI residents who rated a fuels management approach as positive and those who trusted the government to make good decisions about its use were more likely

Table 2.—Statistically significant predictors of acceptance of fuels management approaches

Acceptance of...	Prescribed burning				Mechanical fuels reduction				Defensible space ordinance		
	CA	FL	MI	MO	CA	FL	MI	MO	CA	FL	MI
Attitude toward fuels management approach	+	+	+	+	+	+	+	+	+	+	+
Trust in agency with fuels management approach	+	+	+	+	+	+	+	+	+	+	+
Personal importance of fuels management approach	+	+	+	+	+	+	+	+	+	+	+
Outcome beliefs for...											
Cost-effective	+	+	+		+	+	+		+	+	+
Risk of escaped fire	–	–	–	–	NA	NA	NA	NA	NA	NA	NA
Negative scenery impacts	–				–		–			–	–
Improves wildlife conditions	+		+					+			
Less smoke in long term				+	NA	NA	NA	NA	NA	NA	NA
Restores wildlands to natural condition			+	+				+	NA	NA	NA
Extracts valuable wood products								+	NA	NA	NA

+ = positive relationship; **–** = negative relationship; empty cells imply no relationship was found at the 0.05 significance level.

to express approval for that approach. Additionally, personal importance was a significant predictor of approval: respondents who assigned a high personal importance to an approach were more likely to approve of its use in their local communities.

Outcome beliefs were also associated with approval but not consistently; beliefs that were significant varied across study sites and fuels management approaches. Cost-effectiveness, or whether or not WUI residents believe that an approach will save money by reducing the cost of fighting wildfires—was a significant predictor of approval for prescribed burning and mechanical fuels reduction at all sites except Missouri. Cost-effectiveness was also a predictor of approval of defensible space ordinances at all three sites where that approach was tested. For prescribed fire, the strength of respondents' belief that escaped fire is a likely outcome is inversely predictive of approval level at all four sites. The belief strength in the remaining outcomes varied considerably across study sites and fuels management approaches. For example, strength of beliefs about negative scenery impacts had weak but statistically

significant association with approval for prescribed burning only in California, for mechanical fuels reduction in California and Michigan, and for defensible space ordinances in Florida and Michigan.

Demographics

Our exploration of the association between demographic characteristics (e.g., gender, residency tenure, education, property value, proximity to high hazard fuels areas) and acceptance of fuels management approaches revealed no direct relationships. Surprisingly, the same is true for our investigation of relationships between WUI residents' wildland fire experiences and actions and acceptance, particularly when other factors such as personal importance, trust, and attitudes are held constant. Still, some of these variables may indirectly affect acceptance by moderating attitudes or personal importance—both important influences on acceptance.

Methods

The research for this study was done in two phases. During the first phase, we interviewed randomly selected WUI residents in a focus group setting where participants were encouraged to talk about their experiences with, knowledge about, and opinions of wildland fire-related issues (Winter *et al.* 2002). To ensure that our findings would be broadly applicable, we conducted the focus groups in very diverse communities in four States (California, Florida, Michigan, and Missouri). Next, to measure how well the model explained WUI residents' acceptance of fuels management approaches, we developed a community survey methodology. The purpose of the survey was to test whether our first-phase findings and conclusions could be generalized to other communities.

Survey Sites

The study population for each site consisted of homeowners living in areas abutting or near large tracts of public land with a high potential for wildland fire. The four survey sites were selected to represent a diversity of socioeconomic, ecological, fire history, and land management characteristics. The California site, including Placer and El Dorado Counties, contains federally managed forest with frequent wildfires and rare prescribed burns. The Clay County, Florida, site is primarily privately owned and has frequent wildland fires and prescribed burns. The Michigan site, including Oscoda, Crawford, and Ogemaw Counties, contains forests that are largely managed by Federal and State agencies. The Missouri site, including six counties near or within the Mark Twain National Forest, features a national forest unit where increased prescribed fire activity is being planned for fuels management. At all four survey sites combined, 6,731 households received the survey and 2,869 responded, for an overall response rate of 43 percent (this ranged from 31 percent at the Florida site to 53 percent at the Michigan site).

For more information on the study and the results, including links to publications completed to date, more details about study methodologies, and a tool kit for monitoring fuels management approach acceptance in your community, please see the Social Acceptance of Fuel Treatments Web site at http://www.fire-saft.net/index.htm.

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What Does "Wildfire Risk" Mean to the Public?[1]

Sarah McCaffrey
Northern Research Station, USDA Forest Service
Evanston, IL (smccaffrey@fs.fed.us)

Introduction

> *Risk is a subtle concept with many possible meanings. It is sometimes used as a synonym*
> *for a hazardous activity, sometimes used to mean probability, sometimes used to mean a*
> *consequence, and sometimes used to mean threat. (Slovic 1999a)*

If managers are highlighting "high fire risk" to encourage defensible space or support for fuels treatments, it is important to understand if the public's concept of high wildfire risk is the same as theirs. A common assumption is that if people understand how high the risk is they will naturally do something to mitigate the risk. But as the opening quote indicates, risk is a subtle notion, one that is not simply a scientific concept but also a cultural concept shaped by individual and societal values.

Perceived risk of a natural hazard is generally defined as how serious the threat is deemed to be coupled with the "subjective probability of experiencing a damaging environmental extreme" (Mileti 1994). Thus, perceived risk has much room for variation because different groups may consider a threat to be more or less serious and probability is a highly subjective calculation. Wildfire risk is no exception to this variability. "The phenomenon 'fire' has as many aspects as people who are dealing with it: fire managers and fighters, environmentalists, foresters, house and land owners, scientists, land planning organizations, etc. Based on their primary interests, each of these 'communities' has different notions of the term 'wildfire risk'" (Bachmann and Allgoewer 2000). This paper provides some insight into what wildfire risk means to one segment of the various groups dealing with wildfire: members of the public living in high wildfire risk areas.

Key Findings

This paper will discuss results from discussions of wildfire risk during a series of 2004 focus groups held in five locations in the Western United States (Boulder, Colorado; Flagstaff, Arizona; Hamilton, Montana; Reno, Nevada; and San Bernardino, California).

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[1] The article is an adaptation of a chapter in "Wildfire Risk: Human Perceptions and Management Implications" edited by Wade Martin, Carol Raish, Brian Kent; published by Resources for the Future.

- **People's assessment of wildfire risk is a complex process.** Participants considered a wide array of factors—environmental conditions, ignition sources, and potential damage, to humans and to the environment—when assessing general area wildfire risk. Given the desire to clarify risk context and the variability of factors each person considered, managers may want to clearly define the definition of wildfire risk they are using, including timeframe, area extent, and specific type of damage. In addition, the strong initial emphasis on preconditions as a key part of risk assessment suggests that managers may want to pay particular attention to communicating fire risk when environmental conditions do not visually support the actual risk (e.g., green vegetation).

- **Public wildfire risk perception that managers may see as inappropriately low may not necessarily be a result of poor understanding but instead may be a result of self-selection and of mental balancing of benefits and risk.** Rather than focusing on raising risk perception levels, managers may instead want to focus on changing the perceived balance of risk and benefits—showing how efforts to decrease risk add to rather than subtract from the perceived benefits of living in fire-prone environments. This can take the form of showing specifically how actions such as vegetation management reduce likely damage from wildfire, but perhaps even more useful would be showing how such actions can actually increase the perceived benefits of living in wildland areas such as improved forest health and wildlife habitat.

- **Homeowners generally understand how to protect their homes from fire and many have taken steps to decrease their risk.**

- **"Current Fire Danger" signs are an effective means of communicating local fire risk status.** The signs were the most commonly referenced information source for current fire risk and helped ensure that people didn't put the risk out of mind. However, because people also compare what the signs say to their own observations, it is important to keep the signs current throughout the year, not just to reflect actual fire risk but also to maintain their credibility.

Detailed Findings

In each of the five locations, three focus groups were held. Efforts were made in each location to have a representative sample of residents who lived in the intermix, in the interface, and in nearby areas unlikely to be directly threatened by a wildfire (vicinity). (Quotes are identified by the city and type of location—intermix, interface, or vicinity—of the speaker.) During the focus groups, participants were asked to rate the general fire risk of the area on a scale of 1 to 10. They were then asked to describe what they were thinking of in making that rating. Subsequently, participants were also asked to discuss their reactions to official messages about wildfire risk and to rate the wildfire risk for their house.

People's assessment of fire risk is a complex process.

Overall, participants saw the wildfire risk in their area as quite high, but it also was evident that risk is indeed a subtle concept. Several participants wanted clarification on the timeframe, the weather conditions, and the spatial extent to be considered as well as risk to whom.

Photo credit: Sarah McCaffrey

> *I didn't know if you were asking how likely do you think a fire is to happen, in which case, it happens every year around here, so it's highly likely. Or how likely is it for a fire to kill somebody or burn down lots of houses. (Hamilton vicinity)*

Homeowners generally understand how to protect their homes from fire and many have taken steps to decrease their risk.

However, as discussion progressed, a distinct and fairly logical pattern of wildfire risk assessment emerged. First, participants generally thought about environmental conditions that would affect odds of a fire breaking out and influence its likely behavior. Next, they thought of ignition sources. Although lightning was mentioned, the most common ignition source discussed was human actions, usually in the guise of "stupid people."

> *I think of a really dry forest. I picture a fire about to happen. Mostly it's the condition of the forest because stupid people are always around. (Boulder vicinity)*
>
> -
>
> *Female 1:   I think of bitterbrush and manzanita that's packed up to each other with the dry, dead trees and cheat grass coming from the highway. I can just see it light....*
>
> *Male 1:   I think of my dad, jogging around the basin, coming to visit me and throwing a cigarette out the window. (Reno intermix)*

The San Bernardino interface and intermix groups were an exception to the general pattern of considering environmental conditions first in determining wildfire risk. Two-thirds of these participants had had to evacuate their residences as a result of the large fires of the previous fall. For these two groups, wildfire risk first brought to mind likely human impacts, including emotional responses.

> *Moderator: When you see the words "wildfire risk," what do you generally think of?*
>
> *Male 1:   Evacuation.*
>
> *Male 2:   Fear.*

> *Male 3:*   *Panic, because people don't have escape routes.*
>
> *Female 1:*   *Or how fast that the fire can come, depending on the vegetation.*
>
> *Male 4:*   *I think of dry brush (San Bernardino interface).*

After ignition sources, participants considered likely damage, first in terms of human costs—houses, health, lives—and then in terms of damage to the forest and wildlife. At this point participants began to more openly acknowledge the contextuality of risk, that risk was not just about probability but about consequences.

> *Well, the thing I think was missing in the previous discussion was risk to dwellings. I don't think any of us would be concerned about a wildfire in the jungles in Ghana, for instance. We would be maybe a little bit more concerned about the risk of a wildfire in the Lost Horse Drainage, for instance. But it starts getting to be personal when you can see the fire. So it really gets to be a crisis when it is encroaching on your property and threatening your house. (Hamilton interface)*

Although overt discussion of negative impacts generally emerged after consideration of environmental conditions and likely ignition sources, there was implicit consideration of negative impacts from the start as the environmental factors were discussed mostly in terms of the amount and dryness of the fuel and other variables that would contribute to a less controllable and more damaging fire. That negative consequences were an underlying part of most people's definition of risk came out clearly when they were asked to differentiate between high risk versus medium risk wildfires. Answers focused on environmental factors—such as wind speed, humidity, combustible fuel, and topography—that would increase likelihood of a fire being uncontrollable and more damaging.

> *Moderator:*   *In what ways would a high wildfire risk situation differ from a medium risk situation?*
>
> *Male 1:*   *One uncontrollable.*
>
> *Female 1:*   *It would spread easily.*
>
> *Female 2:*   *How deeply it would burn if you have a wildfire that burns so hot that it burns all the organic matter, so things can't grow back. That's the extreme.*
>
> *Female 3:*   *Risk to residences.*
>
> *Male 2:*   *Of course the wind factor.*
>
> *Male 3:*   *A wildfire doesn't have any natural breaks that slow it down, you know, it just keeps going in the crown.*
>
> *Male 2:*   *Evacuate from the area. (Flagstaff interface)*

I think the other thing that I think of when I see high risk, is it going to be really difficult to get under control. That's just my initial thought is if it is really high risk, that if something does take off, then we are at risk for greater damage. (Boulder vicinity)

The strong initial emphasis on preconditions as a key part of risk assessment suggests that managers may need to pay the most attention to communicating about fire risk when environmental conditions do not visually support the actual risk (e.g., lack of dry and dead vegetation). In addition, the fact that a significant number of participants asked for clarification about what was meant by area risk suggests that managers may want to clearly define the definition of wildfire risk they are using, including time-frame, area extent, and specific type of damage.

Public wildfire risk perception that managers may see as inappropriately low may not necessarily be a result of poor understanding but instead may be a result of self-selection and of mental balancing of benefits and risk.

When participants were asked to rate the wildland fire risk for the general area on a scale of 1 to 10, an interesting pattern emerged. Participants who lived in the vicinity consistently had a higher wildfire risk rating for the area than those who lived in the intermix or interface. Although the focus groups were not structured in a way that made it possible to clearly establish why this distinction existed, analysis of the focus group discussions indicates that part of the difference may be a result of self-selection. This kind of decision process was evident among participants in Flagstaff, Boulder, and Reno.

Female 1: *We aren't allowed to burn at all at my house. (Flagstaff intermix)*

Female 2: *Well, you are in a canopy. You are right there in a canopy. That's one reason we didn't buy up there, I was terrified. (Flagstaff vicinity)*

Female 1: *We are a 7 risk and that's why we didn't sell that house, and just move away. We want our kids to experience living on a piece of beautiful, beautiful land that is not, it is relatively undisturbed by society. You can go out on the trail, right from your door, and see wildlife and be right in nature. So that risk is worth that....*

Moderator: *Is having a wildfire risk of 7, is that acceptable to you?*

Female 1: *Oh, you know; you still have everything else. Although, I guess I should 'fess up, we also bought a condominium in Boulder. (laughter) So, I have to tell you, my husband would deny this, but for me part of the fear is about wildfire. I do*

not want my kids out on the street without a place to be. So, there's a lot of other reasons why we did it, but we have a separate home. (Boulder intermix)

I think there's something to be said about living out rural or in the country. I don't want that taken away from me. Even if there's brush around and there's a potential for fire, I think we take that into consideration when we buy our houses. (Reno interface)

The first two quotes indicate that part of the self-selection is based on emotional responses. Both participants reference powerful negative emotions to explain their decision to have a residence outside of the interface or intermix, thus indicating how their risk perception is not a simple utilitarian calculation based on probability plus outcomes. Apparently, those with lower risk tolerance are choosing not to expose themselves to the risk.

Another likely dynamic, illustrated by the last two quotes, is that people who live in the intermix and interface are making conscious tradeoffs. The open discussion of the positive benefits of living in these areas and the lower risk ratings of people living in them parallel findings from other risk research that higher perceived benefits are associated with lower risk perception (Alhakami and Slovic 1994). This dynamic is linked with a person's overall positive or negative emotional (or affective) response to a hazard; a positive emotional reaction is associated with a lower risk perception. The need for cognitive consistency means that having decided that living in or near wildland areas is desirable, individuals engage in mental strategies that minimize the risk and highlight the benefits, making the tradeoff acceptable. Although Alhakami and Slovic's study was in relation to risks and benefits at the societal level, these findings suggest that a similar process exists at the personal level.

The fact that those living in the intermix and interface have a lower sense of general fire risk than those living in less exposed areas is intriguing. Although further research is needed to clearly understand this dynamic, these findings suggest one reason why increasing wildfire risk perception does not necessarily lead to behavior change. Residents in these areas appear to have already recognized the risk in some manner and have decided, consciously or unconsciously, either that they are unwilling to tolerate the risk and so choose not to live in the WUI or that the benefits outweigh the risks. Thus, public wildfire risk perception that managers may see as inappropriately low may not necessarily be a result of poor understanding, as is often assumed, but instead may be a result of self-selection and of mental balancing of benefits and risk. If this is the case, efforts to raise risk perception levels may be misdirected. Instead managers may need to focus on changing the perceived balance of risk and benefits—showing how efforts to decrease risk add to rather than subtract from the perceived benefits of living in fire-prone environments. This can take the form of showing specifically how actions such as vegetation management reduce the likely damage that the house or landscape will suffer, but perhaps even more useful would

be showing how such actions can actually increase the perceived benefits of living in wildland areas such as improved forest health and wildlife habitat.

Homeowners generally understand how to protect their homes from fire and many have taken steps to decrease their risk.

Participants' ratings for the wildfire risk for their house followed a more predictable pattern than that found with area risk: intermix residents had the highest risk rating and vicinity residents the lowest. Views of house risk were uniformly lower than assessments of area risk. Notably, for house risk there was a significant difference in risk assessment by gender: women had a higher house risk rating than men. This matches findings in other risk research that women tend to have a higher sense of risk then men (Slovic 1997), although there was no such gender difference for ratings on area risk.

Responses indicate that participants generally had a good picture of what factors increased their risk including shingle roofs, thick vegetation and ladder fuels, flying embers, unraked pine needles, and topography.

> *I said 5 because we live on a hill. We get the winds almost as bad as Washoe Valley. Of course, we have a cement roof, that's a good thing, we have defensible space, but we also have a lot of natural brush around our house, all around our home. All our 6 acres and the adjacent area. If the wind is right and the fire in the right place, we could be in trouble. (Reno interface)*

Most intermix and interface participants indicated they had done some type of mitigation work, particularly vegetation management and replacement of shingle roofs. Several indicated they felt their house risk was lower as a result of these actions.

> *I said 4 or 5 because on our own particular lot, we've taken out half the trees that were there when we bought the lot and we built the house at least 15 feet from the closest trees. We rake pine needles incessantly, so there's no cover on the ground. And, we are on the edge of A-1 Mountain, the foothills, and they just this last winter they thinned it. Especially near our house. They took out 2/3 of the trees for a 100 yards back of our house. So I think compared to 7 years ago, I would have said a 7 or 8; now we are at a 4 or 5. And our house partly has a fireproof siding and a steel roof. (Flagstaff intermix)*

Conversely, there was evidence that people had increased their house risk rating as a result of information they had received about the wildfire hazard. However, there also was evidence that individuals could understand wildfire dynamics and still deny the risk. Both of these are illustrated in the following exchange.

Two years ago I would have said [that my house risk was] zero. Until you see the footage of the wildfire that took the camp out up by… in the middle of a meadow. It is just amazing, the winds that get generated by a wildfire come across the flats and nothing is safe.

I said zero, but we live up in Corvallis, and when we had the big fires in 2000 up Dutch Hill, way up there by Pinesville, we found big embers in our yard where the wind had blown them down there. So it might not have been in the middle of a wildfire, but it could have been our house that was on fire from it. (Hamilton vicinity)

Ironically, this last person rates her house as having no risk but then goes on to describe a very logical way the house could in fact be lost to wildfire. Such apparently illogical justifications were more prevalent in explanations of house risk ratings than they were for area risk. Loewenstein *et al.* (2001) argue that a key part of lay risk response is linked to the immediate visceral reaction to the risk, which is closely linked with the vividness of the mental imagery associated with the risk. Losing one's house to wildfire likely engenders more vivid imagery than a more general wildfire in the area, which may encourage people to engage in mental heuristics to minimize their personal sense of risk. This possible dynamic may provide some explanation for why some homeowners may have an accurate assessment of the overall area risk but still not engage in any defensible space measures.

"Current Fire Danger" signs are an effective means of communicating local fire risk status.

In terms of official wildfire risk messages, most participants generally felt little disjuncture between their perception of the wildfire risk and the various public messages they were getting about the risk. A few felt wildfire risk was understated, while others felt it was overemphasized to generate firefighting funds. The most consistently mentioned information source was the roadside signs that indicate the current fire danger. More than half of the focus groups mentioned the signs, often describing their location, and several participants said the signs were what they first thought of when they heard the term wildfire risk.

I think of the signs….there's I guess some type of fire prevention sign right there, but a barometer that goes to the different shades. When I see it go into the orange I know that…It's frightening, I hear that and feel fear. (Boulder interface)

Male 1:   We see the signs on the road, she's referring to. Today the fire danger is low.

Female1:   Elevated, kind of like what they use for Homeland Security.

Male1:   Everybody sees those signs, it does make you conscious. (Reno intermix)

I personally don't think about it until I pass our Ranger Stations and it says on the sign, "Extreme Risk of Fire." And that is a subtle reminder that, "Hey, this is a danger area." (San Bernardino intermix)

These last two comments show the importance of the signs not just in terms of recognition but as a means of ensuring that residents don't put the risk out of mind. The recognition also highlights the importance of keeping the signs current. It was evident that people paid attention to the signs in part because they trusted the messenger but also because the signs supported their own observations.

I agree with it (the sign) because they wouldn't be making it up. And it looks dry and we haven't had rain and I would go with that. (Boulder vicinity)

I usually agree, but the other day I rode my bike out there and the sign said low. This was a week ago. We've had some rain, but I still don't think it is very low. (Boulder intermix)

The attention given to the "Current Fire Risk" signs suggests the importance of keeping them current throughout the year, not just for actual fire risk understanding but also for their credibility.

Background—Different Approaches to Understanding Risk

Over time initial assumptions that people's actions would be directly related to the probability of the event and the magnitude of its consequences have been proven problematic: "apparently minor risk or risk events, as assessed by technical experts, sometimes produce massive public reactions" (Kasperson *et al.* 1994: 113). To more fully understand what shapes public perceptions of risk, researchers have examined the following questions:

- Do lay people see risk as a combination of probability and consequences or do they consider only probability, and what combination most influences decisions to mitigate (Sjoberg 1999a, Slovic 1999a)?

- Are there differences in expert and lay calculations of risk and is risk, in fact, perceived differently by the two groups (Johnson 1993, Rowe and Wright 2001, Sjoberg 1999b)?

- How do hazard characteristics influence risk perception (Slovic 1997)?

A more recent focus has been on understanding how emotions play into risk perception, including how negative or positive emotional assessments associated with exposure to a hazard influence risk perception (Slovic 1999b) and the role of visceral emotional response to risk and uncertainty (Loewenstein *et al.* 2001).

Many WUI residents recognize the fire risk, but have decided that the benefits of living in the woods outweigh the risks.

It is not entirely surprising that definitions of risk differ. The dynamics of risk perception are complicated. In essence, efforts to determine risk exposure are an attempt to bring some level of certainty to an uncertain and threatening situation. Technical experts develop a set of protocols, generally using mathematical calculations, of ways to deal with this uncertainty. "After identification of the failure or damage scenarios (what can go wrong?) the questions are: what are the potential consequences and their likelihoods? The risk can then be quantified by a probability distribution of the potential outcomes, or by the relevant moments of that distribution" (Pate-Cornell 1996). Although the above quote makes technical risk assessment sound like a straightforward process, this is not necessarily the case. Such an assessment can provide different results for the same concern depending on how the negative consequences are defined and how probability is calculated. For instance, defining a risk in terms of accidental deaths per product unit versus accidental deaths per number of employees can yield very different outcomes (Fischhoff *et al.* 1984).

Given the lack of agreement among experts, it is unlikely that lay individuals will be any more consistent in their risk assessments, nor will they be likely to have the time or desire to engage in complex mathematical calculations. Instead, lay individuals have been found to use various mental strategies—such as denying a risk or attributing complete protection to an adjustment (such as flood levees) that only provides partial protection—to minimize the uncertainty (Slovic *et al.* 1990). In the process, misinformation and bias are often introduced into the risk estimate (Slovic *et al.* 1987). Further, individuals will emphasize different aspects in determining risk; one person may focus on probability while another may emphasize specific negative consequences.

In relation to wildfire risk, the story appears to be no different. Within the fire community itself, definitions of wildfire risk vary. Notably, most formal definitions tend to treat the term as solely about probability. The Canadian Committee on Forest Fire Management defines fire risk as "fire probability or chance of fire starting determined by the presence and activation of causative agents" (Bachman and Allgoewer 2000). A recent General Accounting Office report on the need to systematically assess the environmental risks of wildfires defined risk as: "the probability that an event such as a wildland fire

will occur" (U.S. GAO 2004). Neither of these definitions includes consideration of consequences. In fact, in their analysis of how wildfire risk is treated in the literature, Bachman and Allgoewer (2000) found "very few examples" that took "both aspects of risk—probability and outcome—into account." This narrow focus on probability is particularly problematic when, as this paper indicates, the public definition of wildfire risk generally takes more into account than just probability.

Methods

Fifteen focus groups were conducted from May to July 2004 in five fire-prone areas of the Western United States: Boulder, Colorado; Flagstaff, Arizona; Hamilton, Montana; Reno, Nevada; and San Bernardino, California. The overall purpose of the study was to examine public views on fire management. One section of the focus group discussion explored risk perception—particularly what was considered in determining wildfire risk. Participants were recruited via phone calls using a geographically targeted sample list. Because the purpose was to obtain perceptions of the general population rather than those with a particular interest in wildfire issues, all participants were screened to not be employed by a government agency with jurisdiction over forestry or air quality, an organization with any affiliation with the logging or timber products industry, or any firefighting organization. Quotas were established to ensure an appropriate cross-section of the population.

Three focus groups were conducted in each location. The intention was to have one group of residents who lived in the wildland intermix (where houses are dispersed throughout native vegetation), one of residents living in the interface (areas on the edge of town or with moderated levels of native vegetation), and one of vicinity residents who lived in town or in predominantly agricultural areas. Respondents were assigned to a group based on their identification of the landscape where they lived. However, during the focus groups, it became evident that individuals living in the same neighborhood and even on the same street could characterize their surrounding landscape very differently.[2] Therefore, for analysis, addresses were mapped and, based on field assessments at the time of the focus groups and use of satellite photos (via TerraServer), participants were assigned to the appropriate "landscape" group. Focus groups ranged from 8 to 15 participants with an average size of 11 and a total of 171 participants. All groups were recorded and transcribed to allow detailed analysis of the focus group discussion data.

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[2] An interesting dynamic and one that merits further analysis.

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How Forest Context Influences the Acceptability of Prescribed Burning and Mechanical Thinning

Alan D. Bright and Peter Newman
Department of Natural Resource Recreation and Tourism
Colorado State University
Fort Collins, CO (abright@cnr.colostate.edu)

Introduction

Understanding public perceptions of potential management actions and identifying where perceptions differ can help agencies understand and predict how they may react to management decisions. The effects of the public's beliefs and attitudes on fire management strategies have been explored, but the context in which these beliefs and attitudes exist may also be important. We describe the impact of contextual factors on public perceptions of doing prescribed burns, mechanical thinning, or no artificial fire management treatments. The contextual factors included proximity of the forest to urban areas, primary use of the forest (recreational vs. commercial), wildfire history, and current fire conditions in the forest. We compared the effects of contextual factors on the publics acceptance of fire management strategies across three geographic regions with different wildfire histories and experiences: the Front Range of Colorado (high recent wildland fire experience at the time of the study), southern Illinois (low wildland fire experience), and Metropolitan Chicago (no wildland fire experience). This study was part of a larger one, funded by the North Central Research Station of the USDA Forest Service that examined values, beliefs, attitudes, and context toward wildland fire and management (Bright and Carroll 2004).

Key Findings

If fire hazard is high or wildfire occurred recently, people want some mitigative action taken. If current conditions of a forest make a wildfire likely or if the forest recently experienced a wildfire, the public would like the land management agency to take some action to mitigate or eliminate the potential effects of those fires, by prescribed burns or mechanical thinning. Doing nothing in these two situations is not acceptable to a large proportion of the public. A particularly interesting finding is that when forests have little or no wildfire history, prescribed burning and mechanical thinning appear less likely to be supported. In these instances the current conditions are particularly important because no previous wildfire in an area may suggest that a wildfire in an upcoming season may be imminent.

People prefer use of prescribed fire in remote areas and thinning in more urban areas. Prescribed burning was supported more strongly for a rural forest than for a more urban one. The perception that prescribed burning in rural forests directly impacts people less may have played a role in this finding.

If the fire hazard is high, people want some mitigative action taken.

On the other hand, if a forest was in a rural area, support for mechanical thinning decreased, perhaps because of the preference for prescribed burning in rural areas or the opposition to the use of obtrusive management in forests that are seen and experienced away from civilization. Moreover, mechanical thinning may have been perceived as being less dangerous to the public than prescribed burns in forests near urban areas.

Differences across study locations were small. For all three regions, current condition was the most important factor influencing acceptability of prescribed burning, mechanical thinning, and doing nothing, while primary use was least important. The only significant difference among the regions was the relative importance of location and wildfire history on influencing public acceptance.

The public may have some understanding that forest conditions have an effect on the probability and severity of wildfire in a given area, but that understanding may not be complex or accurate enough. For example, our finding that the public is less likely to support prescribed burning and mechanical thinning in areas with little or no recent wildfire history suggests that people may interpret a lack of recent wildfires as an indication of a lower fire hazard. In many locations this is likely to be an inaccurate assessment and could hinder appropriate management actions in areas where there has not been fire or fire has been suppressed, and where prescribed burning or mechanical thinning are therefore warranted.

The complexity of factors that may influence public perceptions shows the importance of creating information campaigns that describe the fire science around wildfire management and decision-making. Regardless of the similarity of context effects on the acceptability of prescribed burning and mechanical thinning across study sites, results showed that many factors may affect support for management actions. Communicating the environmental and geographic context of wildfire management decisionmaking may help foster support for fire management decisions. Recognizing the importance of providing scientific information early allows agencies to create educational programs that explain the context of the decision and let the public know when prescribed burning and mechanical thinning are most appropriate and necessary. With public support, agencies can spend more time and money on

the resource rather than on legal battles and policy adjustments dictated by the courts, interest groups, or on battles for positive public opinion.

Detailed Findings

The first group of detailed findings below describes the main effects of each of the contextual factors on perceptions of prescribed burning, mechanical thinning, and doing no artificial treatments.

- **Current Conditions of the Forest.** In forests where current conditions suggested a wildfire was likely, support for both prescribed burning and mechanical thinning increased. If current conditions suggested a wildfire was unlikely, support for these two treatments decreased. Consistent with these findings, support for doing no artificial wildfire treatments decreased as the potential for wildfire in a forest increased. This was true for residents of all three regions.

- **Forest Proximity to Urban Areas.** For all regions studied, support for prescribed burning increased for a forest in a remote rural area and decreased in a more urban forest. The opposite was true for mechanical thinning. Support for doing no artificial wildfire treatments increased in a remote rural forest but decreased in a forest near an urban area.

- **Wildfire History.** In all regions studied, support increased for prescribed burning and mechanical thinning for a forest with recent wildfire history, but decreased for both treatments when there was little or no wildfire history. Support for doing no artificial wildfire treatments decreased when there was recent wildfire experience in a forest.

- **Primary Use of the Forest.** When the primary use of the forest was for outdoor recreation, support for prescribed burning and mechanical thinning decreased. Support for these treatments increased when the primary use of the forest was for commercial activities such as logging and mining. Primary use had no consistent effect on support for doing no artificial treatments.

The second group of findings describes the relative importance of each of the contextual factors on support for prescribed burning, mechanical thinning, and doing no artificial treatments.

- **Prescribed Burning.** By far, the most important contextual factor to influence support for prescribed burning was the current conditions of the forest. As noted above, if a wildfire was likely, support for prescribed burning as a treatment increased. For the Colorado Front Range and southern Illinois, the second most important factor was forest location followed by wildfire history. In Metropolitan Chicago the two were flipped, with wildfire history the second and forest history the third most influential factors. The primary use of the forest had little to no influence on support for prescribed burning in all regions.

- **Mechanical Thinning.** As with prescribed burning, the current condition of the forest was, by far, the most important contextual factor influencing support for mechanical thinning in all regions studied, with conditions making a fire likely increasing support for this treatment. Location of the forest was the second most important factor influencing support for mechanical thinning for the Colorado Front Range and Metropolitan Chicago, while wildfire history was the second most important factor for southern Illinois. In all regions, there was relatively little difference in impact on support for mechanical thinning between location of the forest and wildfire history. The primary use of the forest was the least important contextual factor influencing support for mechanical thinning.

- **No Artificial Treatments.** The current condition of the forest was, again, by far the most important factor influencing support for doing no artificial wildfire treatments. If current conditions made a wildfire likely, doing nothing was not supported as a treatment. Wildfire history was the second most important factor influencing support for the two Illinois strata but third most important for the Colorado Front Range. Location of the forest relative to an urban area was the second most important factor for Colorado Front Range residents and third for Chicago Metropolitan and southern Illinois residents. Primary use of the forest was again the least important factor in all regions studied.

Background

The shift from fire suppression to the use of prescribed burning and mechanical thinning has troubled some communities and groups with interests in forested areas because of the dangers associated with prescribed fires going awry and the impacts of heavy machinery and road building that accompany mechanical thinning. The public has expressed concern about these issues, and as a result, public perceptions of fire management have become an important consideration for agencies charged with managing areas susceptible to wildland fires.

Much of the social research has examined the impacts of knowledge, beliefs, and experience on perceptions of wildland fire and its management. A more recent line of research has examined the impact of situational factors, external to the individual, on perceptions of wildland fire and its management. Kneeshaw, Vaske, Bright, and Absher (2004) found that factors such as source of fire (human vs. natural) and potential impacts of fire (on air quality and forest health) influenced respondent perceptions of response to fires and fire conditions. We drew upon the Kneeshaw *et al.* (2004) research by exploring situational factors that influence support for specific management strategies: prescribed burning, mechanical thinning, and not treatment.

Methods

Research Design

One thousand names and addresses were randomly selected from each stratum using Survey Sampling, Inc. The three strata were selected as surrogates for wildfire experience in an area. One stratum included residents living near a national forest that had a recent wildfire. Residents of the Front Range of Colorado were selected for this stratum. A second stratum in southern Illinois included residents of a region near a national forest that experienced relatively little wildfire. A third stratum, Metropolitan Chicago, included residents of an urban area not located near a national forest. Dillman's (2000) Tailored Design Method was used to maximize response rate to a mail-back survey. Two mailings of the survey were conducted with a reminder postcard sent to nonrespondents between the two questionnaire mailings. Of the 3,000 surveys mailed, 475 were not deliverable. A total of 868 surveys were returned, resulting in a response rate of 34 percent (868/2,525). Nonresponse tests found very little substantive differences between respondents and nonrespondents on attitude toward prescribed burning and mechanical thinning.

Measurement of the Acceptability of Fire Management Treatments

Respondents were presented with eight scenarios followed by instructions to indicate, on a seven-point scale, if prescribed burning, mechanical thinning, and doing nothing were extremely, moderately, or slightly unacceptable or acceptable. For each scenario, respondents were told to consider a national forest that varied on four characteristics as follows:

- Location (in a remote unpopulated rural area vs. near a highly populated urban area).

- Primary use (outdoor recreation such as backpacking, viewing scenery, hiking, and camping vs. commercial activities such as logging or mining).

- Wildfire history (recent history of forest fire vs. little or no history).

- Current conditions (high likelihood of a fire in the near future vs. low likelihood).

Each contextual factor had two levels, requiring 16 (2^4) scenarios for a full factorial design. An orthogonal fractional factorial design was created to reduce the number of scenarios used on the questionnaire to eight, thereby systematically reducing the burden on respondents. Table 1 describes each of the eight scenarios based on the four contextual factors.

Table 1.—Scenario descriptions

Scenario	Contextual factors			
	Location	**Primary use**	**Wildfire history**	**Likelihood of fire**
1	Near urban area	Outdoor recreation	Little or none	Low
2	In remote rural area	Commercial	Little or none	High
3	Near urban area	Outdoor recreation	Little or none	High
4	Near urban area	Commercial	Recent history	High
5	In remote rural area	Commercial	Little or none	Low
6	In remote rural area	Outdoor recreation	Recent history	High
7	Near urban area	Commercial	Recent history	Low
8	In remote rural area	Outdoor recreation	Recent history	Low

Note: All factors have two levels.

Analyses

Conjoint analysis was used to determine if the study strata differed in their acceptability of prescribed burning, mechanical thinning, and doing nothing across contextual factors. The orthogonal design function of SPSS was used to examine the fractional factorial design used to create the eight scenarios. Using this design allowed us to directly assess the main effects of each of the factors on acceptability of fire management strategies. The two-level factors of location, primary use, wildfire history, and current conditions were independent variables, and the acceptability of prescribed burning, mechanical thinning, and doing nothing were the dependent variables.

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Public Preferences for Future Conditions in Disturbed and Undisturbed Northern Forest Sites

Terry C. Daniel
Environmental Perception Laboratory, Department of Psychology
University of Arizona, Tucson, AZ (tdaniel@U.Arizona.edu)

Introduction

Although professional foresters share a reasonably precise and consistent language for describing forest conditions, this language is not always understood by the public. Therefore, verbal surveys alone are not sufficient for determining public preferences for future forest conditions. Orland and Ursavas (this volume) present one way for managers to communicate with the public about alternative forest management options and outcomes. Realistic and biologically accurate visualizations of future forest conditions can help translate complex biophysical data into meaningful information that concerned citizens can understand. *Such carefully created visualizations can aid manager-public communication in a number of contexts including informal "what-do-you-think-about-this" conversations, formal public meetings, research focus groups, and systematic surveys of public opinion.*

This paper describes findings from a survey of residents and visitors to the Boundary Waters Canoe Area Wilderness (BWCAW) and Gunflint Trail area in Minnesota. Participants expressed their preferences for forest management alternatives based on computer visualizations (pictures) of predicted outcomes over time. Because management actions influence forest conditions for decades, it is not sufficient to assess preferences between options at only one point in time. Rather, each management option is best represented as a series of forest conditions that change over years. For this survey, computer-generated visualizations of projected forest conditions showed alternative management options for the same site over an 80-year period. Respondents viewed two projected-outcome visualizations (treatment vs. no-treatment) for the same site and selected their preferred outcome from the pair. Each of the eight sites used in the study was typical of an important northern forest type in the BWCAW/Gunflint Trail study area that had been hit by a major blowdown on July 4, 1999. Five of the sites were severely affected by the blowdown (disturbed sites) and three were not significantly affected (undisturbed sites). Three treatment versus no-treatment pairs were created for one of the undisturbed sites, so there were 10 choice pairs in all. A quantitative rating-scale response format allowed precise measurement of preferences at each of five projected time-steps (2, 12, 22, 52, and 82 years after treatment), as well as overall preferences based on a review of the full 80-year progression of forest conditions.

Key Findings

For disturbed sites (where virtually all trees had been blown down), both visitors and residents generally preferred salvage-and-plant treatment scenarios over no-treatment (natural regeneration) alternatives. For undisturbed sites, both respondent groups consistently preferred no treatment over treatments (thin, or thin and plant). These preferences were consistent with frequently expressed opinions that forest managers should "fix broken sites," but "leave unbroken sites alone." This sentiment will come as no surprise to managers. Participants' choices were guided only by visualizations of projected future forest conditions for actual sites without any indication of which visualizations represented active treatment or no treatment. Our findings therefore indicate there may be a substantial basis for this commonly expressed pattern of public preferences, a pattern based on how the resulting forest looks rather than on preconceptions about forest management.

The strength of respondent preferences for treatment versus no-treatment scenarios was different for different sites. This may be due to differences in the growth rates of the different tree species on each site, differences in soils, or other site-specific conditions affecting treatment response that were reflected in the visualizations. For both of the undisturbed jack pine sites, respondents slightly preferred thinning in the early years after treatment, but this preference dropped off in the later years. For disturbed jack pine sites, respondents had a relatively consistent but moderate preference for treatment conditions (i.e., planting of jack pines) over all time-steps. For disturbed aspen/birch/conifer sites, there was greater variability in respondents' preferences for planting of red and white pines. In general, the thin and the thin-and-plant options were soundly rejected by all participant groups for the undisturbed aspen/birch/conifer site.

Relative to visitors, residents generally showed slightly higher preferences for the projected conditions associated with treatment options for disturbed sites. This finding is consistent with a general tendency for residents to respond more strongly than visitors to the observable differences in forest conditions.

Ratings for conditions far in the future (+52 and +82 years, when most respondents will be dead) factored more heavily into respondents' overall preferences than ratings for the more immediate conditions (+2 and +12 years). This finding suggests that participants were applying a "negative discount rate," which contradicts the usual economic assumption that long-term future benefits are less valuable to consumers than short-term benefits (i.e., a dollar tomorrow is worth less than a dollar today).

Detailed Findings

Some of the key findings from this study will be discussed in the next three sections. All of the results and comparisons discussed below proved significant and were substantially robust in the statistical analyses of project data.

Study Site Specifics

Each of the eight sites used in the study was selected to be typical of important northern forest types in the BWCAW/Gunflint Trail study area. Five of the sites were severely affected by the blowdown (disturbed sites) and three were not significantly affected (undisturbed sites). The biophysical conditions simulated in the visualizations were developed by professional foresters using computer models calibrated to the appropriate forest type and to the initial conditions at each site. For each site, two management scenarios were modeled and visualized. One scenario assumed minimal or no management action (no treatment) and the other assumed what foresters thought would be the most appropriate active manage-ment approach (treatment) for the site. For one of the sites (north poplar undisturbed) two different treatments were modeled and visualized (thin and thin-and-plant), although the same no-treatment option was used for each. One additional pair compared thin versus thin-and-plant for the north poplar site, bringing the total to 10 site/treatment pairs to be evaluated. Characteristics of the study sites and associated treatments are briefly described in table 1.

Table 1.—Brief description of study sites and treatments

Initial condition	Site name	Forest type	Treatment strategy
Undisturbed	Dumpster	Jack pine	Thin to reduce fire risk
	Rotten Jack Undisturbed	Jack pine	Thin to reduce fire risk
	North Poplar Thin		Thin to reduce fire risk
	North Poplar Thin Plant	Aspen/birch/conifer	Thin and plant red/white pine
Disturbed	Trapper	Aspen/birch/conifer	Plant red/white pine and control hardwoods
	Rudy Salvage	Aspen/birch/conifer	Plant red/white pine and control hardwoods
	Rotten Jack Salvage	Jack pine	Plant jack pine and control hardwoods
	Magnetic Lake	Aspen/birch/conifer	Plant red/white pine and control hardwoods
	Guard Station	Jack pine	Plant jack pine and control hardwoods

Three separate views of each site were shown in the visualizations to depict the variability in both initial conditions and post-treatment conditions (illustrated in Orland and Ursavas, this volume). Conditions for each site management alternative were projected for 2, 12, 22, 52, and 82 years into the future. The study described here focused on people's preferences for the no-treatment option versus the treatment option at each forest site, but did not compare people's preferences across different sites

Overall Preferences

Comparisons of residents' and visitors' preferences for treatments (versus no treatments) at disturbed versus undisturbed sites are of particular interest. Figure 1 shows average preference scores over the five time periods and overall scores for treatment options.

Residents and visitors generally preferred visualized forest conditions of treatment options for disturbed sites but preferred the no-treatment options for undisturbed sites. Both groups expressed the strongest preferences for treatment-scenario conditions at the disturbed sites in the first two time periods after treatment (years 12 and 22). For undisturbed sites, both groups had progressively decreasing preferences for treatment options (or increasing preferences for no-treatment options) over the 80-year simulation period.

Figure 1.—Residents, visitors, and students all preferred treatment options (planting) for disturbed sites, but preferred no-treatment options (versus thin or thin-and-plant treatments) for undisturbed sites
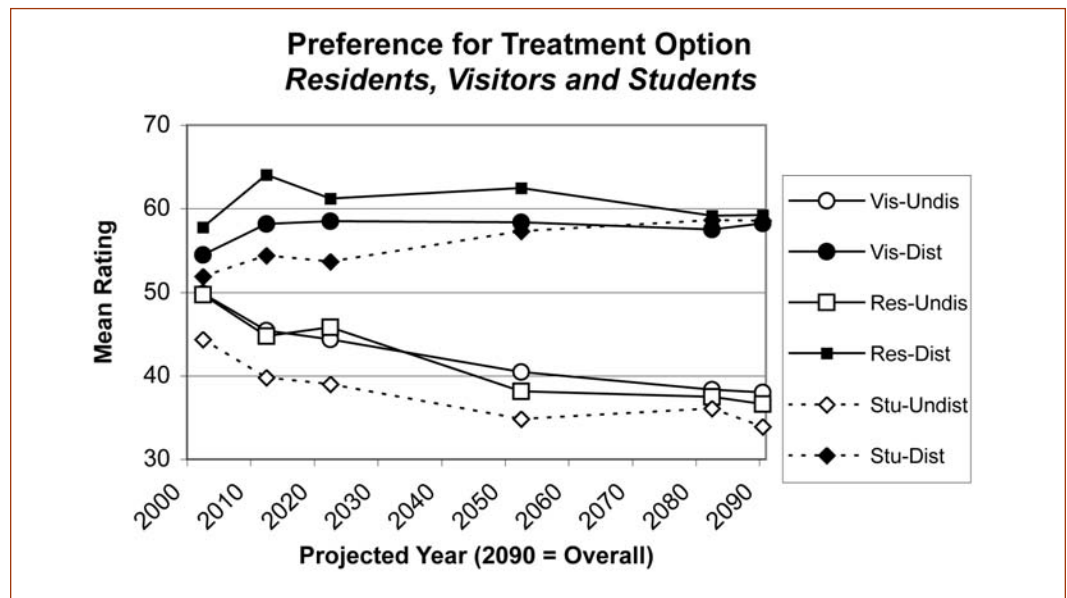
Note: Values below 50 indicate that no treatment is the preferred option.

Also shown in figure 1 are the mean preference ratings for a group of 60 college students from a southwestern university who participated over the Internet. Although these students were not directly familiar with the sites, or the forest type generally, their preference patterns are quite similar to those of residents and visitors, confirming that this basic pattern of preferences can be expected to be quite robust over a number of demographic and other participant variables. Such consistency across groups is commonly found for perceptual judgments based on landscape scenes.

Figure 1 suggests that the overall preference judgments for all groups (graphed at year 2095) tended to most closely match respondents' judgments for the later time periods. This effect was confirmed by multiple regression analyses predicting overall ratings using the separate ratings for each of the five projection-years as independent variables. Ratings for conditions far in the future (52 and 82 years, when most respondents will be dead) weighed more heavily in predicting overall preferences than ratings for more immediate conditions (2 and 12 years). Economists generally assume that future benefits should be discounted; i.e., that a dollar tomorrow is worth less than a dollar today. In contrast, participants in this study gave substantial consideration to environmental conditions that would be achieved far in the future, a finding we are pursuing in ongoing research.

Site-Specific Results

The strength of respondent preferences for treatment versus no-treatment scenarios was different for different sites. This finding may be due to differences in the growth rates of the different tree species on each site, differences in soils, or other site-specific conditions affecting treatment response that were reflected in the visualizations. This finding was anticipated. In fact, the expectation of such differences helped guide the selection of forest sites for this study, and the projected treatments for different sites (including the intensity and timing of treatment stages) took the different initial site conditions into account. The relatively smooth and progressive changes in preferences over time for the disturbed versus undisturbed classes of sites shown earlier in figure 1 reflect the statistical effects of averaging. There is no reason to expect that any particular site would exhibit the exact same smooth and progressive pattern of preferences over the time period simulated.

The left panel of figure 2 shows that the thinning treatment for the Dumpster site (undisturbed jack pine) was generally slightly preferred by both visitors and residents. A similar thinning option for another jack pine site (Rotten Jack Undisturbed or Rjund) was slightly preferred by both groups for the first three time periods (+2, +12 and +22 years), but preferences shifted toward the no-treatment conditions in the later years (+52 and +82 years), especially for residents. The initial condition for both of these undisturbed sites was a rather dense uniform stand of moderate-size jack pines. Apparently the thinning treatments tended to improve attractiveness for the first few time-steps, but

Figure 2.—Preference patterns for visitors and residents over time for individual study sites within disturbed and undisturbed classes
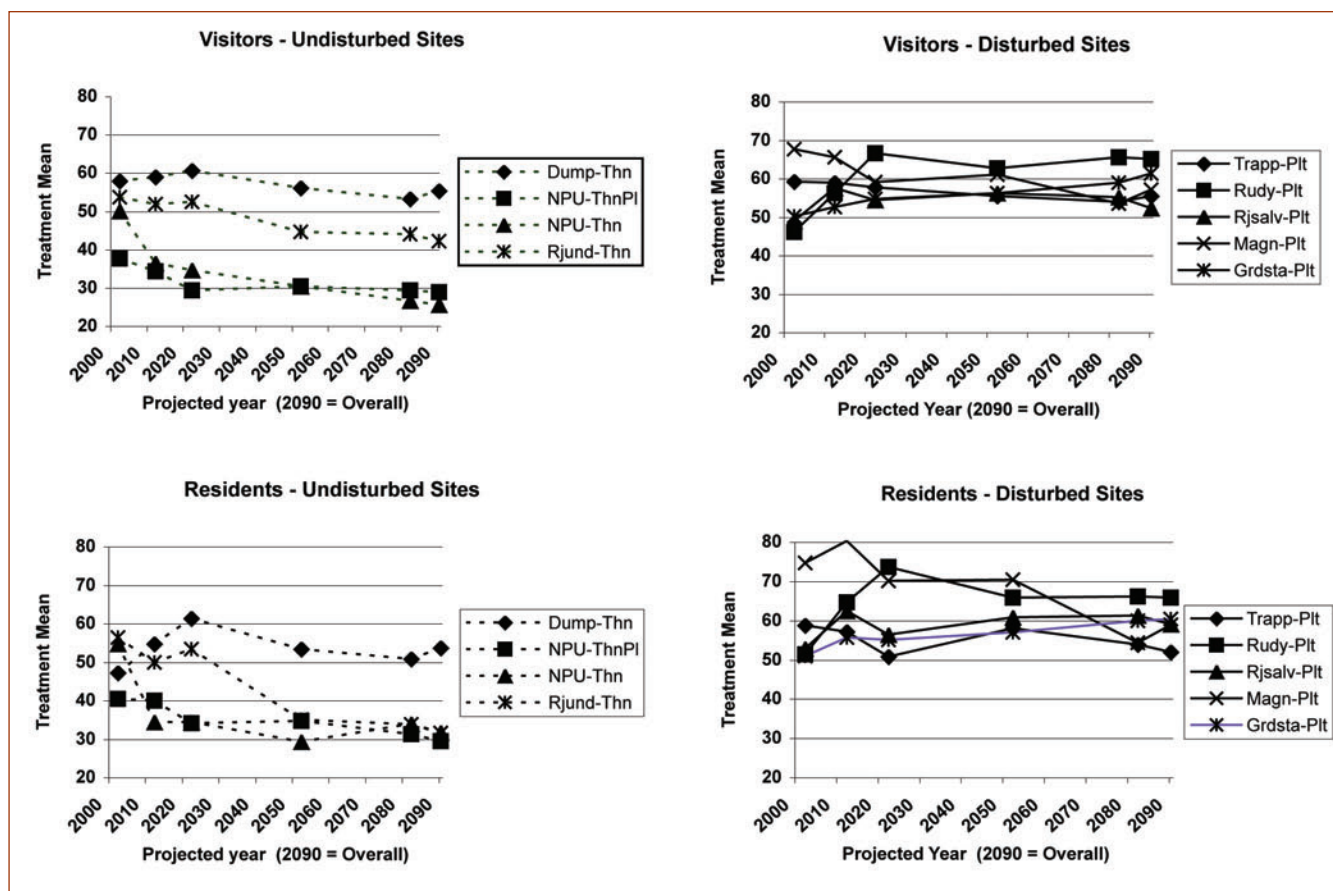
Note: Values below 50 indicate that no treatment is the preferred option.

this perceived improvement failed to hold up as the forest grew in the later years, most dramatically so for the Rotten Jack site. Residents and visitors both preferred no treatment to either of the treatment options for North Poplar Undisturbed (NPU), with the treatment condition generally faring progressively worse over time periods. Based on the visualizations, none of the participant groups were favorably impressed with the effort to shift this stand from a mixed aspen/birch/conifer forest toward a red and white pine forest by thinning and then suppressing regeneration of hardwoods.

For disturbed sites, visitors and residents consistently preferred planting treatments over no treatment with natural regeneration (right panel of figure 2). Residents also generally showed slightly higher preferences than visitors for the projected conditions associated with treatment options, especially for the Magnetic and the Rudy sites. This is consistent with a general tendency for residents to be more sensitive than visitors to the changes in represented forest conditions. The Magnetic site also showed a

distinct pattern of stronger initial preferences for treatment that then declined progressively over time. In contrast, Rudy (another aspen/birch/conifer site) showed no difference in preferences for initial treatment versus no treatment, followed by an increase in preference for the treatment scenario by the +22-year time-step, where it leveled off. Respondents showed a relatively moderate but consistent preference for treatment conditions (versus no-treatment conditions) over all time-steps at both disturbed jack pine sites (Rotten Jack Salvage and Guard Station) and at the Trapper (aspen/birch/conifer) site.

Study Background

On July 4, 1999, the "Blowdown" profoundly changed hundreds of thousands of acres of northern forest. Among the heavily affected areas in the U.S. were public forests around the Boundary Waters Canoe Area Wilderness, including a narrow peninsula of private and public lands along the Gunflint Trail in northern Minnesota. The immediate effect of the blowdown was an immense tangle of uprooted and snapped-off trees that blocked roads, trails, and canoe routes over miles of the landscape. At the beginning of the study reported here (2000), some of the disturbed areas had already been salvaged and cleared, and some had recently been planted. In many places, however, there were still large areas of downed trees, all pointing in the same direction ("the wind went thataway"). These dramatic changes have continued to affect forest conditions and will for decades to come. The blowdown stimulated both public interest and forest management action. Forest managers and the public generally agreed that the "fuels" in blowdown areas had increased wildfire hazards and that affected areas should be restored to ecologically healthy, less hazardous conditions. There was considerably less agreement about exactly how this should be done and about what future conditions forest managers should strive to achieve. This latter concern was the focus of the study described here.

Participants

A total of 215 visitors and 85 residents agreed to participate in the visualization-comparison survey during the summer of 2003. Participants were intercepted at the Gunflint Ranger District Office (where most were on their way to or returning from a BWCAW trip), the Gunflint Trail Association Visitor Center, the Java Moose coffee shop (which had a mix of residents and visitors/tourists), and the town RV Park (which had medium- to long-term visitors) in Grand Marais, MN. In addition, respondents were recruited from various lodges, outfitters, and camping facilities along the Gunflint Trail. Although no claim of a formal "probability sample" can be made, responses to personal information questions confirmed that a very broad cross section of residents and visitors participated in the survey. The similarity of results obtained from a sample of university students further indicates that the general response patterns observed can safely be generalized over a considerable range of participants.

Procedures

Visualizations were presented for evaluation on individual laptop computers. Participants first read a brief background about the BWCAW-Gunflint Trail study area, the blowdown and its effects on the forest, and public forest managers' desire to know public preferences for future conditions in the area and for northern forests in general. A standard set of instructions described the procedures to be followed in the study. Each participant proceeded independently at his/her own pace to view and evaluate the treatment versus no-treatment pairs for each of the sites assigned and then to answer a few questions about themselves.

Evaluations for each site were preceded by digitized photographs showing initial conditions for the three selected scenes at the site. The two photo-simulated visualization options for each site were then presented one above the other on the computer screen, and participants indicated their preference between them by clicking on a scale presented at the right of the screen, as illustrated by figure 3. For each site, the treatment and no-treatment options were shown over the five time-step periods by visualizations of the same three views shown in the initial condition photos. The respondent had to choose one photo from each of the treatment/no-treatment pairs (there was no 50/50 response option) and indicate the strength of the preference for the chosen option by selecting a value from 60 (minimal

Figure 3.—Typical choice display screen showing treatment (upper) versus no-treatment (lower) options for a northern forest study site for year 2082
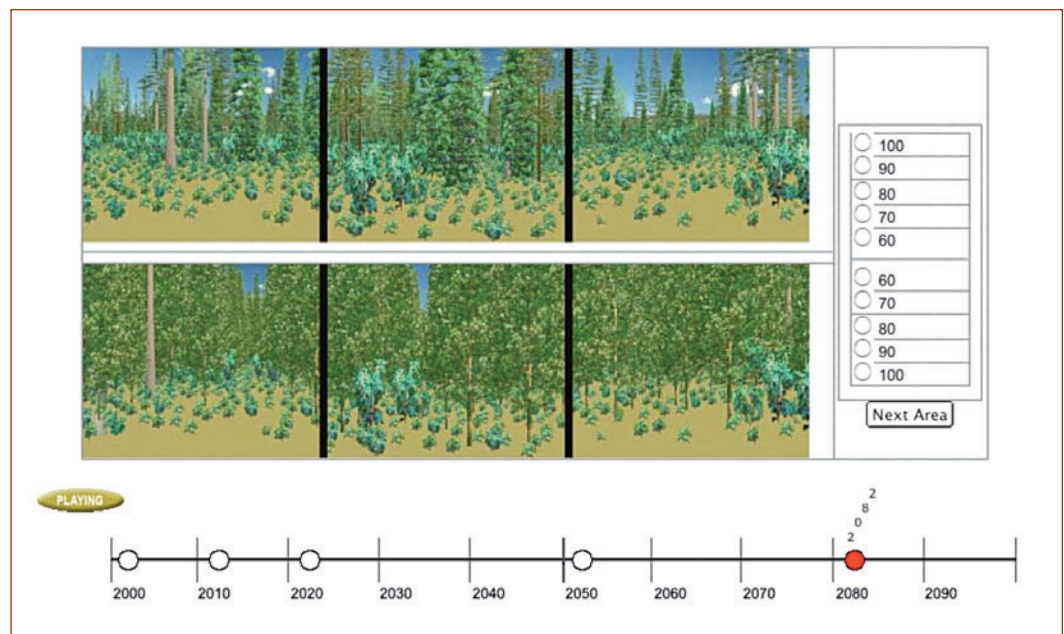
preference) to 100 (maximum preference) on the response scale. For each site, respondents first separately recorded choices/ratings for visualized treatment-versus-no-treatment pairs at each of the five projected time periods (2, 12, 22, 52, and 82 years). Then an animated slide show ran the treatment-versus-no-treatment visualizations for that site in sequence over the full 80-year projection (as indicated by figure 3). The participant viewed this slide show as often as desired and then recorded her/his overall evaluation using the choice/response scale.

Each participant evaluated a random selection of 7 of the 10 visualized site/treatment pairs. The order of pairs and the position of treatment/no-treatment options (top/bottom) were individually randomized for each participant. Choices/ratings were automatically entered into a database and transformed into a measure of the degree of preference for the treatment member of each pair. Scores could range from 0, minimum preference, to 100, maximum preference for the treatment option.

Acknowledgments

Characteristics People Consider when Evaluating Forest Landscape Attractiveness: Fuel Management Implications

Melinda Merrick and Joanne Vining
Department of Natural Resources and Environmental Sciences
University of Illinois, Urbana/Champaign, IL (jvining@uiuc.edu)

Introduction

The management of public land depends highly on the relationship managers have with the public. An effective relationship requires a good understanding of both how people experience natural environments and how they perceive various forest and land management strategies. Understanding public perceptions of visual beauty, attractiveness, and the relative health of national forests is important because many of these elements contribute to the public's acceptance of or resistance to manager's practices and policies. In fact, the public's initial visual reaction to forest environments can play an important role in the development of attitudes and values about forest management.

In this paper[1], we will discuss research findings on specific elements people consider when making decisions about the relative attractiveness of differently managed forest environments. By recognizing which indicators people use when judging the overall attractiveness of a forest, managers will gain a more comprehensive understanding of how the public perceives and interacts with federally managed land. This understanding can help managers design fuels treatments and ecosystem restoration projects that are more likely to meet with public approval while still achieving management objectives.

Key Findings

We were interested in the psychological processes—observations, knowledge, feelings, and emotions—by which participants were making decisions on forest management scenarios. We analyzed transcripts from research participants from northern Minnesota and Illinois who were asked to think aloud while choosing between different computer-generated forest management depictions. This research technique, know as process-tracing, enabled us to uncover the overall cognitive and emotional processes that participants experienced while completing the decisionmaking exercises and provided a rich source of contextual meaning for participants' decisions.

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[1] The findings of this paper are part of a larger study in which our goal is to identify and examine knowledge, feelings, evaluation, and decision processes on fuels treatment scenario preferences using qualitative data collection techniques. Our qualitative findings are meant to complement the quantitative computer-simulated conjoint choice experiments (being simultaneously conducted by Terry Daniel at the University of Arizona and Brian Orland at Penn State University) by adding contextual meaning and depth to the survey findings. Because the larger project is ongoing, we will present only the qualitative findings in this paper, which we found to offer many insights about the public's perception of management techniques.

We identified nine elements of forested environments that people observe when making decisions about the relative attractiveness of a forest. In descending order of frequency of comments, they are:

• Specific characteristics of the vegetation, particularly those related to forest health.

• The experiential potential (i.e., what experiences the scene afforded).

• Human/environment interactions.

• Characteristics of the forest undergrowth.

• Nonvegetative scenery elements, such as the sky.

• Wildlife considerations.

• The naturalness of the setting.

• Familiar forested environments.

• Nature's cycles.

Understanding how these elements shape aesthetic preferences can guide managers as they develop fuels management programs. Managers can better adapt to public preferences either by highlighting how a treatment supports key values, such as forest health, or by adjusting treatments to take into account key concerns, such as access and valued places.

Although only one of our participants mentioned fire specifically, their overall favorable disposition toward active forest management may include management for fire as well. Because the scenarios the participants reviewed were based on fire management outcomes, the comparison with quantitative data mentioned above will help with this sort of interpretation. *However, it is important to note that fire does not appear to be anywhere near uppermost in our participants' thoughts.* This may have implications for fire management programs in which recognition of fire danger is prominent.

Detailed Findings

Specific Vegetative Characteristics

The most frequently occurring category that participants mentioned involved the **characteristics of the forest, trees, and plant life**. One of the most important findings was the emphasis placed by many participants on **forest health**. Three-fourths of the participants mentioned the **health of the forest** and trees as criteria for making their decisions.

> *I like the top one again. It's the same reason. The trees look healthier.*

Because fire management strategies are often undertaken with forest health as a primary goal, it is clear from our data that this is an important objective to emphasize to the public. However, what "healthy"

means seemed to vary among individuals. It is important to examine public interpretations of the meaning of a healthy forest in future research.

Almost all of our participants (19 out of 20) mentioned the **amount of life and quality of growth** depicted in the images as contributing to their preferences. This category included comments on growth, death, lushness, damage, fertility, development, survival, disappearance, and burned trees.

> *Well, seemingly the more growth apparently the healthier the environment all around, that's my impression.*

Almost all of the participants (19 out of 20) mentioned the **spacing** of the trees and vegetation as indicators of why they were choosing one scenario over the other. We coded all references to more, fewer, thicker, thinner, dense, full, dwindling, crowded, well-spaced, individuality, clumping, neater, tidier, symmetrical, and messy trees under this category. Out of 163 text sections coded for this category,[2] 93 indicated that more dense trees and fuller forests were preferred over less thick, sparse forests as in the following quote from a participant.

> *Well, seems like more vegetation, the greater the chance of more healthy undergrowth and animal health.*

This finding is in contrast to decades of scenic preference studies that have shown that people prefer more open and park-like forests. However, many of the responses (67) indicated a preference for less crowded, tidier forests as in this quote.

> *Again, I like the top one. The bottom one's too overgrown. I like the more open look.*

Moreover, other comments about accessibility, line of sight, and recreation may point to the desire for a more open forest. This seeming "conflict" in findings may reflect the tension between visual preferences (an open forest) and the importance of forest health (more growth may be seen as healthier). Of course, additional research would be needed to test this hypothesis.

Also mentioned in this category was the **identification of particular species of trees**, such as birch or elm trees, and **types of trees**, such as deciduous, or evergreen. Many participants also noticed details of the **different components of the trees** depicted in the simulations, such as tree trunks, branches, and leaves. Participants frequently discussed the **age and size of trees** as well as a variety of different types and species of trees in the simulations. The following quote exemplifies the comments of many of these different characteristics of the trees and forests.

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[2] In 3 of the 163 text units coded in this category, it was unclear if the participant preferred more or less density of trees.

Now that the trees have grown to their full size it seems, I can't see much of a difference other than the types of trees that are planted. And I'm definitely seeing a lot more pine trees on the top slides and so I would have to choose the bottom slides but I do not like the random trees. And I don't know if this could be due to nature and the wear down of the trees but I really don't like how there's some tree trunks where there's no leaves or branches but they're just tall, skinny, gray tree trunks so they look very out of place. Because they seem like they're, out of all them, they kind of stick out because they look like they're old and something happened to them. And I definitely do not like that pine tree on the first slide of the bottom half. Because now there's no leaves and it just looks very prickly and very out of place. So I'd have to give the bottom one a 70 because there's a difference but not that large of a difference in preference.

Other characteristics of the forest, trees, and plants that participants discussed included the openness of the forest, the concept of trees as a natural resource, the differing height of trees, the incidence of fallen trees, the attribution of emotions to trees, the interaction of different types of trees, and the indigenous nature of the depicted forest scenes.

Experiential Potential

The next most frequent metacategory of responses was based on the participants' **perceptions of how they would experience the forest**. Many times, participants put themselves in the forest scene and described how they would interact with the various components of that setting. Participants most frequently discussed the **sensory experience**, which included comments on visual beauty, pleasantness, scenic beauty, aesthetics, amount and shade of greenness, amount of vividness, quality of colors, color scheme, contrast of colors, attractiveness, hearing of forest noises, and physical feelings.

I really think that the colors in this particular one are more vivid. And the trees look a little bit more alive than they did in the top level.

Several participants also expressed **emotions** as they commented on the visual images. Most of the comments on emotions dealt with specific emotions including happy, strangeness, love, fear, anxiety, claustrophobia, overwhelmed, lost, safe, calm, comforted, upset, refreshing, and uncomfortable.

Trees have an amazing spirit when they get that old, just lovely to be around. [There is a] very calming effect and a comfort when you walk in an old growth forest. It's like something goes beyond you the human, something you know has been there, weathered the tides, and is probably going to keep on growing providing no one cuts it down, and keeping track of the planet even after we die, fade, we have very short life spans compared to some of the trees.

Several participants also mentioned **ease of travel** and **ease of vision** mostly in terms of recreation and enjoyment of the forest.

> *Well, at this particular time in the forest, for ease of getting around in the forest for recreational activities, I would pick the top one. It looks like I could get through it a lot easier and see things.*

Other experiential characteristics included personal experiences, access to forested areas, perception and distance to the forest, amount of shade, and spirituality.

Human/Environment Interactions

Half of our participants discussed the **level of management** of the forest in terms of the forest looking like it had been managed well or appearing as though a more hands-off approach had been taken. The majority of the comments (22 out of 35) in this category favored management. Participants often preferred one forest scene to another because it looked like it had been cared for and properly managed.

> *We're going right to plan A because it looks like they've actually come and done something, and Plan B it looks like they're just, they're letting it continue growing, where plan A they came and actually took a bunch of trees out.*

> *In this set of pictures, a lot of trees grew on the bottom set of slides. I guess that was the one that was replanted. Well, I'm all for reforestation rather than letting it come up naturally so I'm going to switch over to the bottom.*

Only one comment favored a hands-off approach to the management of forests. Twelve of the comments in this category were observational or neutral comments, such as this one.

> *Now in this one I really like, we got a little fairy book story forest on the top here so it looks very not taken care, in the sense of being taken care of by humans, but tidy nonetheless.*

About one-fourth of the participants also mentioned **logging issues**. Of the 22 comments we coded for logging, 15 favored logging, one opposed it, and six were merely observations that the scene looked as if it had been logged recently. The following quote is an example of a logging supporter.

> *I don't like the size that they're letting the trees get in plan B so we're going with plan A because they aren't quite as big yet. And I go back to the same thing. I don't think our forests should be let to get as old as they get to till they fall down due to age rather then taking them out through logging.*

Many participants discussed the ease of travel for recreation through the forest, and many favored logging at some level, which may indicate that participants did not oppose management of forest environments. The latter is supported by the fact that 22 out of the 35 comments that specifically addressed forest management favored ongoing forest management practices rather than a hands-off approach. However, this finding should be interpreted with caution because of the small number of participants, as well as the fact that half of the participants were from the Grand Marais, Minnesota area, where timber extraction is a source of financial welfare.

Other comments related to human/environment interactions were about human interventions, the forest as an economic asset, responsibility and understanding toward nature, development in forested areas, and fire prevention actions. Although this comment is not representative of the majority of the opinions of the participants, it captures many aspects of human/environment interactions.

> *My main consideration I think is keeping the forest as natural as possible, nature knows what she's doing. However, the more man involves himself in disrupting the ecosystem, perhaps the more responsible we are in trying to maintain its natural state. Do we or do we not interfere with the natural life course of the buffalo shall we say? Do we let them die and starve or do we go in there and manage and support their life through intervention?*

Characteristics of the Forest Undergrowth

This category included comments on less, more, bushy, thick, and more open groundcover. More than half the participants mentioned the quantity of **undergrowth** as factoring into their preferences of the forested environments.

> *There is less brush, underbrush, up in the upper picture. Makes it easier to walk through.*

> *Now definitely we're starting to see a change here, and I am definitely more for the upper slide simply because here we're getting a lot less undergrowth and which just means that obviously there are trees in this management plan that do not promote that undergrowth.*

A few participants also commented on the health of the undergrowth.

Remaining Elements

Participants also talked about **characteristics of the scenes** that were not directly related to the forest, or directly manageable, such as the sky, terrain, soil, weather, landscape, and water as affecting their decisions.

> *With the blue sky and with the white clouds against the dark background, it makes it a little more vivid.*

Only a few participants mentioned **wildlife** in terms of habitat, specific species, health, variety, migration, and quantity. Participants also occasionally mentioned the idea that they preferred one scene to the other because of an inherent **quality of naturalness**.

> *I like the top one. It looks fuller, better taken care of, more natural. I like the natural look.*

Less than half (8) of the participants mentioned **specific sites** in their comments about the forest management images. These included Yellowstone, east/west coast, Minnesota, Gunflint Trail, Grand Marais, and California. There was also some mention of **natural cycles** in participant comments involving ecosystems, birth/life/death cycles, seasons, and environmental cycles.

Finally, only one participant mentioned **fire** specifically, as follows:

> *The same way with fighting forest fires, do we just let it happen, and it's my understanding that the more we try to, or in the past, the more we tried to manipulate the forest, the more harm we can bring to it because we weren't completely aware of the system itself. Whereas nature doesn't need to think about it, she just proceeds for its own benefit. If we were to cut out all the underbrush due to fire threat, what would that do?*

Background Information

The perceptions, values, and motives of land managers and members of the public are derived from different personal and professional backgrounds and are thus likely to differ significantly. For example, forest managers report less emotion and are more likely to endorse commodity-based forest management goals than either the general public or environmental group members (Vining 1992, Vining and Ebreo 2002).

The specific contributions of knowledge, feelings, and beliefs that determine individual environmental policy preferences in the minds of either trained managers or the lay public is complex and difficult to capture. In this study, we were interested in the processes by which participants were making decisions about their preferences of forest management scenarios. Therefore, we were not solely interested in the particular choices of the management plans, but in the types of observations, knowledge, feelings, and emotions that contributed to those decisions.

To learn about this decisionmaking process, we used a technique called process-tracing (Ericsson and Simon 1984, Justin and Montgomery 1999). This is a procedure by which a participant completes a

decisionmaking task while speaking about any thoughts, opinions, feelings, memories, and previous knowledge that the particular exercise is eliciting. Researchers then analyze these processes to help reveal motives, values, emotions, and choices among tradeoffs that are typically unable to be measured by more conventional data collection techniques, such as quantitative-based questionnaires. The process-tracing technique enables researchers to view the overall cognitive and emotional processes that participants experience while completing decisionmaking exercises and provides a rich source of contextual meaning to the decisions participants are making.

We identified nine elements of forested environments that people observe when making decisions about the relative attractiveness of a forest. We did this by analyzing the content of participants' process-tracing transcripts. The results of this study reflect some of the thoughts and mental processes that contribute to public perceptions of managed forests and preferences for certain types of management over others. Most participants successfully performed the process-tracing task. Only one participant had difficulty with the task (either he didn't speak into the recorder or spoke so softly we could not understand his comments) and his results were not used in our analyses. Although process-tracing data take time to analyze, we believe this approach has good potential for further studies of public responses to management scenarios and forest features.

Methods

Instrument. Our instrument was a self-guided computer-based questionnaire, which used SmartForest, a forest visualization application developed at Penn State University (see Orland and Ursavas this volume). This protocol was developed to visually simulate various forest management scenarios over an 80-year period. The exercise required the participants to choose between two different forest management options at five separate points (2, 12, 22, 52, and 82 years) throughout the 80-year timeframe based on only visual changes in the forest. They then evaluated the same management options overall based on a computer-simulated sequence showing the full 80-year projection of conditions for each treatment. The questionnaire led the participants through several choices of simulated panoramic forest scenes and required them to rate their overall preference on a percentage-based scale that forced them to prefer one of the scenarios over the other in varying degrees of their choice. The self-administered questionnaire included an introduction that described the goals of the study and a very detailed set of instructions and examples for participants.

Participants. Participants were 10 residents of the Gunflint Trail/Boundary Waters Canoe Area Wilderness region in Minnesota as well as 5 Illinois residents and 5 University of Illinois students. We recruited Minnesota residents by contacting a random selection of residents from the region of interest and

posting announcements at various locations and on a homeowner's association e-mail list. Illinois residents were volunteers from a local not-for-profit group not affiliated with forest management or environmental issues. We randomly selected the University of Illinois students to participate in the study. All participants were given a small stipend for their participation in the study.

The sample size for this study—20 participants—is typical for qualitatively oriented studies, such as process-tracing. Because the data we received from each participant are so rich and detailed, process-tracing results from 20 participants provided us with a rather large dataset. Another indication that 20 subjects was an adequate sample size is that we began to recognize many of the same themes and found no new themes as we reviewed the last group of participants' transcripts, leading us to conclude that most participants were experiencing similar cognitive and emotional processes while completing the decisionmaking exercise.

Procedure. We conducted the process-tracing procedure at various locations most convenient to Minnesota participants, mostly in the homes of the individual participants. Illinois participants completed the experiment at the Human Nature Research Laboratory on the University of Illinois Urbana/Champaign campus. We gave each participant a short description of the study by stating we were interested in people's perceptions of different forest management scenarios. We also told the participants we were specifically interested in the processes that lead people to decide between the different forest management scenarios. After this explanation, we introduced the concept of process-tracing and explained that we would like the participants to think aloud while they were completing the questionnaire. We instructed them to say anything that came to their minds even if they didn't think it was related to the survey. We mentioned to the participants that they should feel free to speak about any thoughts, feelings, memories, previous experiences, or anything they were thinking about while making their decisions. After ensuring the participants understood their task and how to operate the laptop and tape recorder, we left the room so the participants had complete privacy.

Each tape was transcribed verbatim in its entirety and analyzed by using the QSR N6 text analysis program for qualitative data analysis. Three researchers independently read the transcripts to determine themes that participants talked about while taking the survey. We developed a coding scheme from these analyses and coded each section of text using the QSR N6 software program. This program allowed us to attach various codes to each section of transcribed text and to keep track of the occurrence and frequencies of the categories of coding.

Detailed Results

In table 1, we depict the frequencies of the themes that emerged from the text of participant responses. The first column describes the coding category. The next three columns signify the frequency of occurrence that MN (Minnesota residents), IL (Illinois public residents), and ST (student participants) mentioned in each coding category. The "total" column gives the total amount of times each coding category was mentioned by all participants. It is important to clarify that these numbers do not indicate the number of participants who mentioned these various categories. They indicate the frequency in which participants mentioned each category throughout the duration of the exercise. The last column, "#Par," indicates the number of participants who mentioned each coding category. For example, the quantity and spacing of trees and vegetation, the first coding category listed, was mentioned 163 times by 19 participants. The 163-time frequency is broken down by type of participant, MN, IL, or ST.

As table 1 indicates, nine categories emerged from the analysis of participant responses. Remember that participants were discussing the reasoning and thought processes that contributed to visually identifying which forest management scenario they preferred. Because these categories emerged from participant responses and not from a previously conceived coding pattern, they help us better understand which elements in forested environments people observe when evaluating the relative attractiveness of a forest.

Table 1.—Frequency of themes by subject group, conjoint choice process-tracing analyses

Characteristics of the forest/trees/plant life	MN text units	IL text units	ST text units	Total text units	#Par. N=20
Quantity/spacing of trees/vegetation	55	30	78	163	19
Amount of life/quality of growth	39	13	55	107	19
Health of forest/trees	24	23	46	93	15
Species of trees	49	6	23	78	11
Type of trees	27	7	33	67	14
Qualities of different components of trees				66	
Qualities of tree trunks	1	4	19	24	9
Qualities of braches	4	3	6	13	4
Qualities of leaves	0	0	29	29	4
Age of forest/trees	47	2	17	66	12
Size of trees	32	4	22	58	14
Variety of trees/plant life	14	2	11	27	11
Openness	9	10	7	26	9
As a resource	17	4	2	23	6

MN = Minnesota residents; IL = Illinois residents; ST = student participants.

Table 1.—Frequency of themes by subject group, conjoint choice process-tracing analyses (continued)

Characteristics of the forest/trees/plant life	MN text units	IL text units	ST text units	Total text units	#Par. N=20
Height of trees	2	2	17	21	7
Fallen trees	10	1	3	14	5
Emotion attributed to forest trees	3	2	0	5	3
Interaction (compatibility) of different types/species of trees	1	0	0	1	1
Indigenous nature of forest/trees/plants	1	0	0	1	1
Experiential characteristics of the scene	**MN**	**IL**	**ST**	**Total**	**#Par**
Sensory experience	32	32	54	118	18
Emotional qualit.ies				30	
Gut feeling	1	0	1	2	2
Emotional attachment	1	0	0	1	1
Specific emotions	5	1	20	26	7
Idealism	1	0	0	1	1
Ease of vision	5	1	21	27	6
Ease of travel	12	2	8	22	8
Recreation	11	2	1	14	5
Enjoyment	7	2	2	11	7
Personal experiences	0	3	3	6	3
Access	2	1	0	3	2
Perception/distance to forest	1	1	0	2	2
Shade	1	0	0	1	1
Spirituality	1	0	0	1	1
Human/environment interactions	**MN**	**IL**	**ST**	**Total**	**#Par**
Level of management	24	8	3	35	10
Logging issues	20	0	2	22	5
Human interference/intervention	4	0	1	5	3
Economic impact/issues	2	0	1	3	3
Responsibility towards nature	1	0	0	1	1
Understanding nature/patience towards nature	1	0	0	1	1
Development/human growth/property issues	1	0	0	1	1
Fire prevention actions	1	0	0	1	1
Characteristics of underbrush/undergrowth/shrubbery	**MN**	**IL**	**ST**	**Total**	**#Par**
Quantity of underbrush/vegetation on forest floor	28	3	4	35	11
Presence of underbrush	6	3	6	15	10
Health of underbrush	1	2	2	5	5

MN = Minnesota residents; IL = Illinois residents; ST = student participants.

Table 1.—Frequency of themes by subject group, conjoint choice process-tracing analyses (continued)

Characteristics of other parts of the scene	MN	IL	ST	Total	#Par
Sky	4	8	15	27	11
Mountains/terrain	1	1	9	11	6
Soil	4	2	0	6	2
Weather	1	0	3	4	2
Landscape	0	0	4	4	3
Water	1	0	0	1	1
Wildlife (nonhuman animals) aspects	**MN**	**IL**	**ST**	**Total**	**#Par**
Wildlife habitat	2	3	3	8	4
Specific mention of wildlife	3	0	0	3	2
Wildlife health	3	0	0	3	2
Variety of wildlife	2	0	0	2	1
Wildlife migration	2	0	0	2	1
Amount of wildlife	1	0	0	1	1
Natural/unnatural	**MN**	**IL**	**ST**	**Total**	**#Par**
By virtue of definition	0	6	0	6	1
Natural regrowth vs. planned regrowth	5	0	0	5	2
Natural phenomena	3	0	1	4	3
Qualities of nature	1	0	0	1	1
Sites mentioned	**MN**	**IL**	**ST**	**Total**	**#Par**
Subject mentioned a specific site	7	3	5	15	8
Systems/cycles	**MN**	**IL**	**ST**	**Total**	**#Par**
Ecosystem	3	0	0	3	1
Cycle of birth/death/life	2	0	0	2	2
Seasonal cycles	0	1	1	2	2
Environmental	1	0	0	1	1

MN = Minnesota residents; IL = Illinois residents; ST = student participants.

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Barriers to Community-Directed Fire Restoration

R. Bruce Hull and Bruce E. Goldstein
Virginia Tech, Blacksburg, VA (hullrb@vt.edu)

"Institutions structure landscapes as fully as mountains and seasons… the means by which they decide what to do powerfully influence how fire appears on the land." Pyne (2004: 189)

Introduction

A consistent finding from disaster research is that new social norms and groups often emerge from the chaos and power vacuum that disasters create. An agency's early interactions with new (or emergent) groups can foster or diminish collaborative potential (Sturtevant *et al.* 2005). Post-disaster dynamics present unique challenges to creating collaborative relationships: the groups initially offer only vague expressions of concern and they do not know how to deal with agencies. Moreover, natural resource managers and other agency representatives have little familiarity with the group's goals and capabilities. The natural resource manager's understandable uncertainty about how to deal with these groups can get misinterpreted as obstructionist or attempting to disguise official negligence. As a result, first encounters are often strained, because representatives of the emergent groups may perceive agency personnel as being unsympathetic, unwilling to help, and even scornful of citizen involvement (Stallings and Quarantelli 1985).

By engaging with an active, involved citizenry, land managers can assist their communities in devising effective fire management and restoration strategies that integrate alternative land uses with different expectations of people and nature. Fire restoration can be more than erosion control, fire suppression, and revegetation, but this requires a willingness to listen to outside knowledge and consider alternative visions of how to manage the environment. In 2003, in the wake of an enormous wildfire in San Diego, a coalition of scientists, conservationists, and land managers proposed an alternative way of thinking about fire and the region. We examined interactions between the group that formed and land managers after the fire to better understand the dynamics of working with such emergent groups.

Key Findings

Results from a case study after the 2003 Cedar fire near San Diego suggest that managers can improve community relations and harness new collaborative potential that emerges during times of disaster by taking the following steps:

• Expect community groups to emerge following a disaster, get actively involved with their efforts, and be sensitive to their initial ignorance about established policies and procedures.

- Appreciate that agency norms and procedures have benefits and costs. Agency practices and programs provide needed resources and structure in a time of chaos. However, adhered to too closely, agency norms also can suppress new ideas and solutions that typically emerge from communities mobilized during disasters.

- Recognize that the bureaucratic implementation of pre-disaster programs and priorities can help focus a community on critical tasks. However, these same programs can frustrate community members and create adversarial relations if these efforts are seen as suppressing alternative ideas, goals, and methods.

- Find ways to connect agency culture and practices with the culture and needs of the emergent group. In normal times, these connections are made through regular public participation channels, but during crises, emergent groups do not have the benefit of time.

Detailed Findings

Expect community groups to emerge following a disaster, get actively involved with their efforts, and be sensitive to their initial ignorance about established polices and procedures.

Research on other natural hazards has shown that after a disaster a search for meaning and direction occurs among the affected populace as they reconstruct the event and debate strategies for recovery. Citizen groups emerge to take on a variety of tasks, from immediate disaster assistance to long-term planning. Groups pursuing longer term goals of mitigation and restoration usually have small memberships of about 100, with a half-dozen active members at their core. Decisionmaking is typically informal and democratic, and the organizational structure is flat. In their initial contacts with agency personnel, these groups may not know how to influence public policies and may present only vague ideas about wanting to "live in a safe place" (Schneider 1992; Stallings and Quarantelli 1985: 95-96).

Such a group emerged in San Diego in 2003. While the Cedar fire was still burning, e-mails began to be sent out to a loose network of conservation activists, land managers, and biological consultants. On October 30, 80 people attended a hastily assembled meeting, where they agreed to take part in an association they named the San Diego Fire Recovery Network, or SDFRN (which they pronounced *EssDeeFern*). Members were well-informed about regional ecology and environmental planning and policy because of their participation in local habitat conservation plans. For the next 4 months, core SDFRNers remained in nearly daily contact with one another, guiding their coalition in creating a strategic plan, posting draft articles and editorials on their Web site and listserv for review, sharing impressions of initiatives to address landscape hazards caused by the fire and mitigate future fire risk,

and conducting a regional assessment of flora and fauna. Listserv postings requested, exchanged, and debated information, some of it critiqued as misinformed. Scientific readings were identified and a conference was organized to clarify the most debated topics.

While SDFRN members possessed a great deal of conservation expertise, they knew little about fire policy and management and they approached agencies with vague requests. Regular meetings were held in which some managers and other agency personnel participated but ultimately SDFRN was unable to integrate their positions with the existing public participation mechanisms. In hindsight, it seems that more emphasis should have been placed on the active participation of managers in the SDFRN process, which would have better enabled agency personnel to help the emergent group educate itself about agency science, agency programs, and political realities. In turn, managers would have had more opportunities to understand the group's perspective and take advantage of the large pool of local environmental expertise the group offered.

Appreciate that agency norms and procedures have benefits and costs. Agency practices and programs provide needed resources and structure in a time of chaos. However, adhered to too closely, agency norms also can suppress new ideas and solutions that typically emerge from communities mobilized during disasters.

Another important finding from studies of previous disasters is that an agency's "culture of response" can direct a community's trajectory of recovery, forever changing community form and function. On the positive side, agency norms and procedures after a disaster can help focus and prioritize action on critical tasks. On the negative side, institutional practices can limit the scope and method of a community's efforts by ignoring or suppressing ideas and solutions outside agency norms (Dyer 1999).

Content analysis of post-fire agency studies and related documents, combined with key informant interviews, helped us develop the following description of the agencies' norms that guided their actions after the fire. We call this description of the fire event and necessary restoration the Control and Protect regime (the essential features appear in bold):

> As in much of the American West, **decades of fire suppression** have allowed **unnatural** accumulation of **dry brush** in the San Diego region. After the last 5 years of drought, the potential arose for a **historically unprecedented firestorm** that **overwhelmed regional fire-fighting capacity**. After the Cedar fire began, firefighters even **lacked the surveillance or communications capacity** required to rescue **helpless residents** caught sleeping in their homes. The role of government is to **protect citizens and their property.** Fire control and restoration should be organized by **government agencies advised by professionals, scientists, and other experts.**

Restoration efforts should strive to reduce future risk to citizen life and property by **reducing fuel loads** through **prescribed burning** or other means, by creating **defensible perimeters** around structures, and by other programs that protect structures and people living in or near flammable vegetation. Risk can further be reduced by **technological enhancement** of **fire-fighting capacity**.

SDFRN had its own set of norms. From content analysis of SDFRN e-mail and documents and key informant interviews, we developed the following description of the fire event and necessary restoration called the Between Fires regime (the essential features appear in bold):

The chaparral **ecosystem** is **dynamic** and **self-regulating**, and the Cedar fire was a **normal**, **natural**, **inevitable**, and **recurring** feature within an ecosystem that has **evolved with fire** over millennia and **needs large, stand-replacing fires**. People **cannot control or prevent** chaparral fires, and any attempt to reduce fire risks through controlled burning, clearing, or revegetation may only **convert** this **vulnerable, globally significant** biodiversity resource into highly fire-prone nonnative grassland.

Restoration efforts should emphasize **native** species and **pre-settlement conditions** adapted to fire. Citizens should engage in **land use planning** that **prevents placing people and structures** in locations that will inevitably burn. **Science** provides an important way to understand the situation but is at best **partial** and at worst **biased** by the agendas of sponsors and scientists. **Citizens** should be **mobilized, responsible, and active** in directing restoration, agency action, and regional land use development.

Major obstacles to collaboration resulted from simple but fundamental differences between the two constructions of fire and restoration. For example, a major chasm opened between two competing understandings of fire history and science. Agency managers championed the fire science of Minnich (1983, 2001) that emphasizes the role of fuel load in chaparral fire and thus lends itself to aggressive fuels reduction management, whereas the SDFRNers championed the fire science of Keeley and Fotheringham (1999, 2001) that emphasizes the role of weather and wind in chaparral fire and implies that prescribed burns or other fuels reduction management will have little effect on extreme fires. In the end, neither group successfully stepped outside its norms, and rather than discussing possible common ground and working toward acceptable solutions, agency personnel and SDFRNers chose sides and defended their positions. To avoid such polarization, all parties need to be sensitive to the alternative understandings advanced by emergent groups and work to identify how an agency's more entrenched vocabulary and definitions of issues may create barriers to productive participation and interaction.

Recognize that the bureaucratic implementation of pre-disaster programs and priorities can help focus a community on critical tasks. However, these same programs can frustrate community members and create adversarial relations if these efforts are seen as suppressing alternative or emergent ideas, goals, and methods.

In responding to post-fire issues, the land management agencies understandably advocated pre-existing programs, approaches, and expectations that supported their Control and Protect mandate. When asked by public officials what it would take to prevent future disasters, agencies turned to personnel who were eager to advocate more resources for their programs: greater capacity to control fires, stronger regulations to clear fuels near structures, greater authority to reduce fuel loads, and better science that explained fire, smoke, and erosion control. Moreover, many professional forest and fire managers were not experts in policy, volunteerism, land use, citizenry, and other solutions advocated by SDFRN. Ultimately, the momentum of institutionalized programs with internal advocates carried the day and few, if any, of SDFRN goals were advocated by managers.

The two sides had different visions of what constitutes restored, healthy, fire-adapted landscapes and invoked very different assumptions about the relationship between nature and fire, humans and nature, and the relationship among humans themselves. Neither side really stepped outside its view of fire and nature and society to see the issues from the other group's perspective. It is difficult to think outside the box; it is harder to work there. But recognizing the presence of alternative visions is important if for no other reason than to avoid the poisonous temptations of one-size-fits-all absolutism.

Find ways to connect agency culture and practices with the culture and needs of the emergent group. In normal times, these connections are made through regular public participation channels, but during times of crisis, emergent groups do not have the benefit of time.

The county, USDA Forest Service, local fire authorities, and other agencies have for years promoted and accepted a social contract that obliges them to protect property and people by controlling fire. Society has, until recently, accepted this contract without question, and organizations that have committed enormous amounts of money, time, and expertise to carrying out this contract understandably defend the logic of control and protect. SDFRN described an alternative way to live with fire and nature— empowering people and influencing development patterns—that required tools and understandings unfamiliar to natural resource agencies that have traditionally focused on manipulating vegetation and fire, not on the relationship between people and fire.

Although SDFRN assembled detailed reports—supported by years of expertise and experience, documenting biological conditions and advocating restoration policies—they found the agencies
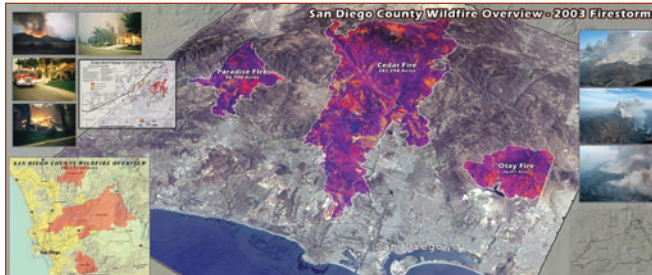
Cedar fire extent.

unresponsive to these alternative solutions. The reports were refused by agencies as being inappropriate public comment and, after SDFRN publicly criticized one local agency's policy, that agency discouraged its personnel from participating in SDFRN activities. Some SDFRNers, dependent on agency funding for livelihood, felt vulnerable to retaliation. These and other events alienated SDFRN from county, State, and Federal agencies, resulting in lost opportunities for collaboration and coalition building, despite the burst of intense public and professional attention focused on the region's environmental issues. Energy, vitality, volunteerism, and capacity slowly ebbed from SDFRN, in part because of the passage of time but also because the affected agencies and professions chose not to nurture SDFRN as an emergent community of new ideas and action. Gradually SDFRN refocused its efforts from advocating an alternative restoration vision to offering public and professional education and networking opportunities.

The region had a rare and narrow window of opportunity to reconsider its development path, reconfigure the responsibilities of citizens, and rethink its relationship with nature. However, divergent approaches interacting in a time-pressed situation made it difficult for all the parties to step outside their standard mode of operation. As a result, there was little room for exploring new ideas or for identifying common ground, and few, if any, of these opportunities were realized in the discussions and practices of fire restoration.

The Case

The largest of the 2003 wildfires in southern California began on October 25 when a lost hunter set a signal fire in a steep roadless area of dense chaparral in rural San Diego County. The conditions were ideal for the outbreak of fire—low humidity, high temperatures, and gusty Santa Ana winds in a landscape already parched by years of drought. County and State firefighters were stretched thin by 11 other recent fire ignitions in southern California, and this new fire—called the Cedar fire—was difficult to control because it occurred in a wildland-urban interface area that had narrow, twisting roads, and a patchwork of houses, many with highly flammable materials such as cedar-shake roofs. By the next morning the Cedar fire had grown to 100,000 acres of chaparral—a growth rate that would have been unprecedented for a fire in any other vegetation type—and began burning into the City of San Diego's suburbs. Local and national media were saturated with dramatic stories and images showing burning homes and landscapes. When the Cedar fire was finally extinguished 3 days later after the winds died down and rain began to fall, it had become the largest fire recorded in California history at 280,278 acres.

Fourteen lives and 2,232 homes were lost, and control efforts required 1,478 personnel at a cost of $27 million. It was a scary and emotional time for area residents, who demanded that fire agencies explain why the fires weren't controlled and who even channeled their anger at firefighters, who were surprised and disheartened by this unaccustomed criticism (California Department of Forestry and USDA Forest Service 2004).

While the Cedar fire was still burning, e-mails began to be sent out to a loose network of conservation activists, land managers, and biological consultants. The City and County of San Diego had supported a decade of intensive field study, preserve design, and public advocacy for three habitat conservation plans that covered the entire county. The design and implementation of these plans kept environmental professionals engaged through a variety of organizations, including conservation science programs at San Diego State and U.C. San Diego, the San Diego Natural History Museum, and many nongovernmental organizations such as the California Native Plant Society and the Biodiversity Working Group. On October 30, 80 people attended a hastily assembled meeting, where they agreed to take part in an association they named the San Diego Fire Recovery Network, or SDFRN. About 10 individuals agreed to coordinate the group's efforts. SDFRN never had a formal "membership" in the sense of dues-paying individuals or elected leaders: "SDFRNers" are defined simply through participation in SDFRN activities.

For the next 4 months, core SDFRNers remained in nearly daily contact with one another. By the beginning of 2004, SDFRN had five subcommittees, each with its own agenda:

- Assessment and monitoring: Fund raising for monitoring, planning a workshop on fire research, setting research priorities.

- Volunteers: Facilitating organization of ecological restoration field trips.

- Policy: Speaking at public forums and submitting materials to the media, organizing workshops.

- GIS: Applying for grants to collect and analyze remote sensing data.

- Education and public outreach: Seeking funding for outreach staff and activities.

Methods

Data include an extensive (500+ messages) e-mail archive of SDFRN communications. These e-mails were supplemented by meeting summaries, SDFRN planning documents, and numerous newspaper articles and editorials describing or authored by SDFRN. County, State, and Federal agencies generated multiple reports, position papers, and public statements describing and defending the status. The California Department of Forestry and the USDA Forest Service (2004) prepared an account of the wildfire and the limited resources available to fight it. The State of California (2004) and the County

of San Diego (San Diego County Wildland Fire Task Force 2003) both convened formal commissions composed of fire officials and elected representatives to address similar issues and provide policy recommendations. A Federal Burned Area Emergency Rehabilitation (BAER) team was assembled from experts around the country and brought into the area for assessing immediate rehabilitation needs to stabilize soil and prevent further damage to community infrastructure (USDA Forest Service 2003). These reports are a principal source of data used to construct and describe the alternative Control and Protect fire regime.

In addition, key informants intimately involved with SDFRN, county government, local USDA Forest Service, and other institutions were interviewed in person and by phone. In-person interviews were recorded and transcribed. Text files of all documents were entered into NVIVO™ qualitative analysis software, which facilitated use of a grounded theory methodology, in which data collection and analysis proceed simultaneously and initial theoretical concepts are continuously modified to reflect and interpret the data (Strauss and Corbin 1990). While our methods of data collection and analysis are guided by the work of numerous discourse scholars, a valuable reference text is the work of social psychologists Potter and Wetherell (1987). Publications with similar purpose and methods include Peterson's (1997) work on sustainable development, Takacs' (1996) work on biodiversity, and Scarce's (1999) work on salmon.

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Engaging Communities in Post-Fire Restoration: Forest Treatments and Community-Agency Relations after the Cerro Grande Fire

Robert L. Ryan and Elisabeth M. Hamin
Department of Landscape Architecture and Regional Planning
University of Massachusetts-Amherst
Amherst, MA (rlryan@larp.umass.edu) (emhamin@larp.umass.edu)

Introduction

A wildfire is dramatic, crisis-laden, and when located near residential or business areas, very public. How managers act during a wildfire to reduce its severity is clearly critical. But forest managers also know that what happens next— how the forest is restored and post-fire community relations are managed—has just as significant long-term repercussions. In this study we asked two critically important questions: first, how do members of the nearby public perceive the treatments their forest received in post-fire restoration; and second, what steps did the Forest Service take that were successful in working with the community in the post-fire restoration period, and what additional actions could improve community relations? Our results help managers:

Forest thinning after devastating wildfires appears to have much more community support than prefire.

- Prioritize rehabilitation projects in the wildland-urban interface.
- Successfully engage communities and volunteers in rehabilitation and restoration.
- Improve agency-community relationships.
- Assist the community in recovering from fire-related distress and associated social and economic disruption.

The conclusions, presented below, are based on interviews and focus groups conducted in Los Alamos, New Mexico, after the Cerro Grande fire of 2000. For reasons described later, the Cerro Grande fire rehabilitation was unique. Research results from this site illustrate a relatively ideal situation in terms of funding and community support from which lessons can be drawn for areas with more typical limited funding, support, and agency resources. Details on this fire, our methods, and the larger study of which this is a part are described toward the end of the paper.

Key Findings

Understanding the public's likely response to rehabilitation efforts has several benefits for improving management. First, this crucial post-fire period provides a window for significantly improving community-agency relations. After a major wildfire, in many instances the community perceives the firefighters as heroes. In fact, the fire puts the agency at the front and center of the public's attention when it is more typically far in the background. The goodwill and publicity that surround post-fire efforts provide the ideal opportunity for the agency to build stronger partnerships with local residents and other stake-holder groups. The public still looks to the agency for leadership and technical advice when it comes to issues of post-fire recovery. When the public scrutiny after a major wildfire is negative, such as when local residents have lost homes or the fire began with agency actions, post-fire management is critical in reducing conflict. Appropriate forest treatments can only be determined in light of the management objectives for that particular area of the forest, and those objectives are determined in part by the local community's needs, desires, and aesthetic preferences.

As our study illustrates, an agency can take some relatively minor steps to respond to local issues and thus improve resident-agency relations. Specific findings can be summarized as the following:

- **Clear communication will help develop community support for actions the agency deems necessary.**
  - The key to successful post-fire rehabilitation from the community's perspective is for managers to quickly communicate the Burned Area Emergency Rehabilitation (BAER) team's plans and continue to communicate longer term restoration efforts to the community.
  - Communication should be a two-way process, with agency personnel also learning from local residents and leaseholders.
  - Community members need a clear agency contact person, preferably someone they already know and trust.
- **Agency managers should support volunteer efforts in the post-fire forest restoration.** These efforts not only help the forest, they also help the community heal from the trauma of the fire. A good use of volunteer energy is to restore the community's "much loved spots," such as close-in trails or swimming areas.
- **Most residents viewed the question of best restoration and rehabilitation treatments as a question for science and Forest Service expertise; however, on some items the public had clear opinions:**
  - Hazard trees near trails and public areas should be taken down.
  - Aerial mulch is effective; aerial seeding less so.

- Forest thinning gained much popularity after the fire.
- Prescribed burning lost popularity (although this may be peculiar to this fire).

- **Overall, there was general support for forest restoration near the urban interface but much less so in the backcountry, although this varied a great deal.**

- **Wildfires can have positive agency-community effects. Public trust in and collaboration with the Forest Service may actually increase, and interagency collaboration may also increase.** Results from the Cerro Grande fire indicate that, from the community's perspective, in many regards Forest Service personnel did an excellent job in working with the community and with treating the affected forest. It is heartening to know that for many people, their respect for and trust in the Forest Service actually seems to have increased as a result of the handling of the post-fire rehabilitation and forest restoration.

Detailed Findings

Based on our Los Alamos results, managers can take some clear steps to strengthen the effectiveness of post-fire rehabilitation efforts. We group these into two categories: (1) working with the community and (2) rehabilitation and restoration treatments.

Working with the Community

Clear communication will help develop community support for actions the agency deems necessary. *The key to successful post-fire rehabilitation from the community's perspective is for managers to communicate the BAER team's plans as well as longer term restoration efforts to the community.*

Important information a fire-stricken community needs to know:

- *Goals for rehabilitation*: Are the key issues prevention of erosion, flood control, or other items? Knowing the reasons for actions helps develop support for the agency's responses.

- *Post-fire threats:* The connection between wildfires, erosion, and flooding is not obvious to most residents. Many people will need to be quickly persuaded of the often-critical nature of post-fire threats to build community support for the rehabilitation actions needed to prevent them. The public also needs to know how long the threat of post-fire flooding is imminent.

- *Reasons for timing*: All managers know that certain actions have to be staged to support other activities, but this is not so obvious to members of the public. Information about timing is particularly important when some desired community actions, such as re-opening hiking trails, take longer than people would like.

- *Outcomes of rehabilitation efforts*: Over the long term, residents want reporting on how the forest has recovered, and whether their volunteer activities have yielded fruit. Publicity in newspapers and other local venues keeps the community informed about the state of the forest.

Early treatment should focus on a community's "special places," such as removing hazard trees along trails so they can re-open safely and quickly.

Communication should go two ways. Managers should use the local knowledge of leaseholders, large landowners, and affected businesses in preparing post-fire plans and in cooperating on post-fire restoration research. Abutters, other local residents, and public lands leaseholders, such as ranchers and outback outfitters, have day-to-day contact with the land and may have very specific and long-term knowledge about the forest lands. Many are delighted to assist agency personnel with observations, test plots, and other labor-intensive observations. Ranchers in particular, given their investments in structures and equipment on their leased lands, feel strongly about having their perspectives included in rehabilitation planning.

Community members need a clear agency contact person, preferably someone they already know and trust. Undertaking this information exchange in the extremely hectic post-fire environment is challenging for existing agency personnel. An approach used in Los Alamos that was extremely well received was to bring in a BAER team leader who coordinated with local volunteer leaders. In Los Alamos, this position lasted longer than the traditional 1-year commitment, which added consistency to the complicated rehabilitation process. This provides one clear person for volunteer leaders to go to with questions and ideas, and for help in organizing volunteer efforts. The volunteer leaders, in turn, acted as the liaison to the community. Study participants suggested that, if possible, the agency contact should be a resident with strong local ties and a solid reputation. The benefit of having a known person to whom residents easily relate is important considering the community trauma, where stability, familiarity, and responsiveness are critical parts of the healing process. A clear contact person would also free up the existing agency personnel to deal more effectively with the forest rehabilitation work and other agencies.

Volunteer efforts in post-fire restoration not only help the forest, they also help the community heal from the trauma of the fire. Encouraging and supporting local volunteer efforts in forest rehabilitation is a critical part of the recovery process, although not necessarily for the obvious reasons. Almost all respondents noted that volunteer efforts had as much to do with community healing as

with actually helping the forest. In Los Alamos, as in many communities, local residents have very strong attachments to the forest and chose this location because of its proximity to the national forest resources. Their love for their "special places" is quite strong, and seeing these places so changed was very difficult for them. Being able to reach out and help, to reestablish a sense of control, in these special places was intensely therapeutic for residents. Thus, even when volunteer efforts do not appear critically important to agency personnel in rehabilitation work, they should be encouraged and supported.

To make the most of volunteer efforts, agency personnel can direct volunteer work to the community's "most loved" spots—trails, riparian corridors, and forest land near neighborhoods. More intensive treatments can be focused on these more heavily used areas to increase the rate of restoration and provide the most community benefit. This work is often more important to volunteers than total acres restored or other such measures. Volunteer work does require management from agency personnel, because the sites for labor must be appropriately located, easily accessible, and staged so that hazard trees and other direct threats are removed before volunteers enter the area. In Los Alamos, the agency provided tools and materials, including helicoptering-in straw mulch and other materials, while community members organized the volunteers. Local residents seemed to particularly like planting trees and schoolchildren enjoyed making and throwing seedballs.

Volunteer efforts are clearly easier to generate where there is an existing relationship between interest groups (such as recreationalists and forest friends) and the agency. We also acknowledge that such efforts are easier to organize in some locations than in others. Los Alamos has an unusually high level of volunteerism and social capacity, and thus it was in a position to have existing organized groups ready to work. In other locations with less existing social network capacity, more agency energy may be required to organize volunteer efforts.

Volunteers also can serve important roles in educating other communities at risk. An interesting use of volunteer leaders was as emissaries to other fire-prone communities or those that had recently had a fire. Residents rated very highly the effect of a presentation by officials and residents from Oakland, California, which had also experienced a wildland-urban interface fire. They spoke of how much more convincing it was to hear from residents ("survivors") than from another official. A further role for such groups would be take their message about the likelihood of uncontrolled fire to fire-prone communities that are not responding well to efforts to thin and otherwise reduce fire risk.

Forest rehabilitation can be an opportunity for network building. A number of interviewees and focus group respondents in our study commented that after the fire there was much more collaboration between agencies, the community, and neighboring Native American pueblos. Topics that often appear to require coordination include forest treatments across jurisdictions, rebuilding of infrastructure, and

educating of local residents about creating more defensible space around their homes. The process of coordinating across jurisdictions is challenging but can result in longer term collaboration on similar and other items. Post-fire partnerships are easier to implement when they build on existing relationships and agreements.

Rehabilitation and Restoration Treatments

Restore forests in the urban interface: leave the backcountry to nature. A strong finding from focus groups and interview respondents addressed the question of whether the Forest Service should try to restore the forest at all. The answer: it depends. The majority of respondents felt it was critical to undertake restoration in the wildland-urban interface and especially important to undertake any actions necessary to mitigate post-fire threats, such as flooding and erosion. In the backcountry, most felt it was right to leave nature to its own processes. For familiar sites, people could evaluate whether they thought a particular treatment had worked, but in general, most respondents seemed to feel that Forest Service experts should decide which treatments to use.

Hazard trees near trails and public areas should be taken down, and the public should help decide which areas get treated first. One item upon which most respondents had strong opinions was the issue of whether or not to fell hazard trees. While most Forest Service policy includes cutting down imminently hazardous trees along trails after a fire, our study found fairly strong consensus that most dead, burned trees along trails should definitely be taken down, so that trails could re-open safely and quickly. This finding emphasizes the need to focus early treatments on the community's "special places." When areas that had previously been an important part of people's recreation were closed for extended times, residents became quite annoyed. Many reported ignoring closure signs, and others said they took their own chain saws in to remove hazard trees along trails on the public lands. Managers are likely to find community relations much better if they work with community members to determine important areas to open quickly and then take the actions necessary to make those safe.

Most respondents support salvage logging, preferably without new logging roads. The overall question of whether to salvage log burned areas had less consensus, although a majority supported salvage logging. Typical comments reported seeing the burned standing trees as "wasteful" and logging these trees as preferable to logging off unburned forest areas. The standing trees were viewed as ugly "match sticks," reminders of the fire that people would rather not see. A caveat to this is that support for logging was much lower in nonroaded areas, with a great deal of concern that salvage logging would require extensive and difficult-to-repair roads. Thus, managers might consider helicopter or logging with horses in roadless areas. A small number of local residents felt that the snags are a part of the natural ecological cycle and should be left to fall.

Residents had distinct views on specific treatments:

- Straw mulch was perceived to have been highly effective in soil protection and regeneration, with or without seeding.

- Aerial seeding alone was not perceived as very effective, considering the rugged topography of the burn area. In areas where seeded grasses did take hold, they were popular, because they provided quick recovery and an aesthetically pleasing view.

- Some respondents noted that whatever would bring back the birds and animals is what should be done; as the loss of connection to these species in hikes was much bemoaned.

Because of the peculiarities of this fire and the generous funding for rehabilitation and restoration, a great deal of infrastructure work was undertaken by the county in coordination with the Forest Service. Residents felt the scope of check dams and other flood control structures was out of proportion to the need for them; at this point residents just want the reconstruction of roads and other facilities to be over.

People's support for long-term forest restoration projects, including forest thinning, was much higher after the fire than before it. Many residents said they now welcomed thinning, but would have argued against it before. The post-fire period thus presents a window of opportunity for managers to highlight the need to also treat nonburned areas that need hazard mitigation. One exception is within heavily burned areas, where thinning of the few standing green trees was very unpopular. While many respondents supported thinning near the urban interface, they also felt that thinning in the wildlands was much less necessary. However, managers need to be aware that even after a fire, local residents are sensitive to the amount of trees that are removed, especially near their homes. Communicating with those who live near thinning projects is critical before work begins.

The use of prescribed fire to reduce hazards was extremely controversial, as can be expected given that the Cerro Grande fire began as a prescribed burn. A few people still supported this as a tool, but most did not, and generally it will be many years before prescribed burns are widely accepted. A first step is to successfully burn the brushpiles left from forest thinning. As noted by one local agency employee: "Fire is a natural part of this system and the only way we're going to get out of this mess is to put the fire back into the system one way or another. This is our first step. If we have 10 bonfires [of cleared brush and trees] successfully without burning down a house, then you know, 2 or 3 years from now we can put fire on the ground."

Study Area

This report is most relevant for fires that occur in the urban-wildland interface and that directly affect people's homes, businesses, and the adjacent public lands they use for recreation. The Cerro Grande fire rehabilitation was unique. Research results from this site illustrate an almost ideal situation in terms of funding and community support, from which lessons can be drawn for areas with more typical limited funding, support, and agency resources. Each wildfire is different, as is each agency and its surrounding community, and the choice of the best restoration treatments must respond to the ecology of the area and the particulars of the fire.

The Cerro Grande Fire of 2000 began as a prescribed fire set by the National Park Service staff at Bandelier National Monument. Unfortunately, strong spring winds, on top of severe drought conditions, fanned the flames into the largest and most costly wildfire in New Mexico's history. The fire burned across the foothills of the rugged Jemez Mountains, almost encircling the town of Los Alamos and the adjacent Los Alamos National Laboratory. Los Alamos is home to highly educated, well-paid people who work at the lab. The entire population of Los Alamos, approximately 11,000 people, was evacuated in a matter of hours, as was the adjacent community of White Rock a few days later (Goetee 2004). Ultimately, the fire burned approximately 48,000 acres and 231 structures, leaving more than 350 families homeless primarily in the neighborhoods that abut the Santa Fe National Forest. Because of the drought conditions and the high fuel load of the forest, this fire was especially intense over much of the burned area. In addition to burning Federal land at the national laboratory and Bandelier National Monument, the fire burned sections of two adjacent Native American lands at San Ildefonso and Santa Clara Pueblos. As described by many of our interviewees, the fire left Los Alamos physically and emotionally devastated.

Restoration and Rehabilitation Activities for the Cerro Grande Fire

Since the fire was started by the Federal government, a special act of Congress called the Cerro Grande Fire Assistance Act generously funded the restoration and rehabilitation: $650 million to the town of Los Alamos, $342 million to Los Alamos National Laboratory, $105 million to the USDA Forest Service to rehabilitate the forest to mitigate downstream effects of flooding from the burned area. Since the fire burned thousands of acres upstream of the Los Alamos lab, there was strong concern about flooding of both lab facilities as well as movement of potentially radioactive soils from canyon bottoms. In addition, several canyons dividing the town of Los Alamos had strong potential for causing major floods to roads and nearby homes.

By many standards, the circumstances surrounding the Cerro Grande Fire create a unique example of post-fire recovery. The large sums of money available for emergency rehabilitation, coupled with the threat of radioactive contaminant transport into nearby streams from Los Alamos National Laboratory lands, created extensive and often elaborate post-fire rehabilitation techniques to deal with the imminent threat of flooding. The most severely burned area was aerially seeded with a mix of annual and perennial grasses. Contour felling was done on 1,000 acres and aerial hydromulch was used on 1,200 acres of especially sensitive areas. Hand-mulching, raking, and seeding were done with organized work crews on 3,000 acres of the burn area (BAER 2000). Additional post-fire activities included long-term forest restoration projects that have thinned large areas of Federal and county forest land in Los Alamos. Consequently, this post-fire rehabilitation effort gave us the opportunity to study the public's responses to a wide variety of rehabilitation techniques that might not be found on smaller, more isolated wildfires that received less rehabilitation funding.

Volunteer Activities for the Cerro Grande Fire

In addition to efforts by the government agencies, the Cerro Grande Fire post-fire recovery was unique in the extensive volunteer effort. In the 4 years since the fire, more than 55,000 volunteer hours were devoted to restoring the burn area, including trail rebuilding, tree planting, seeding, and mulching (Volunteer Task Force 2004a). The volunteer leaders from Los Alamos have made presentations to other wildfire devastated communities to help them organize their community volunteer efforts. More than 2,000 area homeowners participated in a voluntary defensible space program in which foresters hired by the county evaluated private property and implemented defensible space recommendations, such as tree and brush removal at no cost to the private owners.

Local school teachers have incorporated fire ecology and restoration work as part of the curriculum. This ecology curriculum has been used throughout the region and has become a national model for teaching forest ecology (Volunteer Task Force 2004b).

Methods

For the overall study, we selected three case study sites of urban-wildland interface fires in the Western United States.[1] Our three sites are Los Alamos, New Mexico, with the Cerro Grande Fire; Durango, Colorado with the Missionary Ridge Fire; and Arnold, California area with the Darby Fire. For this paper,

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[1] Case studies were chosen where the fire had clear impact on nearby residential areas, those with varying levels of public participation and volunteerism, and those that had different ecologies and treatment regimes applied. Fires had to have been major, and to have occurred between 2 and 5 years ago, thus allowing treatments to have a chance to grow without overtaxing the memories of our respondents.

we report results only from the Cerro Grande Fire, because our research on the other two sites is still ongoing. The scope of this study begins with the BAER team emergency forest rehabilitation efforts, usually undertaken in the first year after a wildfire. The study also focused on forest restoration, the long-term work occurring beyond the timeframe or authority of the BAER teams, including forest thinning.[2]

For Cerro Grande we conducted interviews with 15 representatives from the Forest Service, local government, environmental and recreation groups, industry, and Native American pueblos, in late winter of 2005. In March 2005 we conducted two focus groups,[3] one primarily with residents abutting the fire and one primarily with recreationalists and volunteers who planted trees, cleared trails, and otherwise undertook post-fire restoration work. Focus group respondents were questioned on how the agency had handled community-agency relations; they were shown pictures of various forest treatments (such as seeding, mulching, and thinning) in close-in parts of their forest and asked their opinion on how those had worked out. Focus groups were taped and transcribed, and results were categorized into themes. Combining the focus group findings with the stakeholder interviews provided triangulation on information and actions. Unless otherwise noted, the results reported here as representing "residents" come from the focus groups.

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[2] We did not take the strict USDA Forest Service definitions for these terms with the public, because the post-fire work is often perceived as a uniform work effort by the federal government instead of separate efforts. The main distinction was work done in areas where the majority of trees were burned as compared to other "green" forest areas that appeared unharmed and where trees are being thinned.

[3] A focus group is a meeting with between 8 and 15 people who share some characteristic or experience to talk about their view of a situation. The leaders (in this case, the authors) pose a few open-ended questions and then elicit responses from all group members. Participants also interact with each other to question, clarify, muddy, and otherwise extend other participants' responses. These focus groups were taped, transcribed word for word, and analyzed for themes.

SECTION 2

WORKING WITH HOMEOWNERS AND COMMUNITIES

Communicating with Homeowners in the Interface about Defensible Space[1]

Martha C. Monroe
School of Forest Resources and Conservation
University of Florida, Gainesville, FL (mcmonroe@ufl.edu)

Kristen C. Nelson and Michelle Payton
College of Food, Agricultural and Natural Resource Sciences
University of Minnesota, St. Paul, MN (kcn@umn.edu)

Introduction

Our study's main objective was to facilitate communication between public land managers and residents of wildfire-prone areas. We interviewed homeowners to gain a better understanding of their perceptions of wildfire and their landscape values, preferences, and activities related to defensible space and vegetation management. Eighty individuals were interviewed in neighborhoods at risk of wildland fire in northeastern Minnesota and north central Florida. To better observe residents' settings and understand their landscape preferences, we interviewed them in their homes and asked them to complete a two-page survey.

Our study provides an indepth look at the range of perceptions and types of behaviors for wildfire preparedness. Every interface community may not be exactly like the ones we visited, but we believe there is much to learn from the people we are trying to communicate with. We also believe that what people care about and how they wish to maintain their landscape are mostly compatible with efforts to create safer, defensible, and survivable neighborhoods.

Key Findings

After listening to residents and seeing how they manage their landscapes, we offer the following six points to help managers communicate with residents.

- **Most people have similar attitudes about their yard and immediate landscape, especially favoring wildlife, privacy, a natural appearance, and recreation.** Managers need to help residents understand how activities to reduce vegetation near the home can enhance these values. For instance, on larger properties, residents could be encouraged to maintain screening buffers near the road.

- **People generally understand the fire risk and have taken some action to reduce their risk.** Agency materials may not need to introduce the risk to these residents, but instead emphasize specific problems in an ecosystem and ways to reduce risk from those problems.

- **Interface residents are not all the same. Consequently they act and react differently to the same information.** People will imagine different possibilities and act accordingly. One message or brochure may not speak to everyone. Managers will need to plan for these differences.

- **Most people care at least a little about what the neighbors think about their landscape.** People are not likely to take action they think their neighbors would not approve of. This makes demonstration areas important in a community—so people can see the results and realize that defensible space could be appropriate in their community. It also means that working with neighborhood associations and groups could help in questioning existing norms and establishing new ones.

- **Most people accepted fuels treatments, such as prescribed burning and thinning, as long as they were done by knowledgeable people, preferably local individuals who knew the land.** Managers should communicate frequently with neighbors of properties that require treatment to reduce fuel. This communication should stress the qualifications and experience of the staff who will perform the treatments. The short- and long-term consequences of the method and the associated risk also should be explained.

- **The key to communicating with people in the interface is to figure out what they care about, learn what is missing in what they know, and support what they are willing to change.**

Detailed Findings

Most people have similar attitudes about their yards and immediate landscapes, especially favoring wildlife, privacy, natural appearance, and recreation. How these attitudes affect actions on the landscape will vary based on local context.

The values homeowners associate with the land near their homes could have some bearing on their acceptance of a defensible space message to reduce the vegetation near their home. The residents we spoke with cared about many things and fire protection was not necessarily the dominant value.

A majority of respondents from both States valued four things in their wooded landscape: wildlife habitat, privacy, naturalness, and recreation. How they achieved these values, however, revealed differences in access to information, ability, and preferences. To protect their privacy, homeowners in both States planted screening shrubs at the edge of the property, while others left vegetation near the house. Most managed their land for a "natural appearance." Florida's range of landscape preferences was broader than Minnesota's; some Floridians maintained a mowed yard or grazing animals while most Minnesotans nestled their home in the woods.

[We] like our privacy, let things grow in between lots. If you're in the woods, you're there because you want to be. (Minnesota)

It is a place to come and hide. (Minnesota)

I clear a dead tree if it falls in the driveway. Otherwise, I leave it wild… dead trees are part of the forest. (Minnesota)

It would be nice to be outside but … the heat… mosquitoes, you tend to be inside so seeing green from every window is really important. (Florida)

Floridians created wildlife habitat by hanging birdfeeders, planting butterfly gardens, setting up corn feeders for deer, and leaving brush piles and untended areas. Minnesotans left their woods "untouched" for wildlife. While Minnesotans recreated by skiing, snowshoeing, and hiking on public lands near their home, Floridians created hiking trails, firing ranges, soccer fields, and horseshoe pits on their property.

We like having a lot of wildlife… we've seen deer, rabbits, snakes, armadillos. We get a lot of things city people won't get. (Florida)

I like native vegetation too because it attracts birds and other wildlife, a major part of the attraction of living where we do. (Florida)

Some values reflected the nature of the particular community. One subdivision in Florida required that homeowners leave 40 percent of the native vegetation on the lot. This attracted residents who value native landscaping and dense vegetation. Remote subdivisions tended to have residents accustomed to taking care of themselves with a pioneer mentality. In Minnesota the vast majority of the homeowners felt strongly that lawns did not belong.

Because wildlife, the naturalness of the setting, recreational opportunities, and privacy are important, managers need to help residents understand how activities to reduce vegetation near the home can enhance these values. For instance, on larger properties, residents could be encouraged to maintain screening buffers near the road.

People generally understand the fire risk and have taken some action to reduce their risk.

The written survey indicated that most (84 percent) of these homeowners were very aware of their risk of wildfire. They acknowledged that fire is a constant threat to their home when weather conditions are appropriate.

Homeowners had a fairly sophisticated understanding of the various conditions that affect their risk such as fire behavior, forest ecosystem, or climate, in part from their experience.

It depends on what kind of fire came through. If you had a big fire like they have out west right now, embers can land on the house, even if there are no trees around. (Minnesota)

Our house is protected if it's not too windy. But if it's a high wind, (the) house would probably go anyway, even if we cleared more trees. So we keep the insurance paid up. (Minnesota)

Despite this knowledge, people still had questions and concerns. Those who knew that a fire had jumped a six-lane highway, for example, did not believe that 30 feet of defensible space would reduce their risk.

If the fire jumps I-95, how much do you have to clear to be safe? (Florida)

Most respondents had taken some action to reduce their risk, indicating which actions they had taken to protect their property from wildfire in the survey.

My home is not really at risk because I have cleared at least 125 feet around the house. (Florida)

The three most popular actions in both States were reducing vegetation near the home, installing a water source, and reducing vegetation far from the house (table 1). The least popular actions varied by State: Minnesota landowners invested least in fire-retardant building materials (22%) and widening their driveway while Floridians invested least in sprinkler systems and installing a chimney spark arrester (21%).

Table 1.—The wildfire protection actions

	Minnesota N=36 %	Florida N=43 %
Reducing vegetation near the home	69	70
Installed a water source	53	47
Reducing vegetation far from the house	39	38
Installed chimney spark arrester	31	21
Invested in a sprinkler system	33	12
Widened the road leading to the house	25	33
Invested in fire retardant building materials	22	28

It is clear from these data that people are aware of their fire risk and many have done something to reduce it. However, our firsthand observations of the properties led us to wonder if they are doing the

most effective things, or enough, to really reduce their risk. For example, if one side of the home was left with vegetation, it tended to be the back, which connected the home to the larger natural area.

Homeowners are knowledgeable about their risk of fire. Agency materials may not need to introduce the risk to these residents, but instead, emphasize specific problems in an ecosystem and ways to reduce the risk of those problems.

As a group, interface residents are relatively diverse. Consequently they act and react differently to the same information. Their landscapes reflect these activities.

Visits to each home, and in some cases tours around the house, enabled interviewers to code the landscape and discuss with respondents how they currently managed their land. Interviewers were trained to evaluate defensible space using a very basic assessment of vegetation within 30 feet of the house, vegetation touching the house, and ladder fuels.

In both Florida and Minnesota, the home landscapes included in the study ranged from open meadow to thick vegetation. The degree to which the homes had defensible space created categories between these two extremes. Statements from respondents confirmed these categories.

In Florida, four landscape typologies best represent the pattern of existing landscapes immediately around the homes (fig. 1). In Minnesota, an additional landscape type creates a five-point scale that best represents the existing landscapes (fig. 2).

- *Open Space* (FL=8, MN=5). These respondents preferred a completely cleared landscape. They maintained this opening by mowing or by grazing animals. Some, but not all residents, maintained lawn.

Figure 1.—Florida respondents by land typology distribution defined by 30 feet of defensible space, 2001
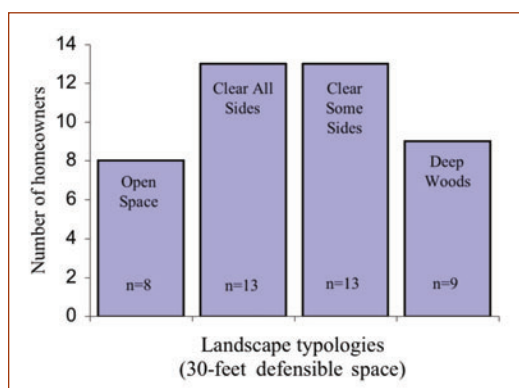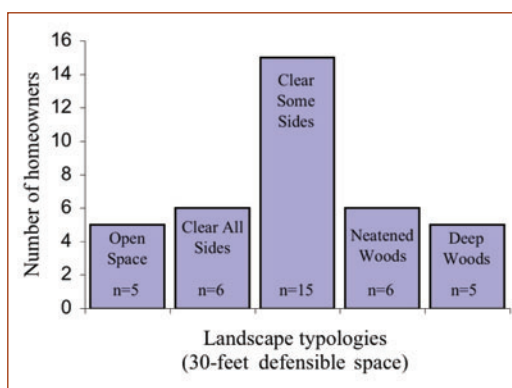

Figure 2.—Minnesota respondents by land typology distribution defined by 30 feet of defensible space, 2001

- *Clear All Sides* (FL=13, MN=6). Properties in this category had reduced vegetation near the house with tree islands and plantings; thick vegetation was present beyond the 30 foot zone. Some residents explained their preference for cleared vegetation on all sides of the house as wildfire protection, while others believed houses should be exposed to the sun or that openness provided a view. Flower and vegetable gardens were commonly carved out of native vegetation in this zone.

- *Clear Some Sides* (FL=13, MN=15). Some respondents explained they just haven't gotten to the back side of the house yet in their efforts to reduce vegetation; others vehemently said they have no intention of reducing the trees on the remaining side(s). These trees provided shade and beauty, and one respondent said it would affect her emotionally to cut those trees.

- *Neatened Woods* (MN=6). Only Minnesotans had this landscape type with trees up to and touching the house but lower branches trimmed and understory vegetation reduced. Many were directly impacted by the blowdown and had proceeded to clear fallen trees, but their goal was to return their land to a natural state, implying even more trees.

- *Deep Woods* (FL=9, MN=5). The respondents who were surrounded by thick vegetation with little or no clearing belong in this category. Usually this category was due to native vegetation that was allowed to creep back toward the house or that was never reduced during construction. Some respondents built their houses and lived their lives for minimal impact on the forest system.

Some people are doing things to reduce their fire risk while others are doing the right thing for nonfire reasons, so their landscapes may change if these reasons change. Other people may understand the risk but do nothing because they care so much about their nearby vegetation that they are willing to chance the wildfire risk or because they are missing details about what needs to be done.

How people manage the space around the house and what actions they choose to do to reduce their risk are important pieces of information for agency managers. This information tells them what messages people accept and what is within their realm of possibility. It may be difficult to believe that people value the forest more than their own home, but the strength of the statements some respondents made about their landscape reveal they deeply cherish their wild and natural view and believe the suggested alterations are too burdensome. Some directly answered the question why they do not alter their landscape to reduce their risk of fire.

> We don't know. It would be nice to know what we could do, other than clear cutting all the trees, which we won't do. (Minnesota)

> For me I guess I would take the risk [of fire] because, just because I like the trees around and I don't like a stark naked looking yard in front of me. (Florida)

I know their recommendation. I should cut stuff, but I don't plan to do it. I like it the way it is. I lost so many trees from the storm I don't want to lose any more. (Minnesota)

Pine trees topple too easily in hurricane winds, and they burn quickly. That's why we've cleared pines from near the house. (Florida)

Managers' messages are not falling on deaf ears, but the public may be confused or may have difficulty balancing the need to reduce fire risk and maintain the look of the landscape they cherish. People will imagine different possibilities and act accordingly. One message or brochure may not speak to everyone. Managers will need to plan for these differences.

Most people care at least a little about what the neighbors think about their landscape.

In both States, most homeowners said the dominant neighborhood norm was independence. Homeowners can do what they want with their land, but there is an unspoken agreement about what is "within reason." The Florida subdivisions varied in the degree to which people interacted with neighbors. In some cases respondents were quite certain neighbors would not approve of defensible space; other respondents were equally certain that their neighbors wouldn't care what they did on their land. In Minnesota, homeowners said you can do what you want as long as neighbors can't see you. In general, there was a common sense of "appropriate" behavior that was maintained by the social norm of the community.

If we came in here and took down a lot of trees there would have been a negative reaction from the neighbors. I certainly wouldn't do anything that would upset the neighborhood. (Florida)

Everyone expects solitude—people don't want to see their neighbors' homes. But we can have defensible space and not see our neighbors. (Minnesota)

The neighbors probably do have expectations. They don't want others to let their property get "run down" but neither do they expect immaculate professional landscaping. (Florida)

No one would pressure anyone, never. There is an unwritten law that you don't interfere with someone else's business. Some do have it more cleared. Don't like it but would never say anything. (Minnesota)

Resource managers must understand the "unwritten law" or "social norm" within a neighborhood or community. People are not likely to take action they think their neighbors would not approve of. This makes demonstration areas important in a community—so people can see the results and realize that defensible space could be appropriate in their community. It also means that working with neighborhood associations and groups could be effective at questioning existing norms and establishing new ones.

Most people accepted land fuels treatments, such as prescribed burning and thinning, as long as they were done by knowledgeable people, preferably local individuals who knew the land.

People who live in neighborhoods that border undeveloped land can be at great risk of wildland fire and may express supportive or unsupportive opinions about the land management strategies to reduce that risk. Respondent comments about specific management practices to reduce wildfire risk brought out clear differentiation between prescribed burning, thinning, and herbicide use for reducing vegetation.

Most respondents were very comfortable with prescribed burning as a forest management tool to reduce wildfire risk. The level of support increased by including those respondents who gave qualified support for prescribed burns that are done well (88% MN and 85% FL). Nearly all respondents (91% MN and 96% FL) thought that prescribed burning was moderately to very effective. Of those respondents who were less comfortable with prescribed burning, responses included nervousness about burning too close to homes and concern about burning getting out of control.

Another fuel treatment option used in both States is thinning or mechanical removal of vegetation on undeveloped lands. More than half the homeowners were comfortable with thinning (68% MN, 57% FL). Those against thinning want the forest to remain natural or believed that thinning would not have an impact on wildfire risk.

Finally, in Florida, herbicides have been used for vegetation management, so respondents there were asked about this particular technique. Distinct from previous vegetation treatments, very few approved of herbicide use (only 7%). Most people found it completely unacceptable. Many worried about groundwater contamination and the risk to wildlife and other inhabitants.

Managers should communicate frequently with neighbors of properties that require treatment to reduce fuel. This communication should stress the qualifications and experience of the staff who will perform the treatments. The short- and long-term consequences of this method and the risk also should be explained.

The key to communicating with people in the interface is to figure out what they care about, learn what is missing in what they know, and support what they are willing to change. Communities may vary on the degree to which individuals represent these various beliefs and attitudes.

Talking to people to understand what they know, what they don't know, and what they care about is of vital importance if resource managers intend to design communication tools to encourage new behaviors. This information may enable an agency to craft a message that will be better heard and generate greater acceptance.

Many people choose to live in the forest because they value the closeness of vegetation, the privacy it affords, the wildlife, the recreation opportunities, and the natural landscape. Their understanding of what it would take to reduce the risk of fire conflicts with these values. Most are aware of the risk of fire, but some do not wish to reduce their risk. In fact, direct experience with wildfire may not alter their convictions. Others, however, have taken limited steps to reduce vegetation or have taken other actions, such as installing a sprinkler and widening the driveway. The social norm within the neighborhood creates an expectation for landscaping. Respondents may use the neighborhood norm to justify their lack of action.

A message about defensible space that concisely explains why certain actions are necessary may be helpful to residents. Information that explains how to keep valuable views while creating defensible space is paramount. Messages have to expand the "why" of defensible space from threatening crisis statements about the potentially deadly consequences of fire, to include a more complex message that argues that it will provide multiple values in a landscape. Messages that give "how to" information but not "why" may support short-term behavior change but may not help when people are challenged with conflicting information (Monroe *et al*. 2005).

Few of the materials we reviewed from State and Federal agencies encouraged neighbors to work together to create defensible space. Although not appropriate for all locations, managers may want to consider promoting defensible space more actively as a neighborhood activity, This could accomplish two important goals: (1) the social norm would favor defensible space and (2) people could no longer use the excuse that their defensible space is meaningless until their neighbor reduces vegetation.

Four photographs of computer-modified landscapes were used in homeowner interviews to discuss defensible space preferences.

Research Site and Methods

Specific objectives of the study were to (1) document homeowners' landscape values, preferences, and activities related to vegetation near their homes and defensible space options, and (2) identify homeowners' perceptions of wildfire, the risk it represents, and their acceptance of fuels treatments of forested public lands. We interviewed individuals at their homes to better observe their setting and understand their landscape preferences. This meant we conducted a qualitative study and chose a fairly small sample. Our neighborhoods were purposefully chosen: all were at risk of wildland fire in northeastern Minnesota and north central Florida. Residents participated in the in-depth interview at their home and completed a two-page survey. The mixed methods used in this study enable us to report on both general tendencies

in themes from open-ended questions in the interviews and frequencies from the survey. All percentages reported here come from closed questions on the survey. All quotes were transcribed from taped interviews.

In large neighborhoods, high-risk regions were identified and information was obtained on each lot from the county tax assessor's offices. In small neighborhoods, a complete census was taken. In both cases the population was homeowners with a local address and working phone number who owned at least 1 acre at risk of wildfire because of their proximity to forested areas. Contacts were made in each State until approximately 40 residents agreed to be interviewed.

A total of 80 interviews were completed. In Florida, 78 respondents were identified and contacted, and 43 interviews were completed, for a 55-percent completion rate. In Minnesota, 46 respondents were randomly selected and contacted, and 37 interviews were completed, for an 80-percent completion rate. Given the difference in response rates, there is a possibility the Florida respondents were more inclined to value their landscape than nonrespondents, but the bias should not influence our discussion of defensible space or fire risk because these concepts were not mentioned. In Minnesota, this bias is less likely given the response rate; most non-respondents wanted to be interviewed, but we could not work out a visit to their homes during the interview period. Overall, this sample of 80 individuals is not designed to be a representative sample of the communities, but rather it is an indepth look at the range of perceptions and types of behaviors for wildfire preparedness.

The two samples were similar in that 78 percent (MN) and 70 percent (FL) of the participants owned 1 to 5 acres at risk of wildland fire. Half of the Minnesota homeowners were permanent residents and the other seasonal by research design, and all of the Florida homeowners were permanent residents. While half the Minnesotans had owned their homes for more than 10 years, half the Floridians had owned them for 3 to 10 years. Most participants had lived in their respective States for more than 10 years. In both States, they represented a range of incomes. More Minnesota participants were retired (50% compared to 21% of Floridians) and had a college degree (71% MN and 44% FL).

To enable residents to speak about their likes and dislikes without focusing on their own yards, 11 photographs of homes from the area representing a range of landscapes were used to prompt participants to reveal what they liked and why. Later, four photographs of computer-modified landscapes surrounding a house were used to help them visualize 30 feet of defensible space. Respondents were asked about the relative acceptability of vegetation removal. After wildfire and defensible space were mentioned, additional open-ended questions were asked about perception of risk of wildfire, neighbors' approval of vegetation removal, efficacy of protection measures, recent respondent actions to reduce wildland fire, experience with wildland fire, and perceptions of various fuels treatments. The survey included scaled questions about specific strategies to reduce fire risk and demographic details. In the yard with

the respondent, the interviewer assessed the homeowner's landscape using a limited interpretation of defensible space, noting vegetation distance from the house on all four sides, size and nearness of shade trees, and ladder fuels. To reduce the effect of respondent bias, the study was described as exploring "the values residents have about their yard and landscape." The risk of fire and term "defensible space" were not mentioned until halfway through the interview.

The interview guide and the survey were pilot tested with wildland-urban interface residents in both States, reviewed by colleagues, and revised. Interviews were recorded with tapes and field notes were taken, usually by two interviewers. Field notes were typed after each interview and checked against tapes. Two or three reviewers read each interview for themes, and the themes were organized and interpreted using Strauss and Corbin (1990) analysis procedures of grounded theory. Survey data were entered into Excel and summarized with frequencies.

For a more detailed treatment of the study and findings, please see Monroe and Nelson 2004; Nelson *et al.* 2004, 2005.

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Wildland Fire and Fuel Management: Principles for Effective Communication

Eric Toman and Bruce Shindler
Department of Forest Resources
Oregon State University, Corvallis, OR
(Eric.Toman@oregonstate.edu) (Bruce.Shindler@oregonstate.edu)

Introduction

Federal agencies have many options for communicating with the public (e.g., brochures, newspapers, Web sites, public meetings, demonstration sites), but often have limited resources for completing the outreach job. Ultimately, agency professionals have to make difficult choices about the most effective use of personnel and financial resources. The purpose of this paper is to highlight successful communication strategies and illustrate a set of four guiding principles for building successful fire and fuels management outreach programs in forest communities.

Public support for fire and fuels management is greatly enhanced through effective public communication and outreach programs. Many management units are well along in their own communication programs and are finding success through multiple methods and support of outreach personnel (Toman *et al.* 2006). The communication principles presented in this chapter, developed from research examining wildfire outreach efforts, suggest how programs can be focused to encourage citizens to share the responsibility for fuels management. We believe a long-term commitment to outreach and education will yield positive outcomes for managers and citizen stakeholders. Not all outcomes will be achieved immediately, nor will each one be achieved everywhere. But as this paper demonstrates, a set of guiding principles can be used to organize outreach activities for effective communication. When implemented, outcomes of outreach and education will include the following:

Internal

- Management units will have an internal planning process for public outreach.

- Personnel will reach agreement on how to proceed and avoid surprises later on.

- Public information materials and programs will be refined; financial resources can be directed at the most productive and useful methods.

- The best personnel for leading the outreach effort will emerge, and resources for doing the job will be identified.

- The agency will appear better organized and ready to respond to citizens' concerns.

- Units will focus on methods that achieve local solutions and be less concerned with national or regional agendas.

External

- A more supportive, more action-oriented constituency will emerge within the community.

- Other citizen groups (homeowner associations, watershed councils) will help carry the fuels reduction message and move the agency off the perpetual hot seat.

- Community capacity will be built for responding to fire and fuels reduction problems.

- Citizens will help identify trouble spots that need active management.

- Community residents will take greater responsibility for defensible space and fuels reduction activities on their own property.

- Citizens will demonstrate greater support for agency fuels reduction programs on adjacent public lands.

Principles for Effective Communication

Four principles of effective communication have emerged from recent studies designed to measure citizen responses to fire outreach (research described in the Research Context section). These principles are further supported by findings from related projects, several of which are discussed in this volume.

These organizing principles are:

- Effective communication is a product of effective planning.

- Both unidirectional (one-way) and interactive approaches to communication have a role in public outreach. The strengths of each should be used to build a program.

- Communication activities that focus on local conditions and concerns can decrease the uncertainty that citizens associate with fire management and build their capacity to participate in solutions.

- A comprehensive communication strategy will emphasize meaningful interaction among participants and build trust along the way.

Principle 1: Effective communication is a product of effective planning.

Fuel managers would never implement a prescribed burn without a comprehensive plan detailing treatment objectives and appropriate conditions. Yet, it is not uncommon for outreach activities to be implemented with nothing more than a vague goal of "educating the public." Not surprisingly, such a simplistic approach is unlikely to succeed. Effective planning depends on the ability of resource professionals to determine communication objectives and organize an appropriate approach to outreach before inviting the public into the process (Jacobson 1999). Two researchers, Delli Priscoli and

Homenuck (1990), refer to this as "up-front thinking" and argue that thoughtfully planning outreach activities can help avoid costly problems such as confrontations, delays, appeals, and lawsuits.

First and foremost, agency personnel should identify what they want to achieve by communicating with the public. For example, objectives may be classified as (1) building awareness or (2) influencing attitude or behavior change (Atkin 2001, Rogers 2003). Is the primary purpose to call attention to basic wildfire prevention (Smokey Bear-type messages) or to encourage property owners to take action in creating defensible space? Perhaps the primary purpose is to enlist public support for agency fuels reduction activities. Each is a worthy objective, and each requires a different outreach approach.

Planning for outreach should consider specific audiences—their information needs, the role they will play, their previous interactions with agency personnel, and the local conditions they are familiar with. Key questions to help organize this approach are presented in table 1. Depending on the communication objectives, the audience may vary from homeowners in a particular neighborhood to residents of an entire community or region. Agency personnel will need to understand stakeholders' awareness of fuel problems as well as their attitudes about severity levels and potential management actions (Jacobson 1999). In some cases, this information may already be available, but in others it may be necessary to

Table 1.—Planning the communication approach

<table>
<tr><td colspan="1" align="center">**Organizing questions[1]**</td></tr>
<tr><td>**1. Determine objectives**
　What do we hope to accomplish with this outreach program?
　What should the public know, or be able to do, as a result of this communication process?
　What does the public need to know to participate effectively?
　What do we need from the public?

2. Assess the target audience(s) and contextual influences
　Who is "the public" for this issue?
　Are there specific groups or stakeholders for this problem or issue?
　What are their initial attitudes or understanding of the issue?
　How might the history of agency-citizen relationships affect reactions to the issue?
　What past management actions might contribute to citizen reactions to the issue?
　What is the public's role in this process and how will it be communicated?
　What other contextual circumstances should be considered?

3. Evaluate internal resources
　How will decisions be made and who will make them?
　What resources can we dedicate to this process?
　Who are the appropriate individuals to be in the lead on outreach activities?
　What internal constraints will influence the types or scope of activities that can be implemented?</td></tr>
</table>

[1] Adapted from Priscolli & Homenuck (1990), Shindler *et al.* (1999), Jacobson (1999).

Interactive communication, such as here where community members discuss fuel management options with a District Ranger, can help reduce uncertainty and increase trust in resource agencies.

assess community characteristics through formal methods (stakeholder surveys or interviews) or informal means ("coffee-shop" meetings or discussions with community leaders).

Outreach planning also includes considering internal resources and constraints, particularly identifying staff with the necessary skills to lead communication activities. Shindler *et al.* (2002) argued that "most effective public processes historically have involved one or two agency members with genuine interpersonal skills" (p. 46). Outreach programs will be more effective when such individuals are given a lead role and supported in their efforts by their management unit.

Once these questions have been addressed internally by relevant personnel, outreach activities can be developed and implemented. Ultimately, these planning efforts will result in communications that focus more on contextual conditions within the community while also meeting objectives of the management unit. Working through this planning process also forces personnel to wrestle with difficult questions before being confronted by citizens. This provides an opportunity to generate a consensus among staff about appropriate actions, get everyone "on the same page" about the need for communicating with the public, identify the best individuals in the unit for working on the front lines of the outreach effort, and organize the necessary resources to carry out the job.

Principle 2: Both unidirectional (one-way) and interactive approaches to communication have a role in public outreach. The strengths of each should be used to build a program.

Public agencies often feel it is their responsibility to develop information and deliver it to the public. But the facts do not speak for themselves; they must be interpreted and appreciated. Generally programs that just provide information are not very successful in improving, understanding, or changing behavior (Jamieson 1994). Individuals progress through various stages in a decision process. They first develop basic awareness of the issue or topic (such as defensible space or agency-implemented fuels treatments), then form opinions about its appropriateness, and, finally, decide whether or not to support or adopt the new behavior. Research suggests individuals rely upon particular communication channels during these different decision stages (Rogers 2003). Mass, unidirectional outreach methods (e.g., public service announcements, brochures) are particularly useful in the first stage when individuals seek basic information about new practices; interactive communication approaches (e.g., personal contacts, guided field trips) are more likely to increase citizen support or encourage behavior change.

The primary advantage of mass communication is the ability to reach a large number of people relatively easily. However, as Atkin writes, messages with the "broadest reach can deliver only a superficial amount of information" (p. 56). At best, these message formats are useful for instilling a central idea or for communicating a general theme (e.g., forest health conditions, need for defensible space around homes, or role of fire in forest systems). These formats are not for delivering details; people will not be able to recall specifics from PSAs, brochures, or signs at kiosks. Accordingly, mass or unidirectional messages can be effective at generating recognition of an issue, sensitizing participants to later messages, and encouraging people to seek additional information (Atkin 2001, Rogers 2003). In limited cases, mass communication methods can influence attitudes among already supportive audiences or among individuals who understand little about an issue (Toman and Shindler 2005). In sum, outreach activities that rely only on unidirectional means appear to have a limited influence on public attitudes or behavior change (e.g., Rogers 2003, Toman *et al.* 2006).

Research has found that people generally turn to interpersonal communication methods when deciding whether to adopt new ideas or change behavior (Rogers 2003). At this stage, individuals want more specific information about likely outcomes of a practice—or alternatively, of doing nothing—either to them or to places they know and care about (such as the impacts of thinning or prescribed fire around a homesite or favorite recreation area). More specifically, they want to know how *serious* and *certain* the outcomes are and *how soon* they will occur in the context of these places (Shindler *et al.* 2002).

Public preference for more interactive forms of information exchange is particularly high for activities such as fuels treatments that may hold a degree of risk or uncertainty for citizens (Jamieson 1994). The ability to engage in discussion, visit a site where treatments have been implemented, or actually view a demonstration of fuels reduction practices can reduce the uncertainty about treatment outcomes. The give-and-take of interactive exchanges allows citizens to become more comfortable with the available options and decide how they feel about managers' ability to carry out fuels reduction.

Recent studies have evaluated interactive forms of outreach including small workshops, field trips, demonstration sites, and interpretive programs. McCaffrey (2004) evaluated a multi-faceted wildfire information program that used both unidirectional (brochures, mass media) and interactive methods (personal contact, group presentations, neighborhood meetings) and determined that personal contact contributed substantially to communication success. Indeed, educational materials, including unidirectional items, were more effective if delivered via personal contact. Similarly, in two recent comparisons of wildfire outreach programs we conducted, interactive methods were preferred over unidirectional approaches and were more effective at influencing public attitudes (Toman and Shindler 2005, Toman *et al.* 2006).

Ultimately, both unidirectional and interactive methods play an important role in a comprehensive communication strategy. At any given point, citizens are likely to be at different stages of the communication process and, thus, have different information needs. For example, residents in a wildland-urban interface community are likely to range from some who have not heard of defensible space practices to others interested in seeing a demonstration of treatment outcomes and to still others who want to confirm the value of treatments following implementation. A comprehensive strategy will target each of these audiences with activities and information designed to meet their specific needs. Unidirectional and interactive approaches can play complementary roles in these efforts. Mass messages are relatively inexpensive and can be used to build awareness as well as to motivate participants to seek more information. Interactive opportunities, although more time-consuming and requiring a certain skill set, can reduce the uncertainty associated with new activities and increase trust in resource agencies.

Principle 3: Communication activities that focus on local conditions and concerns can decrease the uncertainty that citizens associate with fire management and build their capacity to participate in solutions.

At the local level, citizen decisions about adopting defensible space or supporting fuels treatments on nearby Federal lands often boil down to the risk and uncertainty people associate with perceived outcomes (Shindler and Toman 2003, Winter *et al.* 2002). Of particular importance are concerns about the perceived compatibility of treatments with other values specific to the location (such as aesthetics, recreation use, and privacy), perceptions of the local planning process used by the agency (scientifically sound, fair, and inclusive), as well as citizen trust in personnel to do what they say they will do (Nelson *et al.* 2003, Shindler and Toman 2003, Winter and Fried 2000). Evaluations of these factors are place-dependent and can vary over time and across locations. Accordingly, activities acceptable in one situation may be unacceptable elsewhere (Brunson and Shindler 2004). Gaining acceptance among local residents for specific treatments will require more than general interpretive messages. The implementation of specific projects will require effective communication tailored to ecological and social issues at the local, and perhaps the neighborhood, level (Brunson and Shindler 2004).

Communication activities that target local conditions and public concerns about the rationale behind specific practices, potential outcomes, and implementation scenarios are more likely to resonate with participants. Although addressing local needs can be accomplished in varying degrees with many forms of outreach, programs that allow for interactive exchanges, such as guided field trips to project sites and conversations with agency personnel, are better suited to relating information to the local context. One limitation of many unidirectional methods (e.g., brochures, newspaper sections, television messages, and newsletters) is that they rely on fixed messages, whereas interactive formats include citizens

in the discussion and can be adapted to the concerns and interests of the parties involved. Such an interactive approach provides greater flexibility to address participant needs and tailor activities to the local context.

Strong evidence for keeping a local focus comes from citizen reactions to an agency-led field tour to see the aftermath of a 90,000-acre fire on the Deschutes National Forest (Shindler *et al.* 2005). Following the tour, a majority of participants had

Photo credit: Ryan Gordon

a greater understanding of and support for proposed management activities. In particular, responses indicated the ability to see fire impacts firsthand and the opportunity to discuss proposed restoration activities helped participants understand the rationale behind and likely outcomes of treatments. By offering an opportunity for meaningful interaction in a place that is familiar and important to participants, these tours were able to address their concerns and improve their ability to participate in crafting solutions.

Members of a local organization lead a discussion of fuel treatment options at the Heritage Demonstration Project on the Sisters Ranger District, Deschutes National Forest.

Principle 4: A comprehensive communication strategy will emphasize meaningful interaction among participants and build trust along the way.

Fire managers and outreach personnel must recognize that citizens do not come with a readymade ability to engage in constructive, deliberative discussions of fuels management. The use of prescribed fire may seem risky, and thinning (often viewed as harvesting) may be something citizens initially oppose. In any case, the topic may just recently have become relevant to them and will likely involve a degree of emotion that other issues do not. Thus, agency managers will need to consider how they can help residents and communities engage in meaningful discussions (Jacobson *et al.* 2001, Jamieson 1994).

Initially, public judgments of conditions are likely to be based on visual references from personal exposure to forests and interpreted through previous experiences. As citizens begin to receive additional technical information about the landscape, the nature of the communications is likely to be just as important. Accordingly, a comprehensive communication strategy will focus not only on the types and content of the information disseminated, but also on the process of how it is communicated. Specifying conditions and engaging citizens in discussion about the nature of the options is just as essential as providing objective, unbiased information. Thus, personnel must be forthcoming about the difficult decisions, including the uncertainty of outcomes associated with the use of fire and thinning treatments.

While outreach programs typically focus on improving awareness, equally important objectives are often overlooked, including relationship- and trust-building. Indeed, for some projects, changes in the level of trust among stakeholders—because of a well-planned and articulated outreach program—may be the *only* measurable benefits that accrue (Shindler and Neburka 1997). The value of relationship-building can have long-term impacts on management success and should not be underestimated (Lawrence *et al.* 1997). For example, following the Deschutes bus tours described earlier, nearly all participants expressed increased appreciation for and confidence in agency personnel. This confidence translated into support for proposed management activities as participants were vocally supportive of a proposed 13,000-acre thinning project on adjacent forest land.

Ultimately, public trust is central to an agency's ability to act (Kramer 1999) and significantly influences citizen support for fire management (Winter *et al.* 2002, Shindler and Toman 2003). Trust is more likely to develop in the context of personal relationships than through mass information (Jamieson 1994). The give-and-take of interactive exchanges is much more favorable to developing these relationships than programs that rely on an impersonal, one-way flow of information.

Research Context

Prior Research

Two important findings from research on the social aspects of fire management are central to the ideas we have outlined. First, numerous studies over the past three decades have found that citizens with higher fire-related knowledge are more supportive of fuel management activities such as prescribed fire and thinning programs (e.g., Stankey 1976, Shindler and Toman 2003). However, such associations are not evident for all natural resource issues. For example, attitudes toward clearcutting are unlikely to change simply on the basis of new information (Bliss 2000). Additionally, overall public understanding and acceptance of fuels treatments is on the rise. Early studies found that citizens generally overestimated the negative impacts of fire; not surprisingly, a majority preferred complete fire suppression (Stankey 1976). But as the media have begun to cover fires more extensively and fuels reduction programs are underway in local communities, more citizens recognize the role of fire in the landscape (Loomis *et al.* 2001, Shindler and Brunson 2003).

Second, research has demonstrated that fire-related outreach can positively influence citizen understanding and attitudes toward fire management. In related studies, briefly summarized in table 2, several authors evaluated responses following exposure to various communication activities (e.g., brochures, slide shows, workshops). As described, communication strategies can be classified as unidirectional or interactive based on the type of outreach experience they provide. Unidirectional methods consist of a

one-way flow of information from agency personnel to the public, while interactive activities allow for two-way communication. For example, brochures, news releases, and displays at kiosks represent unidirectional approaches, while interpretive programs, guided visits to demonstration sites, neighborhood meetings, and agency workshops are typically interactive. Table 2 shows that both unidirectional and interactive methods have increased understanding and, in many cases, resulted in more supportive attitudes. Ultimately, each method can achieve management objectives and will play an important role in a comprehensive communication strategy. As described in principle 2, both strategies can be used in a complementary fashion to build a successful outreach program.

Table 2.—Outcomes of outreach activities and methods

	Increased understanding	More supportive attitudes
Brochures		
Taylor and Daniel 1984	X	
Loomis *et al.* 2001	X	X
Slide presentation		
Nielsen and Buchanan 1986	X	X
Interpreter guided walk		
Nielsen and Buchanan 1986	X	X
Field visit to affected sites		
Self-guided: Toman *et al.* 20041		X
Agency-led: Shindler *et al.* 2005[1]		X
Interactive, hands-on workshop		
Parkinson *et al.* 2003	X	X
Communication campaigns		
Unidirectional methods only:		
Posters, brochures, news releases (Marynowski and Jacobson 1990)	X	
Unidirectional and Interactive methods:		
Newspapers, personal contact, group presentations, neighborhood meetings (McCaffrey 2004)[2]	X	X
Interpretive centers, brochures, interpreter-guided walk (Toman and Shindler 2005)	X	X

[1] Understanding not measured.
[2] Educational materials were more effective if delivered via personal contact.

Methods

The principles presented here are based on citizen responses to a range of agency outreach and communication activities. Overall, more than 1,300 respondents across nine study locations participated in this research. The research was conducted in two main phases. First, mail surveys were sent to residents in four fire-prone regions in Arizona, Colorado, Oregon, and Utah. The surveys targeted the credibility and overall usefulness of 11 commonly used outreach methods, including six unidirectional (Smokey Bear, TV public service announcements, brochures, newspaper inserts, newsletters, and Web pages) and five interactive approaches (interpretive centers, conversations with agency personnel, elementary school programs, guided field trips, and public meetings).

The second phase of research evaluated participant responses to specific outreach activities in five locations. Participants in Sequoia and King's Canyon National Park in central California assessed a range of unidirectional (e.g., park newsletter, brochures, static displays at interpretive centers) and interactive (e.g., conversations with agency personnel, guided interpretive walks, evening naturalist programs) methods. Those at the World Forestry Center in Portland, Oregon, evaluated the exhibit "Fire: Forces of Nature," which consisted of traditional, unidirectional formats including photographs and text descriptions, examples of fire suppression equipment, and videos. The High Desert Museum in Bend, Oregon, included an interpretive trail through a recent prescribed burn. The self-guided trail included interpretive signs highlighting natural forest conditions, post-fire revegetation, ladder fuels, slash piles, and a historic fire line. Next, respondents in Coeur d'Alene, Idaho, evaluated a public service announcement campaign consisting of daily advertisements in the local newspaper, the Coeur d'Alene Press. Lastly, we also drew upon responses from participants in an agency-guided field trip following a 90,000-acre fire on the Deschutes National Forest.

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Encouraging Wildland Fire Preparedness: Lessons Learned from Three Wildfire Education Programs

Victoria Sturtevant
Southern Oregon University
Ashland, OR

Sarah McCaffrey
Northern Research Station, USDA Forest Service
Evanston, IL (smccaffrey@fs.fed.us)

Introduction

Managers may often wonder why some people do not choose to adopt defensible space practices or engage in other activities to help prepare their community for wildfire. Much research has been done in other fields to understand why a new practice or innovation, like defensible space, is or is not adopted. This work[1] has identified several factors that influence adoption. While some of these have to do with personal traits of the adopter—items difficult for a manager to influence; others have to do with characteristics of the innovation and how information about it is communicated—items easier for managers to alter in order to make a practice more "adoptable." This paper will briefly discuss these factors and describe how three different fire education programs—Firewise Communities/USA, FireFree, and Fire Safe Councils—do or do not address them (see boxes for program descriptions). All three programs share a fundamental goal of creating awareness about wildfire risk, knowledge about wildfire safety, and a stewardship ethic that extends beyond defensible space around individual homes. The purpose of this paper is (1) to provide a framework for identifying key activities managers can undertake when promoting wildfire mitigation and (2) to clarify how each activity can increase adoption of defensible space.

Key Findings

Several key lessons/findings from this analysis can help guide managers who are working with homeowners to create defensible space and reduce hazardous fuels across ownership boundaries:

- People need to know that fire mitigation practices are compatible with their lives and values. Programs that tailor their efforts to address local values and interests are more likely to be adopted.

- People are more apt to adopt practices that complement or enhance social values. Programs that increase contact between neighbors can help develop a sense of community as people work together

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[1] Concepts discussed in this paper are drawn from Everett Rogers' Diffusion of Innovations (published in 1962 and revised and reissued in 1971, 1983, 1995, and 2003), the primary work that brings together diffusion studies in diverse areas. The book is credited with shaping and institutionalizing diffusion research in its current mode and has become an accepted base reference for the field (Fliegel 1993).

to reduce hazardous fuels across ownership boundaries. Working together increases the social advantage of adopting defensible space as such work becomes the "norm" rather than the exception.

- People prefer to try new practices in stages. Being able to adopt segments of a new practice allows people to adopt at a comfortable pace. Checklists can provide homeowners with a way to incrementally assess and test each stage of an innovation.

- People who have opportunities to observe a practice and its benefits are more likely to adopt the practice. Concrete examples allow residents to see the results, reassess their previous notions of what "defensible space" or fuel reduction might look like, and choose the actions they find acceptable. Demonstration sites and neighborhood events provide opportunities for sharing the aesthetics of fuels reduction.

- People will compare the cost of implementing defensible space with the potential benefit. Because people don't really expect to lose a house to wildfire, highlighting the social benefits of adoption may be more effective in encouraging adoption than highlighting economic advantages.

FireFree

FireFree was created in 1997 by four local agencies in central Oregon and SAFECO Insurance Corporation. The FireFree! Get in the Zone campaign educates the public about wildfire safety and promotes defensible space around homes through mass media advertising, public relations efforts, and educational materials, as well as cooperative programs with other local government agencies and business organizations. For the past 9 years, FireFree has sponsored cleanup weekends during which residents of central Oregon can take yard waste and debris to area landfills and transfer stations at no charge. This pilot program was designed as a model for other locations in the Nation susceptible to wildfire and has been adopted in a few communities in Oregon, but not in other States, or nationwide as was hoped.

Detailed Findings

Certain characteristics of an innovation and of the methods of disseminating information about the innovation can influence how rapidly it is adopted. Our key findings were developed by examining how the three programs address each of these areas and are discussed in more detail below.

Innovation Characteristics

Hazard mitigation is a preventive innovation, something adopted primarily for its potential to protect one's current lifestyle rather than to potentially improve one's future through increased income, knowledge, or comfort. Innovations that decrease uncertainty are adopted more readily than those that do not, and because preventive innovations generally do little to decrease uncertainty, they tend to have a very slow adoption rate: "the undesired event may, or may not, occur if the innovation is not adopted. So the desired consequences of a preventive innovation are uncertain. Under such circumstances, the individual's motivation to adopt are rather weak" (Rogers 1983: 171). Five characteristics of a new practice or technology influence how fast it is adopted: trialability, observability, compatibility, relative advantage, and complexity of the innovation.

Trialability is the degree to which the user can test out the innovation. A successful trial increases likelihood of full-scale adoption because it decreases the uncertainty about its effectiveness. Although it can be difficult to fully test preventive innovations, an innovation often can be tested incrementally. In fact, innovations that can be divided into smaller segments that can be tested separately tend to be more rapidly adopted.

All three programs include checklists for homeowners with a number of options or "steps" of wildfire preparedness, such as FireFree's "10 tips—1 zone." Such a checklist allows homeowners to incrementally assess the innovation and how it works for them. It also allows them to choose to adopt only portions of the innovation. Some defensible space is better than none, and as homeowners become comfortable with the changes, they may then try additional actions. Because Fire Safe Councils are developed locally, they have been able to address the trialability issue in creative ways. One council on the northern California coast, challenged by public apathy about wildfire risk, started with projects that had benefits for multiple resource management challenges, such as using goats to remove tall grass and noxious weeds and bringing in large water tanks that could be used for irrigation—both of which also have benefits for reducing wildfire risk. Residents "hooked" into Fire Safe are now moving on to defensible space and applying for funding to complete a wildfire mitigation plan.

> **Fire Safe Councils**
> The California Fire Safe Council was formed in April 1993 "to preserve California's natural and manmade resources by mobilizing all Californians to make their homes, neighborhoods and communities fire safe." The program is designed to function at several scales. Recognizing that local grassroots organizations are best for reaching homeowners, most activity takes place at the local level where there are more than 130 county and community Fire Safe Councils. In addition to emergency preparedness and defensible space planning and implementation, the councils provide a forum where community residents can voice concerns about related issues, such as public safety and forest health, on both private and public land. The State FSC provides a clearinghouse of materials, information, and funding to facilitate the local Fire Safe Councils and works to affect State and Federal policy, evaluating legislation pertaining to fire safety, lobbying Congress for additional funding, and gathering its membership to "speak with one voice about fire safety." This program was recently adopted by the State of Nevada.

Firewise Communities/USA has more comprehensive and integrated requirements for participation in the program that makes incremental trialability more difficult. All selected neighborhoods must have a community assessment completed by a wildfire specialist, sponsor a Firewise Task Force Committee that will develop a plan and track progress, observe an annual Firewise Day, invest a minimum of $2.00 per capita annually in local Firewise projects, and submit an annual report to the national program. This required level of commitment has discouraged some communities from trying out the program and limited its scope of outreach. Individual homeowners may find Firewise information on their own, but they cannot benefit from the full range of its resources without participation in a neighborhood program.

Observability is how apparent the benefits of the innovation are to others. Innovations generally are adopted less as a result of any type of formal or scientific information but more as a result of adoption by peers (Rogers 1987). Concrete examples allow residents to see the results, reassess their previous notions of what "defensible space" might look like, and choose the actions they find acceptable.

Firewise Communities/USA

Created in 2001, Firewise Communities/USA is a nationwide initiative that formally recognizes communities in the wildland-urban interface that are taking specific steps to address wildfire risk. Firewise Communities/USA is an offshoot of the Firewise Program that first focused on fire-safe landscaping, then added safe building and construction practices, and in 1999 began conducting workshops for a community-based, planning approach to wildland fire risk. While these programs targeted builders, planners, community leaders, and fire agencies, the Firewise Communities/USA program is designed for homeowner groups. This program seeks small communities and neighborhood associations willing to work with State forestry agents and local fire staff to conduct wildfire risk assessment, design a mitigation program, and engage homeowners in implementation. Communities are encouraged to develop a plan tailored to their local conditions and needs, and the program offers informational and promotional materials on how homeowners can create defensible space. The Firewise Communities Web site lists more than 60 recognized communities in 21 States, from Hawaii to Florida, Minnesota to Arizona.

All three programs address observability by use of demonstration sites or "show me" homes. For instance, the Post Mountain Fire Safe Council cleared dense hazardous fuels around homes at the entrance of the subdivision so that residents become familiar with the new landscape every time they leave and return to their neighborhood. Several Fire Safe Councils in northern California created a series of photo points to show before and after fuels treatment. Two councils in southern California created Fire Safe demonstration gardens, one at a community fair and another more permanent garden next to the city's library. The FireFree program relies on its advertising business partners to help with observability. Publicizing a home signage project, posting a large sign on a new emergency egress, and flagging fire-resistant plants in nurseries were projects undertaken by one advertising firm to demonstrate to residents the range of fire safety activities and benefits. Potential Firewise Communities/USA applicants or just interested individuals can learn from recognized communities who submit accounts of their progress in wildfire mitigation, both in pictures and testimonials, on the Firewise Web site.

Compatibility is the degree that the innovation is consistent with the needs, experience, lifestyle, and previous values and ideas of the adopter. Many interface or rural residents value characteristics—such as privacy, aesthetics, and wildlife viewing—they may consider incompatible with effective defensible space practices. Programs that can tailor their efforts to address local values and interests are more likely to effectively address compatibility issues than programs entirely packaged and disseminated from outside the community.

Both Firewise Communities/USA and Fire Safe Councils provide materials that each community can adapt to local needs. Although Firewise provides experts for the community risk assessment, it asks

the community to create its own programs for implementation. The State-level FSC provides templates for meeting notices, letters to homeowners, newsletters, and auditing forms, but local Councils are encouraged to adapt these materials to reflect local conditions and experiences. In both these programs, a few communities have used surveys to gather residents' values on wildland-urban interface issues. Survey results were then incorporated into information campaigns, demonstrating how wildfire mitigation could enhance community values such as safety, forest ecology, and habitat—as well as protect property—in the event of wildfire.

Unlike the other two programs, FireFree educational materials, such as videos and brochures, were not designed to be easily customized for local situations and tastes. This was a reported drawback for communities who tried the program but found their homeowners could not relate to the style or pace of the FireFree video. The "ten tips" checklist and fire safe landscaping also were seen as inappropriate or contradicting local specifications. Compatibility can also be an issue at the programmatic scale. While Firewise Communities/USA allows mitigation projects to be designed to fit local conditions, the program itself is less compatible for communities who cannot easily be divided into the small neighborhood units the program considers most appropriate. Many communities also may not be able to leverage the funds necessary for Firewise Communities/USA designation.

Relative advantage is essentially a cost-benefit analysis, the degree to which an innovation is seen as superior to the status quo, either from an economic or a social standpoint. The relative economic advantage of defensible space is problematic because homeowners are being asked to spend money *now* for *possible* benefits down the road. Any rational homeowner presented with "hints" and "tips" for reducing wildfire risk would ask whether the benefits are worth the costs or effort. However, structural survival might easily be attributed to chance rather than mitigation and makes proving the relative advantage of mitigation difficult. Incentives are an important way to alter relative economic advantage, but do not always work well where the innovation is easily discontinued unless the subsidy can be continued over a long time. Given that vegetation grows back without periodic maintenance, financial incentives may be effective for initial vegetation management but social incentives are more likely to be successful for long-term maintenance.

Relative social advantage can be increased by designing mitigation that enhances values important to the community and demonstrating that it does. For example, in most landscapes, mitigation efforts can improve aesthetics and wildlife habitat as well as reduce wildfire threat. Highlighting these features increases relative advantage and provides reasonably immediate benefits that do not depend on experiencing a wildfire. Increasing social capital is another immediate benefit that can increase relative

FireFree sponsors Clean Up Week where debris can be recycled for free at the landfill.

advantage. Programs that increase contact between neighbors help develop a sense of community as people working together to reduce hazardous fuels cross ownership boundaries. Celebrations and annual events provide opportunities for sharing stories and reinforcing the aesthetics of fuel reduction. Working together increases the social advantage of adopting defensible space as such work becomes the "norm" rather than the exception, encouraging individuals to take action in order to belong. Connected neighbors also can exert a kind of peer pressure to have a neighborhood norm of safety by removal of hazardous fuels.

As financial incentives, Firewise and Fire Safe Councils promise to leverage local funds and volunteer hours into Federal grants for fuels reduction work that can cover part of the homeowner's costs. Promise of funding is a significant incentive for local homeowners to participate in planning programs and to mobilize local funds for implementation. A less comprehensive program, FireFree does not hold the promise of future funding for fuel reduction work. But it does mobilize neighbors to work collectively, often assisting individuals unable to complete the work themselves, in effect subsidizing the costs with volunteer labor.

Socially, all three programs emphasize neighborhood-based activities. Fire Safe Councils focus on mobilizing community awareness and empowering local organizations to address wildfire and forest health issues. Firewise Communities/USA relies on local neighborhood associations and leaders to draw on community spirit and develop resolve to take responsibility for "ignition potential." Firewise training, networking, and neighborhood events such as Firewise Days create a sense of community, often in neighborhoods of newcomers who had no previous opportunity to come together. FireFree's annual Cleanup Days encourage civic responsibility; neighborhood associations are provided with materials and assistance, including street banners and drivers of trucks with FireFree insignia, to promote the program. Community building activities have included neighbors jointly renting a chipper and baking cookies for troubled youth brought in to help.

Complexity is how difficult the innovation is to understand and use. Innovations that are simple and easy to understand are usually more readily adopted. Fire mitigation ranks high on the complexity scale. Although on a certain level, fire is a simple phenomenon, successfully reducing wildfire risk is a

complex story that varies based on characteristics such as building materials, site location, vegetation management, and the level of cooperation expected or found among many individuals and agencies.

As with trialability, programs with a number of simple and easy to implement "steps" for fire safety are more likely to show broader success. All three programs provide a number of options for homeowners with audits and handbooks (Fire Safe Councils and Firewise Communities/USA), and "tips" for getting in the "zone" (FireFree). Organized neighborhood activities can help simplify the process of coordinating work across property lines. They also can help create an environment where individuals can be shown exactly what needs to be done and get immediate answers to questions.

Complexity of adoption also exists at the program level. Programs that are complex and require a great deal of investment and commitment are less likely to be adopted. As discussed earlier, qualifying for Firewise Communities/USA requires a significant investment, and to date only high capacity (in terms of economic, human, and social capital) communities have adopted the program. FireFree, while simple for homeowner adoption, is more complicated as a program. Although more than 400 communities have requested program information, very few have adopted it fully because of difficulties getting landfills to cooperate or because of the daunting list of organizational requirements such as securing agency and business partners, developing retail programs and advertising strategy, and recruiting and training team leaders. With Fire Safe Councils, startup can be difficult for grassroots councils. However, coaching and training materials and networking and "cross training" opportunities provided by the State have helped reduce complexity problems, and almost every California county currently has its own council and within them are many local councils.

Information Dissemination

How information is communicated also affects adoption rates. Different media channels are influential at different stages of the adoption process; using the wrong communication channel at the wrong stage can slow the adoption rate.

When simply trying to create awareness of the innovation, mass media are the most effective communication channels. All three programs have created general media materials useful for initial contact and persuasion such as informational videos and brochures. FireFree has been the most active in the media arena. An advertising agency was commissioned to develop and promote FireFree through an extensive ad campaign. Before fire season, television stations run public service spots promoting the "ten tips" and cleanup weekends, as do full-page ads in the local newspaper. A fast-paced and humorous video on FireFree is available in local video stores and shown at neighborhood association meetings; brochures with tips for "getting in the zone" are on racks at the Chamber of Commerce and public library.

Overall program strengths and weaknesses

Examining the three programs through the Diffusion of Innovations lens provides insight into why and how programs are or are not effective. Of the three programs, the adoption of FireFree has been most limited. FireFree depends more on mass media outreach than interpersonal communication; the inflexibility of the media campaign limits its adoption in other regions as people have not found it congruent to their values and ecosystem. On one hand, the program is simple in its message to homeowners, and the checklist provides discrete actions; but on the other hand, the program is too complex in its instructions for others who might want to adopt it, with a daunting recipe book for establishing business partners and too few references to agency staff who might help. This program, while clearly addressing trialability and visibility innovation characteristics, does not address the other characteristics as well as the other two programs-and has not been as successful in its diffusion to areas outside its original base.

At the neighborhood level, Firewise Communities/USA is a textbook case of diffusion of innovation with its strong incentives for membership, its understanding that each community is unique but also desires to be recognized as belonging to a distinctive network, and its use of change agents for providing technical information and opinion leaders for motivation. However, the strict requirements for qualifying as a Firewise community render the program less inclusive. Although many communities have adopted the program and succeeded in gaining significant funding to implement fuels reduction projects, many communities lack the resources or cohesion necessary to successfully apply for the program-it is not divisible or simple.

The multiscale structure of Fire Safe Councils addresses the need for local action while also offering broader support in a flexible structure accessible to a variety of communities and counties. Fire Safe Councils find a range of local organization leadership to serve as change agents and knits them into a network that provides technical assistance, centralized funding sources, and multiple templates and media materials. The State-level Fire Safe Council promises benefits to adoption of its programs, from lobbying governments and insurance companies for fuels reduction incentives to providing checklists and technical assistance for getting the work done. Concerns for forest health and community safety are incorporated into programs, and results are made clearly apparent with demonstration sites and various community and county initiatives.

All three programs recognize the key to their success is neighbors talking to one another. In effect, this helps ensure that efforts address many of the variables the theory of Diffusion of Innovation has identified as encouraging adoption. Working at the local level helps develop conditions that create social incentives for participating in hazard reduction efforts and tailor efforts to address local compatibility issues. Activities in which neighbors work together can aid trialability, simplify a complex process, and create built-in opportunities for interpersonal communication. Seeing defensible space and other fire safe measures in one's neighborhood facilitates observability. Neighborhood-based activities also effectively address the need to work with a group of similar people and identify and enlist local opinion leaders who are most effective at encouraging behavior change. Neighbors in FireFree, Firewise, and Fire Safe communities testify to their increased sense of security, visibility of wildlife, and satisfaction with increased forest health associated with defensible space and thinning.

After the initial awareness stage, interpersonal communication channels, particularly with expert infor-mation sources, become the most effective method for changing behavior. Such two-way communication is most effective in reducing the inherent uncertainty of adopting a new innovation because it allows for discussion and clarification. For preventive innovations, interpersonal communication networks are particularly critical in creating localized incentives—support and peer pressure—to adopt. This is where the neighborhood program and cleanup days play a particularly important role. All three programs have sponsored community events where organizations and volunteers assisted in removing hazardous fuels and debris. Working beside homeowners, fire agency staff can answer questions, help clarify uncertainties, and reduce complexity.

Homogeneity

Generally, the more similar the members of a group are the more easily ideas are spread. When different levels of communication are necessary because of differences in social position, education, or technical training, it is more likely that the new idea will be ignored, misunderstood, or considered suspect.

When the audience is diverse, working with separate segments with similar interests can therefore help ensure the easy spread of an idea within that segment. For preventive innovations, audience seg-mentation has been found particularly helpful because it allows use of messages tailored to the interests of the targeted group. In essence this ensures that the information is received by a homogeneous group, thereby facilitating its diffusion. Segmentation also allows the most effective message to be created to highlight the innovation's relative advantage to the target group. In emphasizing neighborhood-based activities, all three programs recognize the importance of trying to work with like individuals. Neighbors often cluster in residential areas of similar lifestyles or income levels and see one another on a daily basis. In addition, participating in program-sponsored cleanup days and home fire safety audits can help local fire department staff become familiar and trusted community members.

An idea might spread rapidly within a group, but for it to be widely adopted there must be some communication between levels. Outside sources can offer technologically useful and appropriate information, such as GIS mapping and fire ecologists, as well as information on sources of State and Federal funding. The multiscale structure of Fire Safe Councils acknowledges the need for communication across groups and levels. The councils rely on partners from more than 50 public and private organi-zations at the State level to serve as links to resources and political advocates. The Fire Safe Councils' web page has extensive information, including an Ask the Experts e-mail message board for posting questions, and a list of Speakers Bureau members willing to cover topics that range from fund raising and running of a nonprofit to urban forestry and FEMA resources.

FireFree benefited from the interest of a regional insurance corporation that sponsored the program and promoted it nationally. Firewise Communities/ USA draws professional expertise from the National Association of State Foresters, which sends State representatives to training sessions to learn how to help communities understand their wildfire risk and opportunities for mitigation. Recognized communities have access to limited-access Web site pages and participate in meetings such as the National Wildland/ Urban Interface Roundtable where communities can network and learn about technical matters and funding sources from representatives of numerous national organizations including FEMA, the American Red Cross, the USDA Forest Service, and the U.S. Department of the Interior.

Change Agents and Opinion Leaders

Two sets of individuals play an important role in the adoption process. **Change agents** provide information and create interest in the adoption of an innovation by a specific population. Rogers describes a change agent as someone who provides "a communication link between a resource system with some kind of expertise and a client system" (Rogers 2003: 368). While often professionally trained and affiliated with an agency, change agents also may be local residents knowledgeable about local conditions, but lacking in formal training. Several factors influence a change agent's effectiveness: how frequently the agent is in contact with clients; whether the change agent's attitude and the innovation itself are oriented to meeting client's needs, not just the promoting agency's; and whether the agent belongs to the clients' peer group, is credible, and encourages the client to understand and evaluate innovations.

Fire chiefs and local representatives of State forestry agencies are good examples of change agents and play a central role in each of these programs. FireFree was the brainchild of a local fire chief in central Oregon, and State and Federal foresters are important partners. With the Fire Safe Council network, county supervisors and fire chiefs often play the role of change agent, convening county-level councils and connecting to the California Fire Safe Council network. Foresters, University Extension agents, Resource Conservation District directors, and local nonprofits can also bring their resources and leadership. Fire Safe Councils are notable in their diversity of leadership that optimizes the range of expertise and connectedness of change agents; however, it sometimes creates power contests and confusion over who is actually in charge and making important decisions, such as grant applications and allocations.

Opinion leaders are individuals within the target audience who are not necessarily the first people to adopt an innovation but rather are the individuals to whom other members of the group turn to for advice and information. Adoption is positively related with the degree to which change agents identify and use opinion leaders. Opinion leaders are important for several reasons. First, as members of the

local audience (and therefore similar), they are often positioned to spread information more effectively than a change agent, who often belongs to a different social group. Second, because interpersonal communication is key in fostering adoption, particularly of preventive innovations, opinion leaders can access pre-existing communication networks and magnify communication efforts of change agents (Rogers 2003: 388). All three programs are designed to find community opinion leaders to manage the process. Some members or staff of the State FSC will initially work with the community, introducing them to key elements of the program and helping to find local leadership. Local leaders are found in homeowner associations, local watershed, or conservation organizations, or they just "naturally" emerge, e.g., retired foresters, engineers, or newspaper editors.

Methods

Information about the programs was collected in a variety of ways including data from Web sites and interviews with coordinators and implementers of each program. For FireFree, the program founder and designers were interviewed, a sample of 400 organizations nationwide was contacted by phone, and an Oregon Department of Forestry effort to spread the program was followed. For Fire Safe Councils, networking meetings were attended and program coordinators at all levels were interviewed. For Firewise Communities/ USA, interviews with the program founder, program implementers, community members, and a potential community were completed.

Photo credit: Victoria Sturtevant

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Working with Community Leadership to Promote Wildfire Preparedness

Erika A. Lang and Kristen C. Nelson
College of Food, Agricultural and Natural Resource Sciences
University of Minnesota, St. Paul, MN (kcn@umn.edu)

Pamela Jakes
Northern Research Station, USDA Forest Service
St. Paul, MN (pjakes@fs.fed.us)

Introduction

As wildland fires increasingly involve residential areas, communities have to take action to help mitigate the potential effects of wildfire. Unfortunately, residents can be uncertain about what to do, reluctant to get involved, or unclear about the impact they can have. As resources are stretched to cope with suppression and restoration efforts, agency personnel can benefit from understanding the important role local leaders can play in promoting wildfire preparedness and how agency personnel can support these leaders in their efforts.

This study focuses on the role and characteristics of community leaders in wildfire preparedness to gain insight into how leaders motivate residents to get involved. The work builds on earlier research that identified leadership as an important element in community wildfire preparedness that merited further study (Jakes *et al.* 2003a). Land managers can use findings from our research to think about how to support the preparedness efforts of local leaders in their area.

Key Findings

We interviewed 10 individuals, across three communities, identified by other residents and wildfire professionals as leaders in wildfire preparedness. Each leader was interviewed to (1) identify skills and motivations for involvement, (2) measure participation in the leadership process, and (3) characterize leadership style. We found a number of characteristics for managers to consider in working with community leaders.

Leaders become involved for a variety of reasons. Seven of the ten leaders were motivated because their job involved fire management or political office. Leaders also cared about their personal property and the safety of other residents as well as the surrounding environment. A few became involved at the request of other residents.

Leaders bring important skill sets with them. Community leaders identified five skills critical to success, most of which were interpersonal: knowing the constituency, communicating with others,

working toward a goal, using residents' talents, and delegating tasks. *Managers can identify people with these skills and find a variety of ways to develop the skills and motivate them to work on preparedness.*

Community leaders in wildfire preparedness are valuable to their communities for many reasons. As residents themselves, they understand the community and are able to encourage mitigation and preparedness in a number of ways including:

- Helping to identify important local issues and create a vision for action.

- Developing a preparedness strategy that takes community members' goals into account.

- Obtaining commitment to act by communicating with other residents and building one-on-one relationships. Almost all emphasized the importance of individuals taking on responsibilities that would benefit the community.

- Mobilizing financial and material resources.

To get things started, managers may need to be more active in the critical early stages of identifying the issue and creating a vision, but community leaders will take over in later stages. Land managers can help leaders in identifying key preparedness and mitigation issues by supplying information, providing training to improve leaders' skills, and rewarding commitment by sharing ownership or providing funding for future efforts. Local land managers were often an important first link in establishing the ties between community groups and public land agencies that facilitate resource mobilization. In mobilizing resources, agency managers become partners who can identify mutually beneficial resources at all scales.

Leaders consider motivating people and facilitating activities as more important than directing people and activities. Differentiating between motivational and directive leadership can be helpful in understanding leaders' qualities and their work with residents. Land managers may want to use this concept when working in their own areas.

Detailed Findings

Leaders become involved for a variety of reasons. Community leaders cared not only about their personal property and the safety of other residents, but also about the surrounding environment. Seven of the ten leaders were motivated because their job involved fire management or political office. For a few, it took other residents asking them to become involved. One leader noted, "I've been told… by other people that (this) was an area we should concentrate on." Some leaders got involved because they feared no one else would. One leader said, "Basically, it was a void. There didn't seem to be any people who were getting involved at a level that change was going to take place." Almost all had personally

experienced a wildfire. When leaders experienced smelling/seeing smoke or being evacuated, fire became a personal reality for them and raised their awareness. One leader remembered, "…my first exposure to wildfire was being evacuated from [my hometown] in 1959 as a first grader."

Leaders bring many skills from past experiences; interpersonal skills are considered the most important. Once motivated, community leaders in wildfire preparedness were able to draw on skills and knowledge gained from past experiences. Several leaders brought up childhood experiences as Eagle Scouts or the influence of a role model; these experiences helped them believe they could do something. Over time, these individuals had developed a knowledge base that assisted them in their leadership role. Most leaders had informal training that proved relevant in mobilizing residents around wildfire preparedness: ecology and wildfire knowledge, experience managing businesses, public speaking experience, and even leadership training. Seven out of ten added to this knowledge with wildfire preparedness courses.

These community leaders identified five skills critical to successful leadership, most of which were interpersonal skills: knowing the constituency, communicating with others, working toward a goal, using residents' talents, and delegating tasks. "To be a good leader, you have to understand the people…and what their capabilities are," one leader commented.

Community leaders can lead and encourage mitigation and preparedness in a number of ways. We investigated the degree of participation in five identified stages of the leadership process: identifying issues, creating a vision, developing strategies, obtaining community commitment, and mobilizing resources (Chrislip and Larson 1994, Wilkinson 1970). Overall, the majority of respondents played a role in three to four stages (table 1). To get things started, managers may need to be more active in the critical early stages of identifying the issue and creating a vision, but community leaders will take over in later stages.

Identifying the issue(s). As a leader, an individual must first recognize an issue exists and believe it is important enough to take action. Community leaders were asked to rank, on a scale of 1 to 5, how critical wildfire preparedness is for the community. Most leaders believed wildfire preparedness was very critical for the community, giving an average ranking of 4.6 (5 was very critical). In this first stage, three leaders reported they had identified wildfire as an issue for the community, while other leaders found out about the issue through county, State, or Federal natural resource agency personnel, or concerned residents.

Creating a vision. A vision has been defined as "a set of idealized goals established by the leader that represent a perspective shared by followers" (Conger and Kanungo 1998: 156). In wildfire preparedness,

Table 1.—Leader involvement in different stages of the leadership process (n = 10), 2003.[1]

Leader	Leadership stage					Total # stages
	Identify issues	Create vision	Develop strategy	Obtain commitment	Mobilize resources	
1			X	X	X	3
2			X		X	2
3	X	X	X			3
4	X	X			X	3
5			X	X	X	3
6	X		X	X	X	4
7			X			1
8			X	X	X	3
9		X	X	X	X	4
10		X	X	X		3
Total leaders	**3**	**4**	**9**	**6**	**7**	

[1] Stages modified from Chrislip and Larson (1994) and Wilkinson (1970).

fewer than half the leaders reported being involved in creating a vision, but at least one leader in each community reported participating in vision development. Others stated that staff in natural resource agencies, such as the USDA Forest Service, the Lawrence County Fire Advisory Board, and the New Jersey State Forest Fire Service, generated the initial visions. There may be several reasons for this. In some cases, leaders may not wish to give themselves too much credit, or leaders may not have an analytical understanding of the function of a vision or be able to differentiate between early stages. Another possibility is that natural resource agencies are taking on this role and communities have let them, because they have a greater mandate to address wildfire issues. Or, with wildfire, the vision might already be clear: reduce potential damage.

Because wildfire preparedness is a relatively new challenge for communities, leaders may be looking for ideas from land managers who have dealt with this issue for a long time. Managers have the experience to provide the initial support a citizen leader may need in creating a vision for community preparedness. As partners with community leaders, land managers can model how to think beyond property boundaries for landscape-level planning in wildfire preparedness.

Developing a strategy. Community leaders for wildfire preparedness were most comfortable reporting concrete tasks used to achieve the community goals based on their vision for informed citizens, wildland interface protection, and an organized community. For example, leaders disseminated information packets to residents, assessed property for wildfire risk, or formed a FireSafe committee. In developing strategies with other residents, leaders took community members' goals into account. They felt residents

had moderately shared goals for addressing wildfire issues with an average score of 3.8, on a scale of 1 to 5. Respondents said residents wanted protection for their homes and lives, and services from the local fire department and natural resource agencies, including evacuation routes and vegetation management.

Obtaining community commitment. To effect change, leaders had to obtain community members' commitment that wildfire was an important issue that needed a joint effort. One leader stated, "…I think everybody agrees it (wildfire) is a demon that we all have to deal with." Nine leaders noted increased awareness and sense of importance after a wildfire occurred, but many community members already knew the historical importance of fire and landscape changes. Despite the overall agreement about the importance of wildfire, there was still a range of opinions about how critical the wildfire issue was and whether it was worth a joint effort.

Leaders worked with other community members using three primary techniques to motivate residents to get involved: written information, presentations, and workshops. Almost all leaders used the media to encourage people to get involved; they wrote newspaper articles and spoke on the radio. They also provided residents with information using signage, such as fire danger signs, and mailings. In the Gunflint Trail community, leaders asked local businesses to post information. Presentations were done at schools, group meetings, and associations. In the Gunflint Trail and Berkeley Township, workshops proved to be an effective strategy.

Leaders paid special attention to how they constructed their messages. When speaking to homeowners, almost all emphasized the importance of individuals taking on responsibilities that would benefit the community. One leader said, "It (wildfire) is a community-wide problem and each person in the community plays a part in solving the problem or dealing with it." Several stressed the nature of wildfire as a crisis to raise awareness. "…We had this fire this year and it really just brought it to the forefront." To make wildfire a reality for community members, half of the leaders focused on the results of past wildfires, emphasizing stories of property damage and providing graphic images of homes on fire. One leader showed residents pictures of damaged property and told them, "It's not a scare tactic; it's a reality check…this is your community and I'm going to give you the address so you can go and see it (house)… this can happen again…" In two communities, individuals presented the future possibilities of preparedness by using their own property as a model of defensible space and brush thinning.

An important technique used by leaders was working one on one with residents. These methods may be important in helping overcome residents' different perceptions of risk and responsibility, which make it particularly challenging when trying to steer people toward a general goal of wildfire preparedness. Land managers can also use these methods when they communicate with private landowners and community officials. However, in some cases it may be beneficial for managers to contact local leaders

who have already established a relationship with their neighbors and have gained respect and trust. In addition, local leaders can identify with resident needs.

Mobilizing resources. Finally, 7 out of 10 leaders played a key role in mobilizing resources to address wildfire preparedness (table 1). Within all three communities, leaders encouraged residents to give their time, knowledge, and material and monetary donations to the community effort. Residents attended meetings, gave feedback to local leaders, volunteered for the fire department or a committee, hosted fundraisers, and cleaned up their own property. In addition to individuals, volunteer fire departments, businesses, homeowner associations, and schools got involved. However, as in many community development efforts, some residents were more active than others, and others were not involved at all.

One major component of resource mobilization is the ability to bring in resources from State and Federal agencies to support community goals for wildfire preparedness (Brown and Nylander 1998). In all three communities, some leaders were effective in linking community fire preparedness objectives to programs and resources at the county, State, and Federal levels. As one individual said, "It is a total commitment of the mayor and his administration, the town facilities, the state, and the federal." Another mentioned "…agencies—we've had just excellent help. I would say it was a joint effort." Gathering resources from external groups may be especially important in rural and unincorporated spaces (Duhl 1997). This was especially true for the Gunflint Trail and Spearfish communities that, because of isolation and a small tax base, found it challenging to provide services to their residents without the help of others.

Local land managers are often the most important first link in establishing ties between community groups and public land agencies. In addition to providing more information to citizens, managers may be able to link leaders into national initiatives, saving leaders time looking for contacts and brainstorming options as they develop their own ideas. In helping mobilize resources, agency managers become partners who can identify mutually beneficial resources at all scales. Managers are often able to provide resources to communities in the form of new partners, equipment, or grants. For example, Jakes *et al.* (2003a) found that "agencies…have resources that influence and help implement their decisions relating to the purchase and availability of gear, scheduling and conduct of training, and implementation of protocols (p. 4).

Leaders consider motivating people and facilitating activities as more important than directing people and activities. As a group, the community leaders ranked both transformative (motivational) and transactional[1] (directive) qualities as important, with a range of 1.15 to 2.7 average scores on a scale of 1 to 5 with 5 being least important (table 2). However, they consistently placed more emphasis

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[1] A more detailed discussion of transformative and transactional leadership can be found in the Literature Review section.

Table 2.—Average scores for the evaluation of transformative and transactional leadership style qualities on a scale of 1 to 5 in close-ended questions; 1 = most important and 5 = least important (n = 10), 2003.[1]

Leadership style	Type of quality	"A leader should…"	Average
Transformative	Process	"motivate people"	1.15
Transactional		"train people"	2.15
Transformative	Risk	"take risk"	1.90
Transactional		"go with what you know will work"	2.70
Transformative	Role	"facilitate others"	1.33
Transactional		"direct others"	2.30
Transformative	Outcome	"be evaluated by process"	1.88
Transactional		"be evaluated by product"	2.50

[1] Qualities modified from Burns (1978) and Bass (1985).

on transformative qualities, such as motivating people to get involved over training people. One leader stated, "You certainly should motivate people. If you aren't going to motivate people… then you are really not a leader." Leaders who were city officials placed a greater emphasis on training residents, a transactional quality.

In terms of risk, leaders emphasized trying new things and taking a risk, a transformative quality, as opposed to reducing risk and going with what you know will work. On one hand, most leaders were willing to take risks, and each identified some risk in their leadership experience. Just getting involved in wildfire issues was seen as a risk for half the leaders because they risked their credibility, relationships, and the safety of others. On the other hand, several leaders did not want to risk something new. Often, these individuals were volunteer firefighters whose primary concern was safety. "You want to be safe… Human safety would be my first concern."

In describing how they work with residents, leaders ranked facilitating activities as more important than directing activities. When working with other residents, the majority of leaders either felt they were equally involved in the work or delegated tasks, a transformative quality. Leaders remarked, "It was just a question of utilizing the attributes of the personnel that were willing to volunteer their time," and "…you don't always want to be leading. There are times when you have to be the volunteer." Leaders who stressed the need to direct people were positional leaders, who do this as part of their job.

Finally, in terms of final outcome, most leaders thought process was more important than product. As one leader noted, "…the product can be a single entity and end there. But the process is an ongoing thing used over and over again." A few leaders, however, placed more emphasis on the product. "You want it done, you don't care how it is going to be done."

Overall, differentiating between motivational and directive leadership can be helpful in understanding leaders' qualities and their style of working with residents. Land managers may want to use this concept when working in their own areas. Like leaders, land managers may have to influence people's opinions, especially if the issue is contentious. Transformative qualities are important and may help land managers shift their focus from equipment and tasks to a broader presentation of the crisis. Managers can also emphasize the importance of citizen ownership, resulting in leaders ready to take over a project when the land manager is gone.

Study Sites

In the broader community preparedness study, 10 researchers in 15 cases throughout the United States focused on wildfire actions and the social factors a community needs to maintain or improve wildfire preparedness (Jakes *et al*. 2003a). In three pilot case studies, researchers found several important "community characteristics critical to wildfire preparedness," including social capital and, in particular, leadership (Jakes *et al.* 2003a: 7). As one resident of the Gunflint Trail community observed, "leadership is the critical piece."

Our study focused on 3 of the original 15 communities. Previously we had visited the communities and interviewed 15-18 key informants about wildfire preparedness. Three leaders were identified in the Gunflint Trail, Minnesota; three in Spearfish and the Northern Black Hills, South Dakota; and four in Berkeley Township, New Jersey. These 10 were identified multiple times as important leaders in wildfire preparedness during key informant interviews with local residents or natural resource agency employees.

The Gunflint Trail, Minnesota. Located in northeastern Minnesota, this community is known for its pristine beauty and many recreational opportunities available to its 2,500 permanent and seasonal residents. The region is characterized by northern boreal forest and rocky terrain that experiences annual surface and crown fires. In 1999, a straight-line windstorm affected 477,000 acres in the region, dramatically increasing the fuel load. Community residents are aware of the wildfire risk and have taken action to increase their preparedness (Nelson *et al*. 2003b). Actions include creating a volunteer fire department, holding a Firewise meeting, and marketing wildfire sprinkler systems for both homes and businesses (Jakes and Nelson 2002).

Spearfish and the Northern Black Hills, South Dakota. Surrounded by the foothills of the Black Hills National Forest and rolling prairies, Spearfish is home to more than 13,000 permanent and seasonal residents. After years of fire suppression, the historically open ponderosa pine ecosystem has been transformed into a dense forest with large fuel loads. In response to recent wildfires, residents, volunteer fire departments, and natural resource agencies throughout Lawrence County are working together to

address wildfire issues. Activities include educating the public, organizing a Firewise conference, assessing property, establishing fuel breaks, and thinning brush (Lang *et al.* 2003).

Berkeley Township, New Jersey. Located adjacent to the Atlantic Ocean and divided by the Garden State Parkway, Berkeley Township in New Jersey is made up of 43,000 residents living in single homes or retirement communities. On the landward side, this community is surrounded by a fire-dependent pine/scrub oak ecosystem. Two major wildfires have threatened homes and lives in the last 10 years. In response to these wildfires, a Fire Safe committee was created, linking town officials, citizen groups, volunteer fire companies, and natural resource agencies. Neighborhood associations have provided information on key topics such as evacuation routes (Nelson *et al.* 2003a).

Methods

We conducted audiotaped phone interviews during February/March 2003. Leaders were asked 19 open-ended and 2 close-ended questions in a semi-structured interview (table 3). Each interview tape was transcribed and then coded based on the key themes. Multiple researchers independently coded open-ended questions in a random assignment manner.

Table 3.—Questions focused on community leadership in wildfire preparedness

Skills theme: In thinking about your leadership role in wildfire preparedness—
    What personal attributes made you successful?
    What do you consider the essential characteristics of a leader?
    What experiences/training have you had that may contribute to your leadership ability?

Motivation theme
    Why did you choose to get involved in wildfire preparedness?
    What risks did you have to take as a leader in wildfire preparedness?

Stages/roles theme
    What role(s) did you play in identifying wildfire as an issue?
    What did you do as a leader? Please describe.
    How did you convey your idea(s) to others and motivate them to get involved?
    What tools and tactics were used to motivate people?

Transformative and transactional qualities ranking
    In a series of close-ended questions, leaders were asked to rank the importance for them of four transformative qualities and four transactional qualities, using a scale of 1 to 5; 1 = most important and 5 = least important.

    Transformative qualities: motivating people, taking risks, facilitating others, and being evaluated by how they achieve outcomes (process).

    Transactional qualities: training people, going with what they know will work, directing others, and being evaluated by what they produce (product).

Nine of the ten respondents were male. The majority of the respondents were between the ages of 40 and 50, with an equal number of remaining individuals in their 30s and 60s. More than half the leaders were long-term residents (more than 15 years). Others had moved into the community more recently after retirement or other lifestyle change. Community leaders for wildfire preparedness held various jobs including volunteer fire chief, resort owner, recruiter, lumber company manager, GIS analyst, rancher, retired accountant, municipal fire administrator, construction officer, and mayor. In addition to their jobs, seven leaders were volunteer firefighters with some wildland fire experience. The majority had a college education; others were technically trained in firefighting.

Literature Review

Key themes in leadership scholarship and practice emphasize skills, motivation, roles, and the style of the relationship between leaders and followers. In recent years, various authors have moved from what "a leader is" to what "a leader does." "Leaders will take responsibility for initiating, formulating, coordinating, and continuing local action to improve the social well-being of community residents" (Pigg 1999: 197). Leadership is also defined as a process of facilitation, mutual education, learning, mentoring of others, and collaboration and cooperation with diverse groups and individuals (Duhl 1997).

Leadership skills and motivation. When people think about a leader, an individual's skills are often the first thing they mention. Commitment, vision, and knowledge are emphasized in environmental and community leadership (Berry and Gordon 1993, Egri and Herman 2000), because environmental problems are often complex, long-term, and involve multiple constituent groups. But even if some people have the skills, they may not choose to get involved in community efforts. Motivation to become involved may arise from a natural disaster (Brown and Nylander 1998, Machlis *et al.* 2002), a position the individual holds, personal experiences over a lifetime (Duhl 1997), or a deep concern.

Leadership roles and relationships. Leadership involves several stages with unique roles. The first stage is helping create a vision and working with others to obtain resources to achieve that vision (Foster 2000). After vision development, a variety of leadership stages have been identified. Chrislip and Larson (1994) identified collaborative leadership process stages such as convening, energizing and facilitating, creating a vision, problem-solving, establishing ownership, and expanding involvement. Wilkinson (1970) defined five phases of task accomplishment by community leaders: initiation and spread of interest to raise awareness, organization of sponsorship, goal-setting and strategy formulation, mobilization of resources, and implementation to reach an outcome.

In addition to leadership roles based on stages, leadership arises from a relationship between leaders and followers (Brown and Nylander 1998, Pigg 1999). There is a back-and-forth nature to this relationship;

the origin of ideas and decisionmaking is rarely unidirectional. In all relationships, work is facilitated by the wise use of techniques to encourage collective work. Scientists and concerned citizens alike can use speeches, demonstrations, and exhibits to work with others (Jacobson 1999). In their studies of homeowners living in the interface, fire management specialists organized workshops with community leaders and distributed surveys to solicit residents' opinions on defensible space (Hodgson 1995). Unlike some leaders in business, community leaders involved in wildfire preparedness are often not in a position to mandate or tell others what to do. While the former may be able to use directive techniques, the latter must use more influential methods to receive support. Organizational leaders use authority and power when working with followers, while local leaders develop relationships and networks with groups (Pigg 1999). In contrast to business leaders who may use "institutional power differentials," environmental leaders use "social influence, such as words or deeds" (Egri and Herman 2000: 572). By knowing which combination of techniques and persuasive methods to use, a leader may be able to work more successfully with a variety of people and achieve the desired goal.

Leadership styles. Transformative and transactional leadership styles are a typology that persists in current assessments (Burns 1978).

Transformative leaders have a vision and gain support by inspiring others (Berson *et al.* 2001). Followers may be motivated because transformative leaders consider other people's needs, stimulate their minds, and empower them to take action (Bass 1990). Transformative leaders expect their followers to rely on themselves and take initiative (Bass 1985). These leaders develop new ways to solve problems while often taking risks (Berson *et al.* 2001).

Transactional leaders commonly take a position as coordinator or monitor and provide support and direction to followers (Egri and Herman 2000). In working with followers, transactional leaders address their followers' needs in exchange for the completion of tasks (Berson *et al.* 2001). Followers are expected to be goal oriented, needing clarification and reinforcement along the way (Wofford *et al.* 1998). Unlike transformative leaders, transactional leaders prefer to avoid risk by working in familiar environments (Bass 1985). While some leaders make a distinction between transformative and transactional qualities (Burns 1978), others argue that leaders may exhibit both leadership styles (Bass 1985). Using both styles, a leader may be able to work more effectively with diverse stakeholder groups.

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Working with Neighborhood Organizations to Promote Wildfire Preparedness

Holly Johnson Shiralipour
Brooker Creek Preserve Environmental Education Center
Tarpon Springs, FL

Martha C. Monroe
School of Forest Resources and Conservation
University of Florida, Gainesville, FL (mcmonroe@ufl.edu)

Kristen C. Nelson and Michelle Payton
College of Food, Agricultural and Natural Resource Sciences
University of Minnesota, St. Paul, MN (kcn@umn.edu)

Introduction

The structure of neighborhood organizations can encourage resident participation in a range of activities, which suggests that neighborhood organizations may be one of the more effective ways to involve people in adopting wildfire preparedness actions. Examples of neighborhood organizations include homeowner associations, neighborhood councils, and volunteer fire departments. Using established neighborhood organizations potentially offers several advantages over forming new groups or working with service and church-based organizations, social groups, and sport clubs. This has been recognized by a growing number of government agencies, nonprofit organizations, and fire departments that are working with neighborhoods to promote wildfire preparedness (Boura 1998, McGee and Russell 2003, NWCG 1998). This research project was designed to learn about the role neighborhood organizations play in helping people reduce their wildfire risk. Results show these groups are a readymade physical, social, and political entity capable of playing that important role.

In this paper we present insights developed in interviews with leaders of the local neighborhood organizations and employees of community fire departments and forestry agencies to learn about wildfire prevention efforts and the role of neighborhood organizations in these efforts. The interviews showed tremendous diversity in neighborhood organization membership structure, functions, dues and budget, and wildfire preparedness activities offered. These characteristics were examined to identify possible relationships with the willingness of neighborhood organizations' to participate in wildfire preparedness activities.

Key Findings

We interviewed individuals in six communities that had WUI neighborhoods at risk of wildfire, a history of fire within the region, and a history of wildfire education and outreach efforts. The study communities included Anchorage, Alaska; Bastrop, Texas; Berkeley Township, New Jersey; Colorado Springs,

Colorado; Ormond Beach/Volusia County, Florida; and Spearfish, South Dakota. Findings from the interviews highlight several areas that may help resource managers work with neighborhood organizations and develop effective programs within their jurisdictions.

- **Working with neighborhood organizations can be one of the best ways for resource managers to reach residents and extend agency outreach.**

- **Neighborhood organizations can help model fire mitigation behavior for community members.**

- **There is no one-size-fits-all neighborhood organization; instead these organizations fit the character of the people and the place. Managers need to adjust their approach to fit the local organization's characteristics.**

- **Wildfire preparedness activities cannot be explained by an organization's resources, membership, or budget.**

- **Leaders who are networked with other groups may be the key to increased preparedness activities. Identifying active neighborhood leaders and providing opportunities for recognition can greatly increase the effectiveness of outreach efforts.**

- **Managers can support local fire mitigation efforts by providing resources and technical assistance to neighborhood organizations.**

- **Open communication facilitates the process. Managers need to work to create, maintain, and support good lines of communication.**

Detailed Findings

Working with neighborhood organizations can be one of the best ways for resource managers to reach residents and extend agency outreach efforts. Neighborhood leaders mentioned many preparedness activities, but educating homeowners and creating efficiencies by supporting group projects were the major activities undertaken. Basic wildfire preparedness activities conducted by neighborhood organizations ranged from disseminating information in newsletters and Web sites to having fire department and Firewise representatives speak or show a video at meetings. More comprehensive programs included activities such as holding chipping/mulching events, working on common areas to reduce wildfire risk, and scheduling special events to educate residents, e.g., fairs, picnics, and school programs. In several cases, communities provided cost-sharing grants or equipment to the neighborhood organizations to facilitate the chipping/mulching events and common area cleanups.

Other types of advanced preparedness activities included creating demonstration areas around homes, assisting residents with evacuation planning, holding workdays to assist elderly and disabled residents, and forming a committee to address wildfire preparedness. In some neighborhood organizations, leaders

reviewed covenants and regulations to determine if they contributed to wildfire risk. They worked to make changes either in their own covenants or at the community level in the areas of roofing material, vegetation clearing, and slash burning. Two neighborhood organizations enforced their covenants to require noncomplying homeowners to manage overgrown vegetation and replace wood-shake roofs.

Some neighborhood organizations contacted government agencies about reducing wildfire risk on adjacent lands through prescribed burning or mechanical vegetation removal. Bob Bendlin and Jim Mozo, officers with the 200-home Plantation Pines Homeowners Association (Volusia County, Florida) have established strong relationships with Ormond Beach and Volusia County fire departments and The Nature Conservancy. In addition to attending local government-sponsored Firewise training workshops and meetings, the two men helped coordinate a prescribed burn on adjacent public lands that included outreach to neighborhood residents. Said Bendlin, "We felt it was important to educate residents so they understood why we were doing the burn and what effects they could expect from it. Reactions from residents have been favorable for the most part. The one person who complained moved." Bendlin and Mozo also convinced residents in the rural subdivision to pay for the installation of horizontal hydrants to improve firefighting capabilities. Recently, they worked with fellow residents to convince the fire department to locate a new station next to their subdivision on a donated parcel of land.

Neighborhood organizations can help model fire mitigation behavior for community members.
The type and frequency of social events offered by neighborhood organizations do not suggest a strong relationship with their proclivity to undertake wildfire preparedness activities. At the same time, social networks do seem to play a role in wildfire preparedness. Several of the interviewees from more active neighborhood organizations commented that residents who see neighbors remove vegetation or take other preparedness actions are often inspired to do the same. The Texas Forest Service and Bastrop Volunteer Fire Department worked with Pine Forest and Tahitian Village neighborhood associations to organize two mulch festivals for residents. According to Mike Norman, Chief of the Bastrop Volunteer Fire Department, "During the second festival, chippers went around to peoples' properties, ground the vegetative debris, and left the chips for homeowner use. The chipping was supposed to be done in two weekends. Residents saw their neighbors clearing vegetation and decided they needed to do the same. It ended up taking 2 months to do all the chipping."

In Hunters Ridge (Volusia County, Florida), board members and association staff worked hard to reduce their wildfire risk in several common areas located within the 400-home subdivision. Ken Duvall, president of the homeowners association, explained, "We trimmed trees, cleared brush, and removed all highly flammable types of vegetation such as palmettos, replacing it with less flammable species. In addition to reducing wildfire risk, we want to set a good example for residents since we are encouraging them to do the same." The association made the common area cleanup a priority and was able to fund cleanup and planting costs within their budget.

There is no one-size-fits-all neighborhood organization that is best to work with; instead these organizations fit the character of the people and the place. Characteristics such as size, membership type, and budgets do not matter in selecting neighborhood organizations to work with. Managers need to adjust their approach to fit the local organization's characteristics. They need to talk to leaders to determine what priority wildfire preparedness may have and to identify possible barriers to adopting preparedness behaviors. Learning about each neighborhood organization's structure, communication system, demographics, and social norms will be helpful in assessing resource and information needs and developing effective messages.

Neighborhood organizations in this study include homeowner associations, community councils, volunteer fire departments, and neighborhood block clubs. The number of homes in each neighborhood ranges from 15 to more than 1,000. Membership types include mandatory, voluntary, or mandatory with a grandfather clause for residents that pre-dated formation of the association. Membership dues for these organizations range from $25 to more than $1,000 per year. Some neighborhood organizations secure additional funds through voluntary assessments, fund-raising events, and grants.

Annual operating budgets vary considerably depending on the services provided. Neighborhood organizations that provide infrastructure elements such as road building and maintenance, water systems, and fire protection tend to have larger budgets and typically hire part- or full-time staff. Other functions performed by neighborhood organizations include reviewing and controlling architecture/landscape actions, enforcing codes and covenants, providing social opportunities, operating recreational facilities, solving neighborhood problems, educating homeowners about important issues, and representing the neighborhood in the larger community.

Activities common to almost all neighborhood organizations include holding general membership and board meetings, organizing social events, and communicating with other entities. Frequent interactions have occurred with government agencies, fire departments, and umbrella organizations (e.g., coalition of homeowner associations) on issues such as zoning, subdivision infrastructure, wildfire preparedness, neighborhood schools, and adjacent developments. Several of the neighborhood organizations have some type of internal neighborhood communication system. According to Bill Bomberg, president, the Mountain Plains II Homeowner Association (Spearfish, South Dakota) is especially effective at communicating with its members:

> *We probably communicate more than anyone, we try to keep information out in front of people. We have up to 75 percent of the homeowners' e-mail addresses so if anything needs immediate attention, we'll go ahead and put out an e-mail. If the information can wait, then we put it out in a newsletter every 2 months. If it's something important, we have a*

calling tree. We've used it for rationing water when levels in the tank were low and could use it if we're threatened by fire.

Wildfire preparedness activities cannot be explained by an organization's resources, membership, or budget. Our review suggests that the size, membership type, and budget of a neighborhood organization do not have a significant effect on the type and number of wildfire preparedness activities conducted. The more active groups vary widely in their structures, ranging from one organization with less than 50 voluntary members run by volunteer officers with a small budget to another with several hundred mandatory members run by paid staff with a more substantial budget.

Neighborhood organizations that provide infrastructure services tend to be among those more actively involved in wildfire preparedness. It is possible that the officers and staff of those organizations view wildfire preparedness as similar to a service such as fire protection. The Circle D Civic Association (Bastrop, Texas) encompasses 460 homes and provides road maintenance and paving, architectural review and control, maintenance of two common areas, and neighborhood representation on issues such as endangered species and unexploded Army ordinance. Tammy Pickering, office manager of the Circle D Civic Association, explained,

Board members cleaned up vegetation in common areas and around their Florida clubhouse to reduce wildfire risk and demonstrate a firewise landscape to the community.

The association is closely intertwined with the volunteer fire department. We lease the fire station to the VFD for $1 per year and contributed an addition on the building and money for trucks. Ten dollars of every assessment goes to the fire department. We work closely with the VFD to help homeowners with wildfire mitigation and give fire department officials time at every board meeting.

Leaders who are networked with other groups may be the key to increased preparedness activities. Identifying active neighborhood leaders and providing opportunities for recognition can greatly increase the effectiveness of outreach. Identifying neighborhood organization leaders who will champion the cause of wildfire preparedness is an important place to start. The most obvious leaders are officers or committee members. Other potential leaders include residents with a personal interest

in the issue such as environmentalists (e.g., members of The Nature Conservancy or Audubon), people with a related occupation (e.g., firefighters), or residents with previous wildfire or home fire experiences. Managers can obtain contact information for neighborhood leaders from property appraisers, planning and zoning departments, fire departments, and areawide councils of neighborhood associations. If neighborhood organization officers do not appear to be the most appropriate contacts for working on wildfire preparedness, they may be helpful in identifying residents who would be willing contacts.

Bill Robertson and Richard Randall, officers with Top of Skyway Homeowner Association (Colorado Springs, Colorado), are examples of neighborhood leaders that act as champions. A wildfire risk map produced by the Colorado Springs Fire Department helped them realize their neighborhood was at high risk of wildfire. "We want to be responsible homeowners and were naturally drawn to the topic of wildfire preparedness," Robertson said. "We put our civic hats on and decided to get our association involved," Randall added. The two worked frequently with the Colorado Springs Fire Department to organize a neighborhood meeting that featured a fire department speaker and traveling Firewise trailer, set up a home demonstration site to show vegetation removal, and obtained material for their association newsletter. They also organized a cleanup. A neighborhood survey they conducted showed a very positive reaction to the Firewise initiative.

Recognition programs for neighborhood leaders who effectively champion wildfire preparedness increase local awareness of wildfire preparedness actions, provide positive feedback to participants, and help to establish a social norm of increased wildfire preparedness. The Colorado Springs Fire Department started a program to recognize neighborhood leaders that promoted wildfire preparedness in their subdivisions. The neighborhood champions receive awards and media recognition for their efforts. Kathy Prudhomme with the Colorado Springs Fire Department noted, "The recognition program has been very well received and seems to help motivate other neighborhood leaders to act as champions." Another opportunity for recognition is the national Firewise program. Neighborhoods can elect to participate in the program and if they meet the criteria of the program, they will be certified as Firewise communities (www.firewise.org).

Managers can support local fire mitigation by providing resources and technical assistance to neighborhood organizations.

A number of helpful wildfire preparedness resources and ideas for technical assistance identified during the interviews are useful to consider when developing a neighborhood outreach program. Many of the government agencies and fire departments in the study made staff available to assist neighborhoods with presentations at meetings, hazard assessments and evaluations, and evacuation planning. These agencies also helped neighborhoods plan vegetation removal/cleanup events (sometimes offering

incentive grants), conduct demonstration sites at neighborhood homes, and review covenants and regulations pertaining to wildfire preparedness. Resources provided to neighborhood organizations include articles for their newsletters; wildfire preparedness checklists or assessment tools; videos; and brochures, magnets, posters, and demonstration site signs.

Open communication facilitates the process. Managers need to work to create, maintain, and support good lines of communication.

Study results suggest that creating and maintaining good communication with neighborhood leaders helps foster more wildfire preparedness activity at the neighborhood level. Contacting neighborhood organization leaders several times a year will engage them and encourage them to use available resources.

The degree of internal and external communication occurring within neighborhood organizations also appears to have a bearing on how active these organizations are in conducting wildfire preparedness activities. Neighborhood organization leaders who communicate regularly with both members and outside entities act as champions for issues such as wildfire preparedness. They use personal conversations, phone trees, e-mail messages, Web sites, and newsletters to create awareness, educate members, and galvanize them to take action. These individuals readily seek outside expert assistance from fire departments, government agencies, and others to enhance their efforts.

Methods

We selected six communities that had WUI neighborhoods at risk of wildfire from nearby forested wildlands (public or private) and a history of fire within the region. In addition, State forestry agencies and fire departments that serve the six study sites had implemented wildfire education and outreach with a number of the local neighborhoods. The study communities include Anchorage, Alaska; Bastrop, Texas; Berkeley Township, New Jersey; Colorado Springs, Colorado; Ormond Beach/Volusia County, Florida; and Spearfish, South Dakota. Within each of the six communities, four to six geographically defined neighborhoods were identified with assistance from local fire department personnel and State forestry agency staff. Each neighborhood is located in the WUI around a community. Some have formal, functional neighborhood organizations and some do not. The neighborhoods also differ in the amount of wildfire prevention education they received, ranging from none to considerable.

Interviews were held from October 2003 to May 2004. Across the six communities, 27 interviews were carried out with officers and staff from neighborhood organizations. Three interviews were conducted with volunteer fire departments that effectively functioned as neighborhood organizations. An additional 14 interviews were held with fire department personnel and government agency staff.

One interview guide was prepared for neighborhood organization officials and staff with qualitative and quantitative questions. The first section contained qualitative questions designed to elicit open-ended responses. Questions were asked about:

- History and activities of the organization

- Neighborhood layout, lot sizes, average home prices, and number of developers

- Fire risk to the neighborhood including fuel treatments

- Fire preparedness activities specific to the neighborhood

- Social capital within the neighborhood; "Social capital refers to those stocks of social trust, norms, and networks that people can draw upon to solve common problems" (Sirianni and Friedland 2005)

- Interactions with government agencies.

The other section included quantitative questions about the structure of the organization and neighborhood demographics: membership requirements, meetings and meeting attendance, officers, elections, planning efforts, operating budget, staff, newsletters, active block clubs or crime watch groups, number of homes and lots in the neighborhood, and age of the development.

The second guide was developed for interviews with fire department personnel and agency officials. It contained questions about the types of actions taken to promote wildfire preparedness within the general community and specifically with the residents of the study neighborhoods, fuels treatments carried out near the study neighborhoods, and general background data on fire departments serving the area. Additional questions were asked about study neighborhoods without an association to determine the approximate number of homes and undeveloped lots present and a description of the development.

Literature Review—Neighborhood Organizations as Outreach Partners

The structure of neighborhood organizations encourages resident participation in a range of activities, which suggests that neighborhood organizations may be one of the more effective ways to engage people in adopting wildfire preparedness actions. Examples of organizational structures include homeowner associations, neighborhood councils, and volunteer fire departments. Using established neighborhood organizations potentially offer several advantages over forming new groups or working with service and church-based organizations, social groups, and sport clubs. This finding has been recognized by a growing number of government agencies, nonprofit organizations, and fire departments working with neighborhoods and neighborhood organizations to promote wildfire preparedness (Boura 1998, McGee and Russell 2003, NWCG 1998).

Neighborhood organizations represent a physical, social, and political entity. Each neighborhood is a limited territory within a larger urban area where people inhabit dwellings and interact socially. As a territory, a neighborhood is a physical place that others can visualize in terms of structures, streets, and natural features. To residents, their neighborhood has a distinct appearance that they use to differentiate themselves from other neighborhoods (Hallman 1984). Residents vary considerably in perceptions of fire mitigation measures such as creating defensible space (Nelson *et al.* 2004, 2005; Vogt *et al.* 2003). How they view their neighborhood may influence their perceptions of these measures. At the same time, having the same physical territory in common can facilitate participatory opportunities such as organizing a cleanup mulching event or a work day to clean out common areas, or addressing a neighborhood concern such as insufficient evacuation routes.

In addition to being an objective reality, a neighborhood is a subjective entity. Informal neighboring activities, travel patterns, status and bonds of race, religion, or social class are among the factors that shape how each resident perceives his or her personal neighborhood identity (Hallman 1984). Residents may have strong social ties, particularly if they live in a neighborhood populated by strong racial, ethnic, or socioeconomic groups. Neighborhoods may also contain residents who hold conflicting values over various issues (Hallman 1984, Perkins *et al.* 1996, Sampson *et al.* 2001). Being aware of this information can help community officials and fire protection departments tailor their messages to each neighborhood (McKenzie-Mohr and Smith 1999, Mileti *et al.* 2004, Tierny *et al.* 2001). These characteristics will also come into play as neighborhood organizations address the wildfire threat in ways that meet their specific needs.

Because many neighborhoods are relatively homogeneous, most of their residents have similar behavioral norms and values. These might include common expectations of house upkeep, yard care, use of yards, level and timing of noise, and acceptability in terms of displaying wealth and other status symbols (Hallman 1984). Much of the process of communicating neighborhood values and norms occurs informally within the family, neighbor-to-neighbor, or through peer groups (Hallman 1984, Sampson *et al.* 2001). The communication process helps residents confirm information they receive from outside sources. These values and norms influence behavior as residents see neighbors creating defensible space and doing other wildfire preparedness activities (McKenzie-Mohr and Smith 1999, Rogers 1995). Neighborhoods also have more formal channels of communication including newsletters, newspapers, posters, e-mail listservs, and phone trees. The informal and formal communications process forms the nerve system of the neighborhood community. This communication process can help foster acceptance of responsibility for reducing the wildfire threat because residents will be more likely to personalize a message when they receive it via multiple channels and see others taking action (Mileti and Fitzpatrick 1992, Milieti *et al.* 2004, Rohrmann 1999).

Neighborhood organizations are a political entity. Governance can range from informal self-governance over a few aspects of neighborhood life to full-scale self-governance. The neighborhood can be a base of political action for dealing with local governments or function as an interest/advocacy group for wider representation in those domains (Berry *et al.* 1993, Hallman 1984, Thomson 2001). The issues they tackle often range widely. Regular or annual meetings can be used to provide wildfire education to residents or to discuss how the members of the organization want to address wildfire preparedness (NWCG 2004). Communities may find it easier to approach and work with neighborhood organizations on wildfire preparedness issues because they have previously established relationships (Kruger *et al.* 2003, Tierny *et al.* 2001). Conversely, residents may find the ties useful for obtaining information and assistance with activities such as mulching events and common area cleanup projects. Residents look to their neighborhood to provide protection of values, properties, and personal safety, which may be accomplished through homeowner associations, volunteer fire departments, crime watch groups, or hired security patrols (Hallman 2004). Some neighborhoods are involved in providing services such as overseeing home construction oversight and constructing and maintaining open spaces, facilities, and roads (Berry *et al*. 1993, Hallman 1984, Thomson 2001). In some cases, neighborhood organizations may have restrictive covenants that prevent or discourage wildfire preparedness activities such as creating defensible space. The neighborhood organization can work alone or with the community to make regulations more favorable (NWCG 2004).

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Using and Improving Social Capital to Increase Community Preparedness for Wildfire

Shruti Agrawal and Martha C. Monroe
School of Forest Resources and Conservation,
University of Florida, Gainesville, FL (mcmonroe@ufl.edu)

Introduction

Community education programs are an important aspect of wildfire preparedness. Research suggests that social capital is also an important element of community preparedness. A community with greater social capital will likely have residents more willing to participate in community activities and solve problems they face together. For example, residents in a subdivision vulnerable to wildfires and with high social capital would be more likely to work together to manage vegetation, install dry hydrants, rent a chipper, or widen an access road, thus reducing their vulnerability to wildfires.

However, education programs can vary in the degree to which they improve community networks and relationships. A brochure left on the door likely would not have the same impact on the community norm as the same brochure distributed in a community meeting. But programs that include activities that increase participation, interaction, and communication can build and improve social capital. The formal and informal networks formed are a resource available to individuals in the community and can be used to achieve a variety of objectives.

Key Findings

This paper discusses findings that show the likely advantages for managers in developing wildfire education programs that also emphasize building social capital. Three key results are discussed:

- **People who perceive greater social capital in their community are more likely to take action around their homes to create defensible space and reduce wildfire risk.**

- **People who perceive greater social capital in their community are more likely to participate in activities to increase their knowledge and skills on wildfire mitigation.**

- **People who stated that talking to neighborhood friends or to a community leader influenced them to take steps to reduce wildfire risk perceived greater social capital than those who did not credit friends and leaders.**

> **Social capital** is both an economic and non-economic benefit that individuals, groups, and communities get through the structure of their relationships. It is referred to as "social" because it grows out of relationships between people. It is a form of "capital" in that it helps individuals achieve things that they might not have been able to achieve otherwise (e.g., obtain job information, safer communities because of social norms, and reduced risk of wildfires). It can be assessed by the degree to which people participate in community activities and the strength of community ties and networks.
>
> In this study, social capital is defined as an individual's perception of the quality of relationships he/she holds with his/her neighbors and other people in the community, and community characteristics like community participation.

These findings suggest that educational programs that strengthen social capital by fostering interaction between people will be more likely to motivate community members to take steps to reduce their wildfire risk.

Detailed Findings

This study surveyed residents in seven neighborhoods in fire-prone areas in Florida that had been exposed to some type of wildfire education program. This section describes the three key results and their implications for resource managers. Specific statistical analyses for the study will not be reported in detail here. All the results and comparisons discussed below proved significant at the .05 significance level.

People who perceive greater social capital in their community are more likely to take action around their homes to create defensible space and reduce risk of wildfires.

The study found that people who took steps to reduce their risk of wildfire were significantly more likely to perceive greater social capital than those who did not. This is not unexpected because the theories about social capital suggest that communities high in social capital are more likely to work together to solve problems. It is important to note that the correlation between these variables does not tell us if one caused the other: the process of learning how to create defensible space may have enhanced a respondent's perception of social capital, or those who already interact and care about the community might have been more eager to take steps to reduce wildfire risk. In either case, the apparent reciprocal link between defensible space actions and social capital gives managers an important reason to develop wildfire outreach programs that also enhance social capital.

People who perceive greater social capital in their community are more likely to participate in activities to increase their knowledge and skills on wildfire mitigation.

At a general level, we found that people who participated in the wildfire education program were significantly more likely to perceive greater social capital than people who did not participate. A key question is whether all activities in a program are associated with social capital. To determine this, the survey presented specific types of activities that can be combined into three activity groups: viewing electronic media, receiving printed information, and attending wildfire-related events. Participation was defined as receiving and using any of these informational media. We found a significant positive relationship between perception of social capital and each activity group. People who viewed electronic media, received printed information, and attended a wildfire-related event perceived greater social capital in their community than those who did not receive information in these formats.

We further broke down each activity group into specific sources (see table 1). Among people who received information from various electronic and print media, only listening to television and radio news and receiving a handout or newspaper were significantly related to greater perceptions of social capital. For events, only attending a meeting to discuss wildfires, a prescribed burn demonstration, or a picnic were significantly associated with greater perceived social capital. The last three activities likely involve interaction with other people—neighbors, community members, and agencies delivering the information—which is generally associated with greater social capital. Wilson (1997) suggests that social capital can be built or rebuilt through an incremental process that helps individuals break out of their isolation, brings them into interaction with other individuals, improves connectedness among one another, and makes them responsible for their actions. It is also possible that the results reflect a dynamic whereby people who perceive higher social capital are more likely to attend meetings and interact in their community.

Table 1.—Specific media sources and effect on perceived social capital

Electronic media sources	Print media	Wildfire-related events
Web sites	Handouts**	Presentations
TV advertisements	Brochures	Meetings to discuss wildfires**
TV news**	Door hangers	Prescribed burn demonstrations**
TV shows	Newletters	Equipment demonstrations
Radio advertisements	Magazines	Landscape demonstrations
Radio news**	Newspapers**	Information booths
CD/video		Community picnics**

**Significant (0.05) positive association with higher perceived social capital.

Given the positive relationship found between perception of social capital and risk reduction activities, managers may want to focus their education programs on using the information sources associated with greater social capital: using television and radio news; developing handouts and newspaper articles; and organizing meetings, prescribed burn demonstrations, or community picnics. Public affairs officers and mitigation specialists could work to place fire-related stories useful to mitigation and preparedness in all three types of news media, create handouts that play off of current wildfire news, and provide keys to creating defensible space around homes. Managers also could use demonstrations, meetings, and get-togethers as ways to disseminate wildfire information to residents. Handouts with information on ways to reduce wildfire risk could be distributed at the events.

People who stated that talking to neighborhood friends or to a community leader influenced them to take steps to reduce wildfire risk perceived greater social capital than those who did not credit friends and leaders.

Respondents who indicated they had taken steps around their homes to reduce their wildfire risk were asked whether any of the electronic, print, or event information sources influenced them to take action. They were also asked whether talking to neighbors, experts, leaders, or friends, or participating in workdays or a Firewise program influenced them.

Of all the types of educational activities assessed, the two most strongly correlated to perception of social capital were talking to friends in the neighborhood and talking with a community leader. Three other activities—attending a wildfire preparedness event, participating in a Firewise program, and seeing neighbors engage in risk reduction activities—also were positively correlated with perception of social capital, although the effect was smaller. All these activities involve interaction among people, whether with a neighbor, community leader, or forest or fire protection agency personnel. Thus, engagement in activities and interaction with people has a significant effect on perception of social capital.

These findings indicate that programs that emphasize interpersonal interaction will be more effective in influencing people to take steps to mitigate their fire risk. Resource managers therefore may want to focus attention on designing outreach programs that foster interaction between community members, such as a community workday or a neighbor appreciation day that would bring together friends and other members of the community. At these functions, people who have taken actions around their homes to reduce wildfire risk can talk to peers about what they have done around their homes, what motivated them to take the actions, and why others in the community should also get involved.

Study Communities

This study focused on seven neighborhoods in three communities in Florida:

- Wedgefield (in Orange County).
- Two neighborhoods of Palm Coast (in Flagler County)—Seminole Woods and Cypress Knoll.
- Four neighborhoods on the Lake Wales Ridge (in Polk and Highlands Counties)—Tiger Creek Forest, Indian Lakes Estates, Placid Lake Estates, and Leisure Lakes.

Of these, Wedgefield and the two neighborhoods of Palm Coast participated in the national study "Community partnerships: landscape level strategies to reduce the risk of wildfires" (Jakes *et al*. 2003). Communities were selected based on their risk of wildfire and their wildfire education programs. All seven neighborhoods are at risk of wildfires, have been exposed to some educational program to educate residents, and are taking steps to increase wildfire preparedness.

Methods

For this study, social capital is defined as an individual's perception of the quality of relationship he/she holds with his/her neighbors and other people in the community, and community characteristics like community participation. A wildfire education program is defined as an educational initiative that informs homeowners about the history and risk of wildfires, educates them about steps they can take at individual and community levels to reduce their vulnerability to wildfires, informs them about new policies and ordinances, and increases support for expenditures and policies.

Mail surveys were sent to a sample of 3,744 homeowners. The survey contained questions on the individual's perception of wildfire risk, participation in wildfire education programs, steps taken to reduce risk of wildfires, and involvement and perception of their community. The Dillman method (2000) for administering mail surveys was used to improve response rate. This included first survey mailing (with cover letter, survey, and magnet) followed by a reminder postcard after 2 weeks; second mailing (with cover letter and survey) 2 weeks after the reminder postcard; followed by a final reminder postcard after 2 weeks. Usable data were obtained from 1,350 participants for an overall response rate of 36 percent (ranging from 43 percent in Tiger Creek Forest to 26 percent in Seminole Woods).

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Defensible Space in the News:
Public Discussion of a Neglected Topic

Jayne Fingerman Johnson
Conservation Biology Graduate Program
University of Minnesota, St. Paul, MN (fing0006@umn.edu)

David N. Bengston
Northern Research Station, USDA Forest Service (dbengston@fs.fed.us)

Kristen C. Nelson
College of Food, Agricultural and Natural Resource Sciences,
University of Minnesota, St. Paul, MN (kcn@umn.edu)

David P. Fan
InfoTrend, Inc
2115 Dudley Avenue, St. Paul, MN (dfan@InfoTrendInc.com)

Introduction

This study examined how wildfire management issues are covered in the news media. In this paper we discuss one aspect of the research—how defensible space has been portrayed—and report two key findings and opportunities we identified.

Key Findings

Defensible space is only a small part of the wildfire discussion in the media, which is dominated by large spikes in coverage on firefighting that occur during major fires. This poses challenges and opportunities for managers interested in communicating about defensible space. When a wildfire is burning, educational information about defensible space may be overshadowed by reports of the disaster of the wildfire and the heroics of firefighters. But the huge peaks in media coverage that occur at this time also represent an opportunity to communicate messages about defensible space. With headlines focusing people's attention on wildfire, fire mitigation will be a more salient issue, making homeowners more open to new ideas. This may be an opportune time to present information on the full range of defensible space actions that can be taken. For example, a story about a homeowner whose house was saved by defensible space could be placed beside news coverage showing homes destroyed by fire.

Coverage of defensible space focuses on clearing vegetation. To encourage a comprehensive under-standing of defensible space concepts, managers may want to work with the media to expand their discussion of defensible space beyond vegetation management. Many property owners may be reluctant to clear vegetation around all sides of their homes if that conflicts with deeply held values about living deep in the woods (e.g., Nelson *et al*. 2004). The manager's challenge is to encourage a more complex and complete discussion of defensible space.

Detailed Findings

News media coverage of wildfire and other natural disasters often focuses on immediate and dramatic events, rather than on the broader context in which they occur (Smith 1992). Wildfire and dramatic accounts of fighting fires attract significant media attention. On occasion, the media have been accused of giving exaggerated or inaccurate accounts of fires and other natural disasters (e.g., Reid 1989, Smith 1992). Not surprisingly, we found that news media discussion of wildfire is dominated by coverage of firefighting, and defensible space is a small fraction of total wildfire-related coverage. Over the 3 years examined in this study, defensible space accounted for only 4 percent of the news media discussion on wildfire (3,899 paragraphs on defensible space vs. 88,906 on firefighting). News media discussion of defensible space was barely visible when plotted on the same graph as firefighting (fig. 1). This figure also shows the dramatic peaks in media coverage of wildfire that corresponded to major fires. Peaks occurred in June 2002, July-August 2003, October 2003, and July 2004.

Figure 2 shows the volume of news media discussion of defensible space plotted alone. When viewed at this scale and compared with figure 1, media discussion of defensible space clearly follows the peaks and valleys of firefighting discussion. This makes sense when we consider that the imminent threat of wildfire encourages coverage for property owners about steps they could take to protect their property. That defensible space coverage is highest during fires is not necessarily a negative because this is when questions of how to mitigate fire risk are most salient and when homeowners are more likely to be receptive to the information. However, managers may want to consider working to ensure that defensible space issues are highlighted throughout the year because research on other natural hazards has found that information provided during this "window of opportunity" is more likely to have a positive response when people are already aware of the problem and possible solutions (Monroe et al. 2005).

Figure 1.—News media discussion of firefighting and defensible space, January 2002 through January 2005
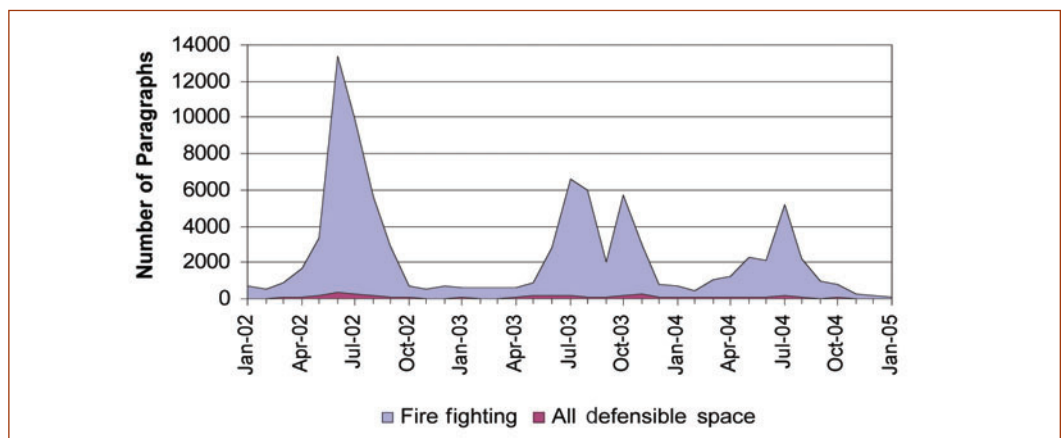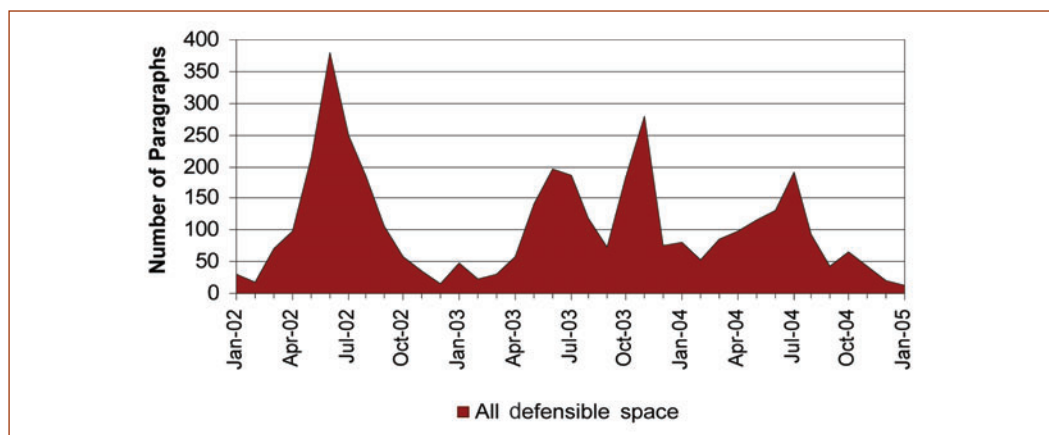
Figure 2.—News media discussion of defensible space, January 2002 through January 2005

To look at more in-depth coverage of defensible space concepts, we categorized actions as either land treatments (such as clearing, thinning, or trimming vegetation around a structure) or "other" treatments (such as using fire-resistant building materials, chimney spark arresters, or moving woodpiles away from structures). We also counted the number of paragraphs with just a general reference to defensible space (e.g., firewise or fire safe), and community-level defensible space actions (e.g., clearing brush or thinning forested areas in a community).

As shown in figure 3, there was almost twice as much media discussion of land treatments for defensible space as "other" actions (42 percent, compared to 24 percent). If general reference to defensible space (e.g., firewise) is perceived as primarily land treatments, the amount of defensible space discussion

Figure 3.—Percentage of defensible space concepts in all defensible space news media discussion, January 2002 through January 2005
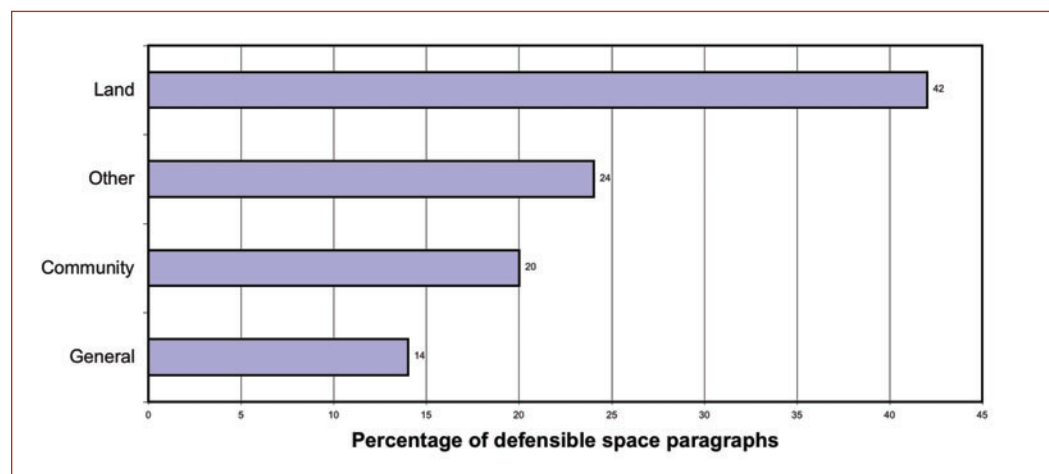
devoted to land treatments was even higher, suggesting the main message being conveyed to the public was that implementing defensible space primarily meant clearing vegetation around one's home.

Community-level defensible space was mentioned infrequently. Only 20 percent of all defensible space references mentioned defensible space around a community.

Background Information

News media are the most important source of information for most people about a wide range of natural resource and environmental issues (e.g., Atwater *et al.* 1985; Fortner *et al.* 1991, Ostman and Parker 1987, Wilson 1995). For example, the top source of information about Federal forest management for residents of Oregon's Central Cascades was newspapers, followed by television, radio, magazines/books, friends/relatives, interest groups, and natural resource agencies (Shindler *et al.* 1996). For most people, these information sources play an important role in public discussions of policy issues and have been shown to both shape and reflect how the public views and understands a wide range of issues. In addition, analysis of the news media has been successfully used to indirectly measure public attitudes and opinions related to many topics (e.g., Fan 1997, Fan and Cook 2003).

While the vast majority of media coverage of wildfire is devoted to firefighting and destruction, this study examined the extent of coverage devoted to defensible space. We also looked at the complexity of news media discussion of defensible space by analyzing specific actions discussed. The defensible space study is part of a larger project examining news media discussion of wildfire and risk mitigation, focused on ecological facets of wildfire coverage, problems and costs associated with wildfire, and public land treatments (e.g., thinning and prescribed burning).

Methods

The study methodology involved five steps. First, we downloaded news stories about wildfire from an online commercial database. Newspapers we accessed ranged from national papers such as the New York Times, to regional papers such as the Arizona Republic, to more local papers such as the Monterey County Herald. Approximately 77,000 stories from more than 200 newspapers, newswires, television and radio news transcripts, and news magazines were downloaded, covering the period January 1, 2002, through January 31, 2005. Second, we examined a random sample of the downloaded news stories to determine whether or not they were "on topic." Virtually all of the stories were in fact about wildfire. Third, we identified the main ideas about defensible space (from Firewise 2005, Cohen 2000, and others) expressed in the database of news stories. Fourth, we developed a computer algorithm to score paragraphs in the database for defensible space concepts, using the InfoTrend™ computer content

analysis method and software.[1] Finally, we assessed the accuracy of the computer scoring by examining a random sample of the stories that had been coded by our computer instructions.

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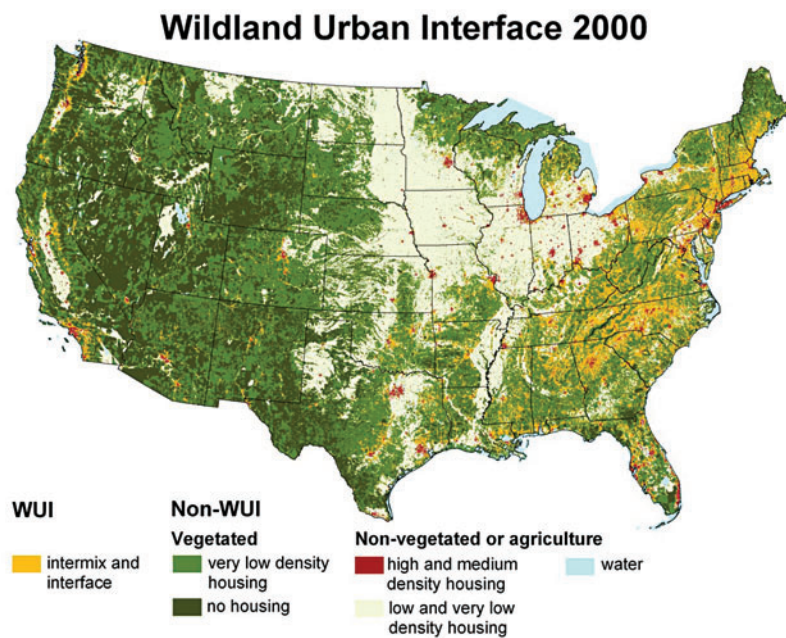Shindler, B.; Steel, B.; List, P. 1996. Public judgments of adaptive management: a response from forest communities. Journal of Forestry. 94(6): 4-12.

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SECTION 3

TOOLS THAT CAN HELP US UNDERSTAND SOCIAL ISSUES

Wildland Urban Interface 2000

WUI	Non-WUI		
	Vegetated	**Non-vegetated or agriculture**	
▢ intermix and interface	▢ very low density housing	▢ high and medium density housing	▢ water
	▢ no housing	▢ low and very low density housing	

Using Focus Groups to Involve Citizens in Resouce Management—Investigating Perceptions of Smoke as a Barrier to Prescribed Forest Burning

Brad R. Weisshaupt, Matthew S. Carroll, and Keith A. Blatner
Department of Natural Resource Sciences
Washington State University, Pullman, WA

Pamela J. Jakes
Northern Research Station, USDA Forest Service (pjakes@fs.fed.us)

Introduction

The information reported here is part of a study of citizens of the Northern Inland West that examined how the source of smoke (agricultural burning, prescribed forest burning, or wildland fire) influences people's tolerance of the negative effects from that smoke (for example, breathing problems and limited visibility) (Weisshaupt *et al.* 2005). Through a series of focus groups we learned the source of the smoke does make a difference, and under certain conditions, smoke from prescribed forest burning will be tolerated and accepted even by anti-agricultural burning interests. However, the focus of this paper is on another lesson from the study: the focus group method can be adapted to serve as a tool for community collaboration in developing and implementing projects for wildland fire management.[1]

Key Findings

> *"I felt my opinion changing as I learned more, and that made me mad."*
> (Anti-smoke activist)

In our research, we found that the most exciting aspect of focus groups is the way members react to and build on the comments and observations of other members. Stewart and Shamdasani (1990: 16) describe "the synergistic effect of the group setting" in which ideas are generated that may not have been uncovered in individual interviews. This "synergistic effect" encouraged learning and change in the focus groups conducted for this study. As a result, we have three recommendations for managers:

Conduct focus groups as a means of public involvement and a first step in building collaborative relationships.
Focus groups provide participants with the opportunity to work through their beliefs and feelings about an action. By observing or participating in focus groups, decisionmakers can begin to understand residents' depth of feeling about an issue and their reasons for accepting or resisting different actions.

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[1] A brief summary of specific findings from the research project can be found at the end of this paper.

Building on this understanding, decisionmakers can identify where their own perceptions of problems differ from those of the public and develop more socially acceptable solutions to a problem.

Develop a dialogue with the public—it may be the most important element of a fire or resource management prescription.

Colleagues conducting research in hazards communication have long found that it is not enough to tell people what you are going to do or what you expect them to do, you must also tell them why the action is being taken and the expected impacts (Monroe *et al.* 2005). Focus groups provide opportunities for this type of communication—during our focus groups we saw participants change their minds about prescribed forest burning as they learned more about the reasons for and the process of conducting this fuels treatment. They provide a means of establishing a dialogue with the public that allows citizens and resource managers to work through important issues—to have the give-and-take that is critical to understanding others' perceptions, attitudes, and values.

Discuss tradeoffs to build understanding of management activities.

In our focus groups we were able to build understanding and support for prescribed forest burning by describing the tradeoffs between less smoke from prescribed forest burning now versus more smoke from wildland fires later. Participants were also more accepting of prescribed forest burning if the benefits were described in terms of improving forest conditions for a variety of benefits. If managers can build dialogue with the public around the tradeoffs of different management actions, they can often build greater understanding of the desired action. Through these changes in beliefs and values, new behavior is adopted.

What is a Focus Group?

Kruger (1994) identifies six characteristics of a focus group: (1) people, (2) gathered in groups, (3) process certain information, and (4) provide data (5) of a qualitative nature (6) in a focused discussion. A well-run focus group creates an environment in which people face complexity, alternative perspectives, and tradeoffs they might not otherwise encounter. Focus groups can replicate the kind of "working through" that Yankelovich (1991) and other public policy scholars argue is needed in successful public decisionmaking forums that deal with complex issues (Reich 1985, Weber 2003).

Some group discussions are labeled focus groups, when they would more accurately be called community forums, discussions, or hearings. What distinguishes a focus group from these other group conversations is that participants have been specifically recruited to participate, and the topics and the flow of the focus group discussion are carefully predetermined and sequenced based on an analysis of the event,

experience, or topic of interest (Kruger 1994). This directed discussion stimulates new ideas, develops interest, and builds a commitment to take action or make changes (Bader and Rossie 2002).

The Focus Group Process

The focus group process allows managers to involve citizens in directed discussions of topics of interest. However, to ensure that a focus group is a success, particular attention needs to be paid to two matters (Kruger and Casey 2000). First, the purpose of the group must be clear. Second, the focus group facilitator must have the skills necessary to guide the group. An additional item to consider is ensuring that participants represent the range of relevant points of view.

The purpose of the focus group must be clearly defined and followed or participants will become confused and frustrated. We wanted to find out if the origin of smoke makes a difference in how people perceive that smoke. Along the way we sought additional information on people's perceptions of the conditions of Northern Inland West forests and ways in which public land managers and private citizens could reduce the risk of wildland fire in these areas. Our discussions focused on these three issues—perceptions of smoke, conditions of the region's forests, and ways to reduce the risk of wildland fire.

Kruger and Casey (2000) offer valuable insight for **deciding if a focus group is the right approach** for determining the perceptions, feelings, and thinking of groups of people about issues. They suggest that focus groups can be valuable in a variety of situations including when you are—

- Looking for the range of ideas or feelings that people have about something.
- Trying to understand differences in perspectives among groups or categories of people.
- Trying to uncover factors that influence opinions, behavior, or motivation.
- Trying to draw ideas from a group.

Among the situations for which a focus group would be inappropriate are when—

- You are trying to educate people (although education can be a by-product of focus group discussions).
- You want to give the appearance of listening, but don't intend to use the results.
- You want people to reach consensus.
- The environment is emotionally charged, and a group discussion will likely intensify the conflict.

The moderator is key to ensuring that focus group discussions go smoothly and, if necessary, directing the discussion to the various topics. The moderator introduced topic areas, and the groups were allowed to explore the ideas and tradeoffs at length. In this study we used a professional focus group facilitator to select participants, conduct the focus groups, and produce a transcript. A professional facilitator helped ensure that the quality of all 10 focus groups—in terms of participants, process, and product—was consistent. The facilitator also provided a buffer between the participants and researchers, ensuring the researchers did not influence the content of the discussion or participants' opinions and perceptions. Having a professional facilitator helped protect the integrity of this research.

A professional facilitator may not be needed if someone on staff has the necessary group process skills. However, when facilitating groups, different group objectives can call for different skills, "the processes used to get participants' reactions to ideas are different from the processes used for group decision making" (Kruger and Casey 2000: 3).

> In general the facilitator needs to show characteristics of supportive leadership: show concern for the well-being and personal needs of [participants]; be friendly and approachable; be considerate; create a friendly climate; and treat group members as equals (Stewart and Shamdasani 1990: 73).

Finally, to understand the range of perspectives on an issue, it is important to carefully consider who should participate in the focus groups. Our knowledge of the issues related to smoke helped us define citizen categories that represented a range of possible opinions on smoke, and from which focus group participants would be drawn. First, we identified anti-smoke activists—people who actively worked to limit smoke from agricultural fires in the region. After the anti-smoke activists we had our silent majority—people who hadn't spoken out against smoke, but for whom the issue has salience. We divided the silent majority into urban and rural residents. Our urban residents would come from two metropolitan areas: Spokane, Washington, and Missoula, Montana. Both urban areas had experienced smoke, and Missoula's recent wildland fire season had produced significant smoke that affected the area for many days. Rural residents would consist of anyone living outside census-defined metropolitan areas. A final group we included was Native Americans.

Smoke Focus Group Details

One of the more significant barriers to increased use of prescribed forest burning is air quality concerns related to the smoke generated by these fires (Weisshaupt *et al*. 2005). In some areas of the West, agricultural field burning has been prohibited because of concerns about air quality from the smoke produced by this practice. To learn more about people's perceptions of prescribed forest burning and the significance of smoke as a barrier to the increased use of prescribed burning for fuels reduction, we conducted a series of focus groups in eastern Washington and Montana.

Methods

Focus groups were conducted in the greater Spokane, Washington, and Missoula, Montana, areas between October 2003 and January 2004. Each of our focus groups had 6 to 13 participants; all participants in each focus group represented one of the five citizen categories defined above: (1) anti-agricultural smoke, (2) urban—Spokane, Washington, (3) urban—Missoula, Montana, (4) rural, and (5) Native

American (table 1). Although participants were selected for a specific focus group because they fit the category of that particular group, participants could belong to more than one category. For example, a participant in an anti-smoke focus group also could be considered as urban or rural or Native American. Two focus groups were held for each of the five citizen categories, for a total of 10 focus group sessions. Focus group participants were paid $50. The focus groups were conducted in specially designed facilities that allowed us to videotape and record the discussion for transcription at a later time. We hired a professional focus group facilitator who helped us select local residents to represent our citizen categories, designed a series of questions that would bring us to the topics of interest, conducted the focus groups, and produced transcripts of the discussions.

Table 1.—Description on citizen categories represented in focus groups

Citizen categories	Description	Number of participants in each focus group	
		Group 1	Group 2
Anti-smoke	Health/environmentally minded eastern Washington residents	10	13
Urban-Spokane	Citizens residing within Spokane County	10	12
Urban-Missoula	Citizens residing in a town that recently experienced wildfire	10	10
Rural	People from eastern Washington living outside Spokane or reservations	12	12
Native American	Members of the Colville Confederated, Spokane, and Kalispel Tribes, all with reservations in eastern Washington	6	13

The flow of each focus group discussion varied, but the discussion ultimately took us to each of our topics of interest. The discussion began with questions about the quality of life in the region. It then generally moved to what contributed to that quality of life (forests would eventually come up), how participants perceived current forest conditions (dense and dying), what level of wildland fire risk was posed by current forest conditions (high), what could be done to reduce that risk (various methods for mitigating fuels risk), what role prescribed forest burning played in reducing risk (recognized as a tool to mitigate high fuel levels), what barriers prevent use of prescribed forest burning (fear of escape, smoke), and finally, how smoke from prescribed forest burning differed from smoke from agricultural burning and wildland fire (people did see a difference and had greater acceptance of smoke from prescribed forest burning). Each focus group ended with an explanation of why the focus group was being held, and the researcher was available to answer participants' questions about the study. Focus groups generally lasted 90 minutes to 2 hours.

The researchers reviewed the transcripts of each focus group, identifying comments related to the topics of interest. For each topic, themes and issues emerged from the discussions and lead to the findings discussed below.

Findings

Fuel Reduction Methods

After the focus group discussed the condition of forests in the region and agreed on the need to reduce the levels of hazardous fuels, the moderator asked participants to suggest different methods for reducing fuels. Time was spent defining and describing each method, so that participants shared an understanding of the different terms being used.

Harvesting was generally the most-often mentioned fuels reduction method, followed by thinning and chipping. The exceptions were the Native American groups—they were most apt to support the use of prescribed forest burning to reduce fuels.

The Native Americans brought to their focus groups the best understanding of prescribed forest burning, the rural groups had some understanding of the practice, while the other groups had little detailed knowledge. Native American members talked about the history of burning on reservation lands:

> *Just setting a fire and letting it go. That fire might get a foot and a half maybe two feet*
> *high, if that. Then after that the fire would go out…He said 'Now, when this is dead out,*
> *and the ash is going to still be there, we've put something back into the ground. We didn't*
> *take it all. So when the rains do start coming, that ash is going to help hold that soil there*
> *so when the grass starts growing, then I've got something for my livestock out here…'*
> (Native American talking about his grandfather burning his property)

Members of the Native American groups also reported they had burned some of their own property:

> *It lowers the fuel around my home site if I burn every spring before it gets too dry, or right*
> *after its just started to dry out I will do a prescribed burn. So it will take down all the dry*
> *old weeds… the green comes back up and you don't have to worry about the danger of*
> *high fuel for forest fires.* (Native)

As mentioned above, the urban groups were the least familiar of any with the concept of, and issues surrounding, prescribed forest burning. For them, concerns about smoke and declining air quality were linked to fireplaces or industrial stacks. When the discussion focused on forest or field burning and smoke, the urban group members generally expressed willingness to live with it:

> *…the only thing you can do about it is either live with it or move…I choose to live in this*
> *area and I know that agricultural burning happens, forest fires happen. There have been*
> *days when I cannot leave my house. But it's one of those things.* (Urban)

As participants learned more about prescribed forest burning, they expressed more tolerance for the practice:

> *The discussion on why we would have prescribed burns definitely made me look at the subject differently. I really never thought about it at all.* (Anti-smoke)

Many participants thought prescribed forest burning was needed in the forest to reduce fuel loading, wildland fire risk, and potential property loss from wildland fires, but most disliked the idea of a prescribed forest burn being conducted near their homes. They accepted using prescribed forest burning in remote, unsettled areas, but thought that burning in the wildland-urban interface posed unacceptable risks. As our participants discussed the problem of fuels reduction, and worked through various approaches to mitigating risk, they often reached the conclusion that no one method of fuels reduction would adequately reduce fuels and that a combination of thinning and prescribed forest burning would be "most practical."

Smoke Sources

The moderator directed the discussion so that participants had the opportunity to consider three different sources of smoke—agricultural burning, prescribed forest burning, and wildland fires. From naturally occurring forest fires to field burning, area residents were accustomed to smoke:

> *I know I have it [asthma] and I know that smoke affects it…I live with it. I can't expect the whole world to change just because I have asthma. I have to adapt to the fact that I live where I live and there's smoke.* (Rural)

Most reported they had never differentiated between smoke sources when thinking about their perceptions of or reactions to smoke. However, once the distinction was suggested, many participants, evaluating the various tradeoffs, concluded they would accept the smoke from prescribed forest burning now if it could lead to less smoke from large wildland fires later. By the end of the discussion, a majority of each group, even the anti-smoke groups, thought they would be less opposed to prescribed forest burning if it reduced the number of wildfires and thereby the overall amount of smoke:

> *If it is a prescribed burn, there's the possibility for intelligent smoke management… it is an inexact science, but at least it's better than not having any control over it [smoke]…*
> (Anti-smoke)

Participants, even those opposed to agricultural burning, became more receptive to smoke from prescribed forest burning when they were able to identify a number of positive effects for everyone in the region:

> *You are burning the forest so it can renew itself and be better for everyone and if you are burning grass for next year's seed for sale, then that's just individual profit.* (Native American)

When discussing agricultural burning, those who accepted the practice did so for three main reasons: (1) field burning contributed to farmers' incomes and provided jobs, thus contributing to the region's economic base; (2) smoke was a part of life in their community; and (3) agricultural fields were a natural resource and benefited from burning. Anti-smoke groups recognized only one benefit from agricultural burning—to increase a farmer's revenue. They also saw the negative health effects from smoke as affecting many more citizens than the other focus groups.

Although the anti-smoke focus groups were opposed to agricultural field burning, they were willing to accept the smoke from prescribed forest burning. Distinguishing between smoke sources increased the expressed tolerance of prescribed forest burning by these groups. The Missoula focus groups were tolerant of prescribed forest burning smoke because they had been "smoked in" by wildfire smoke the previous summer. They viewed prescribed forest burning as an effective fuels reduction technique that reduced catastrophic wildfire risk and smoke.

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Using Computer Visualizations to Help Understand How Forests Change and Develop

Brian Orland and Cenk Ursavas
Penn State University, State College, PA (boo1@psu.edu)

Introduction

Trying to understand the effects of alternative management practices over long periods puts an enormous burden on decisionmakers or the public when making decisions. One means of easing the burden is to develop a range of precise, carefully developed illustrations of the important characteristics of the anticipated changes. Computer visualizations can be a powerful tool for such illustrations. The significant advantage of the computer image is that it is readily manipulated to represent the impact of management activities on forest growth.

The work described in this paper offers some guidance toward making the power of the visual world a valid and reliable surrogate for the real world that we manage. As part of a larger study (see Daniel and Vining chapters for other aspects), computer visualizations were developed—using the kind of data a forest manager will typically be able to access—to clearly show the development of the forest over time and in response to different management actions. This paper will discuss four aspects of the process managers need to consider in using visualizations and then provide a specific example of how these issues were addressed in our study.

Key Findings: Making Visualizations Useful to Forest Managers

Managers need to consider four issues when using visualizations:

- **Visual realism:** To what degree does the image match the real world?

- **Information-driven visualization**: Can it be shown that the image is an accurate representation of forest conditions?

- **Change over time:** Can it show an essential component of forest landscape management, change over time?

- **Challenges in using visualizations**:

    - Using sampled data

    - Data availability and quality

Visual Realism

Using digital or scanned photographs, it is feasible, and quite easy, to use image editing tools such as Adobe Photoshop® to create highly realistic images of landscapes modified by management and changing over time. Figure 1 provides an example from a study of forest harvest practices (Orland *et al*. 1994). The visualizations were created by referencing a large library of photographs of known ground conditions that provided visual templates, but most projects do not have the luxury of such libraries. While the images themselves are convincing representations, the visual changes are not necessarily connected to any underlying information such as forest density, species mix, diameter, or terrain.

Figure 1.—Images representing attribute levels for variable "residuals in cut area"

Information-Driven Visualization

Generally, investigation of such complex issues as forest management requires that images accurately represent measured or predicted ground conditions. Some software developers have created tools that provide visual representations of forest inventory data. The Stand Visualization System (SVS) and Envision, a landscape-scale visualization tool, were developed by Robert McGaughey and his colleagues (McGaughey 2003), and SmartForest was developed by the author and his collaborators (Orland 2003). Both use USDA Forest Service forest inventory data to create visual representations of forest stands. In the former case, this is done at the scale of a 1- to 4-acre plot with no reference to the landscape context; in the latter case, this is done at landscape scale in the context of other stands and including the representation of topography.

Another necessity is a dataset with sufficient detail to show noncommercial or less important species beside the dominant forest types and including details of the shrub and herbaceous components of the forest. Each of these has significant visual impact, but requires that sufficiently detailed data are available. Such information is particularly important when discussing treatments to decrease fuel loads; studies have found that understory vegetation is an important component of scenic beauty ratings (Ryan 2005).

Change Over Time

As Figure 2 demonstrates, the necessity to consider change over time is a central aspect of forest management. To project the changes in biophysical components of the forest, the Forest Vegetation Simulator (FVS) (Dixon 2003) is one of a family of tools developed to enable forest managers to project future forest conditions. In wide use by forest management agencies, FVS and its derivatives are capable of modeling very complex growth processes. In the context of silvicultural and harvest operations, users can specify parameters for a range of forest operations including thinning and planting as well as major treatments anticipated for the study sites. The growth model takes into account overperforming and underperforming trees, as well as mortality among outcompeted or senescent trees, and includes natural regeneration of both commercial and noncommercial species.

Output data from FVS can be used by each of the visualization tools identified earlier to create images of the forest under a range of management scenarios and at time-steps into the future as specified in creating the FVS projections. The resultant images are a powerful tool for communicating the implications of management programs, especially to groups from multidisciplinary backgrounds where the visualization serves as a common meeting ground for their different understandings.

Figure 2.—Actual site conditions photographed in 2001 and 2003

Challenges in Using Visualizations

Visualization is especially challenging where trees and shrubs are recognizable as individuals of different species and are clumped or dispersed with respect to one another, yet the information gathered and projected about their growth and change is based on sampled data and statistically summarized. In foresters' terms the "stand" or "block" is a fundamental unit of forest management, each being defined as an area of relatively homogeneous forest of consistent topographical characteristics such as slope

and aspect. The same conditions apply to urban and recreational forest, where management actions are taken on individual and recognizable trees, yet information about the forest is maintained as numbers of trees per acre, with little or no spatial information maintained at the tree-by-tree level.

One critical necessity at the heart of using such visualizations is to accept that the image is from sampled data and does not represent a real location—even though the visualization is sufficiently realistic to create a plausible sense of place. Users must accept that scenes are no more than surrogates for "the real world" and that all that is necessary in the context of a project such as this one is to ensure that the landscape behaves plausibly. Managers will need to constantly remind people to separate themselves from considering each location as "real."

The other closely related fundamental considerations are the availability and quality of the data used to develop the visualizations. FVS is a highly developed tool, but its capabilities are dictated by the completeness and accuracy of the input data. One thing that visualization is especially useful for is to show the errors and omissions in available data; in other scientific fields a principal use of visualization is in data verification. FVS is also a statistically derived numerical modeling tool—thus its projections have uncertainties associated with them. That uncertainty, while challenging to visualize, is nevertheless an important issue to consider when using visualization in decisionmaking. The realism of the visual imagery may create a false sense of confidence in what are, in fact, best approximations of what the future will bring (Orland *et al.* 2001).

Visual Case Study

On July 4, 1999, a powerful windstorm affecting the Boundary Waters Canoe Area Wilderness resulted in widespread forest blowdowns—areas of completely uprooted or snapped-off conifer and deciduous trees (USDA Forest Service 2000). The blowdown area is in northern Minnesota and across the Canadian border in western Ontario. The opportunity to monitor the recovery of this important area has resulted in forest inventory data of high quality, collected as part of an intensive inventory for ecological modeling (Gilmore *et al.* 2003). The data included the species and size of each stem more than 6 mm in diameter.

Using that data alone, it was possible to create very convincing images using SmartForest (http://www.imlab.psu.edu/smartforest)—a tool developed as a landscape-scale visualization tool capable of distributing forest stand data according to stand boundaries defined via the ArcGIS® Geographic Information System and over terrain derived from a USGS Digital Elevation Model. We will use SmartForest images as the basis for our discussion here, but the principles apply to images created using other visualization tools.

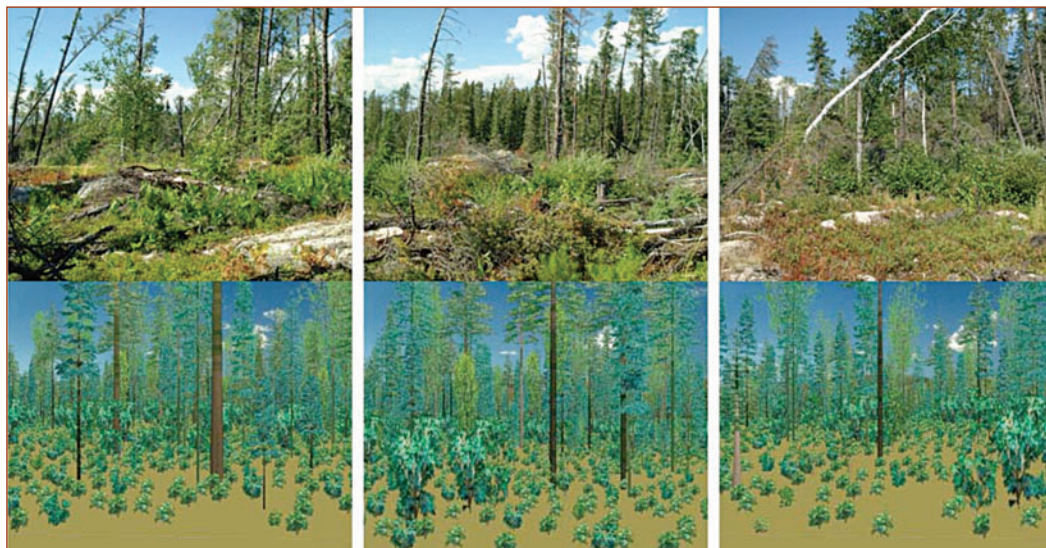**Figure 3.—In-stand photos and visualization: salvage area residuals**

Figure 4.—In-stand photos and visualization: undisturbed, mature forest area

Figures 3 and 4 represent different forest conditions. It is evident that the computer-generated images lack the realism of the photographs. However, it is also evident that the distribution of large woody material within the immediate forest stand is similar in numbers, species, and sizes of trees—the component of forest management most likely to be impacted by policy changes.

Figure 5.—Tree component; with grass and half-density shrubs; and with full shrubs


Much realism can be achieved with full representation of shrubs and grasses. Figure 5 illustrates the effects of adding those components to the scene. Just as in photographs of the real landscape, the addition of a vigorous shrub component to the visualization can be as visually devastating as it is in the real world.

The images in figure 6 show the early stages of recovery from a salvage operation in an area heavily impacted by the blowdown. The top images show the regeneration from natural seed sources; the lower images show the effect of deliberately planting a mix of red and white pines. Figure 7 shows representations (in years 2022 and 2052) of the planted forest conditions in figure 6. When we look at the first set of images, the impact of the pine planting is very clear and seen in the context of the residual hardwoods. In the "growth" images, individual trees can be tracked between the time-steps, although the major visual change is the density of the youthful growth.

In the instances visualized in figures 6 and 7, base data were available for those shrubs and forbs present in 2001, but growth and development data for groundcover and shrub species are generally not a component of the growth models. Although the resulting images of those components were thus not accurate to the anticipated conditions, if such detailed information had been available the improved validity of that aspect of the visualization might well mask changes in the major vegetative component— the trees—just as in the photographs of the real location. Figure 4 indicated the technical feasibility of creating accurate images of groundcover, given adequate data.

The resultant images were used in a survey (fig. 8) (Daniel, this volume) that was used to solicit public input on desirable management scenarios for a much-impacted forest in more than 200 face-to-face interviews. To express the passage of time represented in the image sets, they were shown as animations stepping viewers through five time-steps. They were also used by Merrick and Vining (this volume) to investigate what forest elements people pay attention to when determining visual preferences.

Figure 6.—Recovery from salvage: natural regeneration (top) vs. planting with pines
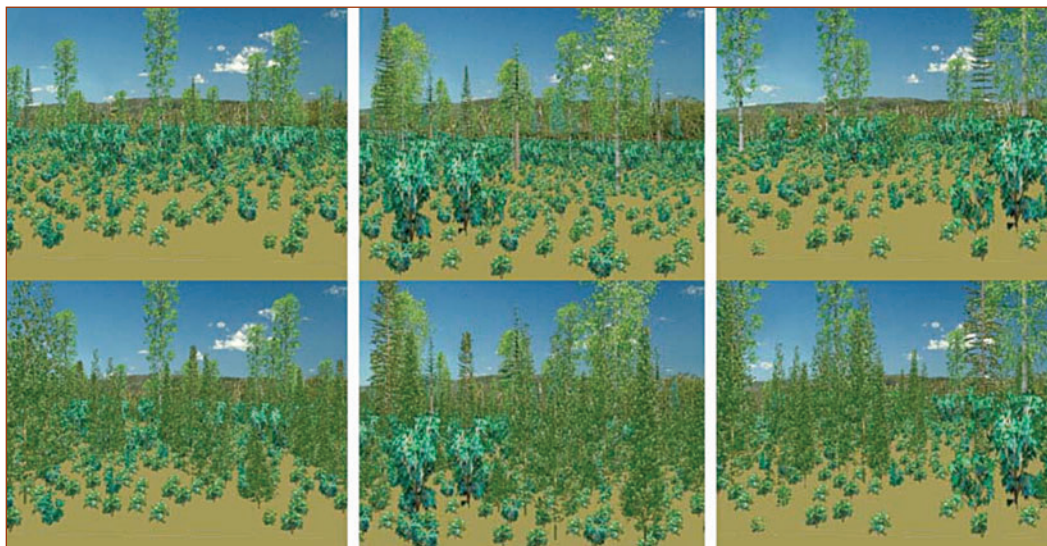
Note: Images show 2002 conditions.

Figure 7.—Growth: 2022 (top) and 2052 visualizations of the planting scenarios in figure 6
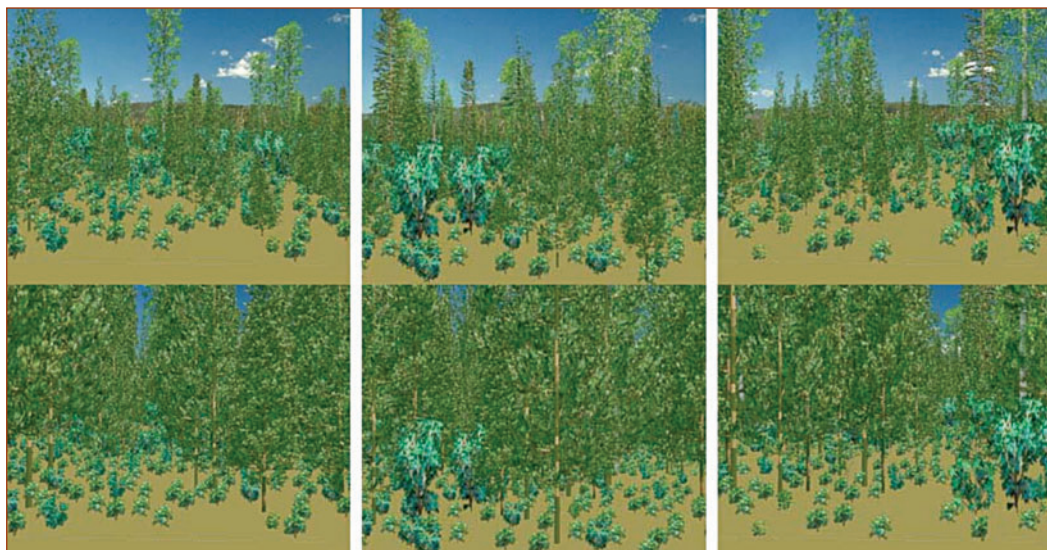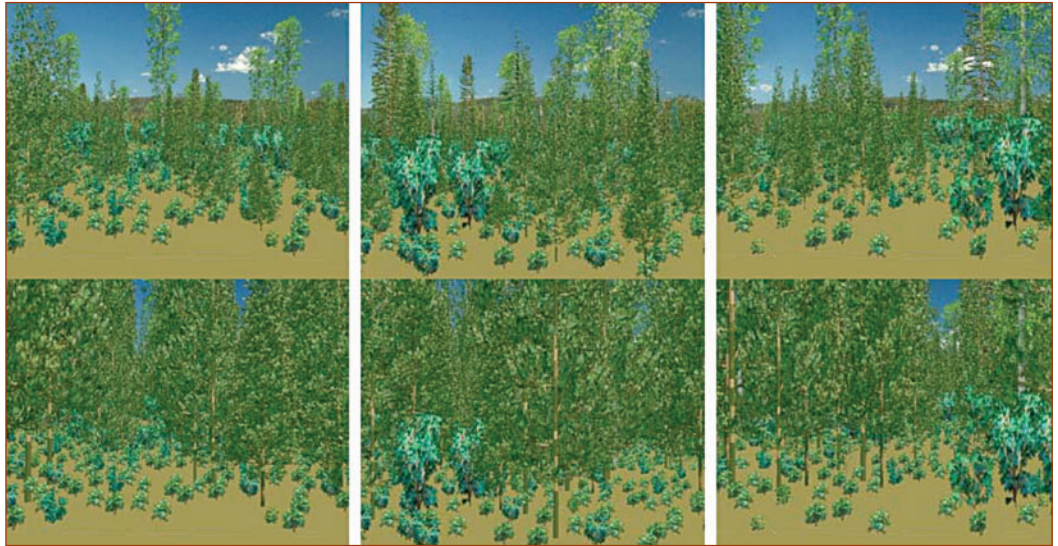
Figure 8.—Typical survey page

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The Wildland-Urban Interface in the United States

Susan I. Stewart
Northern Research Station, USDA Forest Service, Evanston, IL (sistewart@fs.fed.us)

Volker C. Radeloff
Department of Forestry, University of Wisconsin-Madison

Roger B. Hammer
Department of Sociology, Oregon State University

Introduction

The purpose of this project is to provide information on "the area where houses and wildland vegetation coincide." Although there are other ways of defining the wildland-urban interface (WUI), this is the definition referenced in the National Fire Plan. Details about the rationale, development, testing, and sensitivity analysis of this definition, as well as the data sources and analytical methods we used, can be found at the end of the article in the methods section.

The WUI maps and data were created with the hope they would be useful to planners and managers at the local, state, and national levels. Tools and information regarding the WUI are available on our Web site for public use. Users should note that the resulting WUI map does not indicate the risk of fire; it shows only where houses and wildland vegetation coincide. Some of the areas identified as WUI are prone to fire, and some are not.

Key Findings

The 2000 U.S. WUI map offers insights about the extent and distribution of the interface across the United States (fig. 1).

- All States have at least a small amount of land classified as WUI, and some have almost three-quarters of their land area in the WUI.

- Across the United States, 9.4 percent of all land is classified as WUI.

- WUI is concentrated along the eastern seaboard.

- WUI is also commonly found in amenity areas with extensive recreation and tourism including the northern Great Lakes and the Missouri Ozarks.

- In the Rocky Mountains and the Southwest, virtually every urban area has a large ring of WUI, reflecting the sprawling patterns of recent growth, with extensive medium- and low-density housing near or in low-elevation forested areas.

- Although the WUI is not extensive along the west coast, it encompasses a high percentage of homes, particularly in the fire-prone areas of southern California.

Figure 1.—The 2000 wildland-urban interface
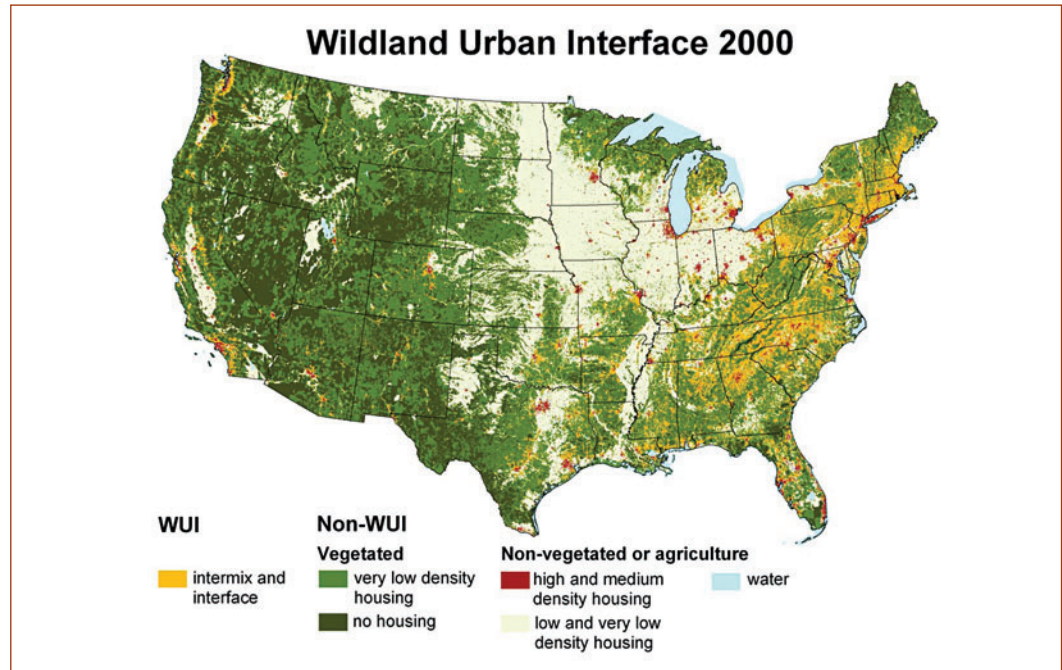
Source: Radeloff *et al.* 2005b

WUI Distribution Across the U.S.

- Large Eastern and Southern States have the most land area in WUI.

- The smaller States, all in the Northeast except for North Carolina, have the highest percentage of land in the WUI.

- California, Florida, and Texas have the largest numbers of homes in areas where wildland vegetation is relatively dense.

- The Western States have the highest proportions of their homes in the WUI.

- Across the country, 38.5 percent of all homes are in the WUI.

- In 19 of the 48 contiguous States, more than 50 percent of all homes are located in the WUI.

State by State, distribution of the WUI varies with the physical and biological settings and the infrastructure an area provides for home building. Several State rankings are shown in table 1 to illustrate how the WUI varies across the country.

Tools for Resource Managers

A complete listing of State-level WUI statistics is available on our Web site, http://silvis.forest.wisc.edu/projects/WUI_Main.asp. The Web site has an interactive mapping feature that allows any user to create custom graphics showing the WUI in a county or a group of counties or in a group of States. A help card available on the Web site provides step-by-step instructions for creating custom WUI graphics. Both WUI and housing density map images, with a black background suitable for slide shows or a white background for publications, can be downloaded for individual States, Forest Service regions, and for the whole United States Statistics also are available at the state, regional, and national level as well, detailing the land area and number of homes in interface and intermix in 1990 and 2000.

Because the WUI data make up one of many layers or sources of information that may be useful in community, regional, or state fire planning, the Web site has been designed so that our maps can be downloaded for use in GIS applications. Alone, our data indicate only where houses and wildland

Table 1.—State rank by area and housing units in interface, intermix, and total WUI

Rank	Interface		Intermix		WUI	
	Area (ha)					
1	PA	1,048,577	NC	4,784,695	NC	5,527,830
2	CA	746,021	GA	3,328,527	PA	4,338,705
3	NC	743,134	PA	3,290,128	GA	3,957,293
4	TX	728,196	VA	2,911,236	NY	3,573,641
5	NY	707,604	NY	2,866,037	VA	3,504,168
	Area (percent)					
1	DC	19	RI	61	CT	72
2	NJ	15	CT	60	RI	70
3	MA	12	MA	53	MA	65
4	CT	12	NH	38	NJ	46
5	RI	9	NC	38	NC	44
	Housing units (number)					
1	CA	3,480,285	CA	1,607,624	CA	5,087,909
2	FL	1,636,248	GA	1,479,368	FL	2,587,074
3	TX	1,426,326	NC	1,451,811	TX	2,568,047
4	PA	1,395,140	PA	1,146,366	PA	2,541,506
5	NY	983,059	TX	1,141,721	NC	2,322,458
	Housing units (percent)					
1	WY	62	ME	50	NH	83
2	NM	41	NH	47	WV	82
3	MT	40	GA	45	WY	80
4	UT	40	WV	42	ME	79
5	WV	39	NC	41	NM	79

vegetation coincide, which is just one small part of the information resource planners must assemble in developing fire management plans. GIS technicians can access the WUI Web site and overlay WUI boundaries and characteristics on their own GIS map(s) of local road networks, resource conditions, values at risk, fire hazard, ecological characteristics, and so on. ArcIMS software automates the process of matching locations and accounting for different mapping projections. Using our ftp server, GIS analysts can also download our dataset to modify our analysis and create original maps using their own local or regional datasets, such as a county-level "buildings layer" (i.e., digital record of specific building locations), which would be more complete and precise than census housing density data.

WUI Change Over Time

The key to future trends in the size, extent, and location of the WUI lies in housing growth, a function of many local and state policy decisions and economic conditions. Our analysis of WUI change indicates that growth in WUI housing was rapid during the 1990s. The counter-urbanization trend of the 1970s that brought retirees and many others to rural high amenity areas as well as the growth of suburban and exurban areas have increased the WUI, particularly the number of houses it encompasses. We estimate that 60 percent of the homes constructed between 1990 and 2000 were built in existing WUI areas. Further analysis of change over time in the WUI will provide us with useful insights about WUI dynamics, an essential foundation for projections of future WUI growth.

Methods

Although mapping the WUI might appear to be straightforward, there are actually many different ways to define the WUI that capture the basic concept of human presence in or near wildland vegetation. Our intent was to produce a national map, both to provide information for policymaking and to assist managers whose work is directly impacted by national policy. Because these were our goals, we used the policy-specific criteria for the WUI that were published in the Federal Register, January 4, 2001 (66 FR 751). The Federal Register definition borrows heavily from a consultant's report about fire in the WUI, commissioned by the Council of Western State Foresters (Teie and Weatherford 2000). A national map such as this can be made only with data that are nationally available. For this reason, the map and the data on which it is based are relatively simple, using just two key characteristics, human presence (measured by housing density) and wildland vegetation. We expect that managers with more complete local data will supplement the WUI map with these data to extend the quality and quantity of information conveyed in the map.

We map the WUI using *housing density* data, because housing density is a more suitable measure of human presence and influence on the landscape than population density. Housing counts include

seasonal residences, whereas population counts do not, and because national forests, parks, and other natural resources are attractive to seasonal home owners, this is a significant distinction. Housing density information was derived from U.S. Census data. Analysis was conducted at the finest spatial scale possible, census blocks, from the 2000 census. The Federal Register established a minimum density of one structure per 16 ha.

The housing density data are combined with vegetation data that indicate the areas where wildland vegetation is continuous in housing areas, or is within their vicinity. We use the National Land Cover Dataset, a satellite data classification with 30-m resolution based on 1992/93 satellite images, and available for the entire U.S. (Vogelmann *et al.* 2001). Our definition of **wildland vegetation** includes land cover classified as forests (coniferous, deciduous and mixed), native grasslands, shrubs, wetlands, and transitional lands (mostly clearcuts). We exclude land cover that is intensively human-dominated, including urban grasslands (often golf courses), orchards, arable lands (such as row crops), and pastures.

Finally, the Federal Register identifies interface communities as those where housing is "within the vicinity" of forests and other wildlands as part of the WUI, but it does not say what distance counts as the "vicinity." In its identification of WUI, the California Fire Alliance (2001) defined **vicinity** as all areas within 2.4 km of wildland vegetation, because that is roughly the distance that firebrands can be carried from a wildland fire to the roof of a house. This rationale for defining the vicinity takes into account the idea that even those homes not sited within the forest are at risk of being burned in a wildland fire. We adopt this vicinity measure as the buffer distance used to identify interface areas.

With housing density threshold, wildland vegetation types, and interface buffer distances determined, the operational definition of the WUI is complete: There is more than 1 house per 16 ha and more than 50 percent wildland vegetation; and, neighborhoods with less than 50 percent wildland vegetation are included if they are within 2.4 km of an area (made up of one or more contiguous census blocks) more than 500 ha that is more than 75 percent covered with wildland vegetation.

Users should note that the resulting WUI map does not indicate the risk of fire; it shows only where houses and wildland vegetation coincide. Some of the areas identified as WUI are prone to fire, and some are not.

The WUI data were tested for sensitivity to each aspect of the definition we use. The 2.4-km vicinity distance, the housing density threshold, the vegetation density threshold, the vegetation types treated as "wildland vegetation" were changed, and the analysis was rerun in selected States across the U.S. Combinations of these changes were also made to assess the extent of overlap between them. Sensitivity tests show that the WUI definition is robust. For each change we tested, the responses

(measured as the number of acres characterized as WUI, and as the number of homes located in WUI areas) were minor in comparison to the definition change. The biggest response was to changes in the housing density threshold. Changes to other aspects of the definition had smaller effects. Individual States varied in their sensitivity to the changes. Details and results of the sensitivity analysis can be found in Radeloff *et al.* 2005. Testing WUI definition changes is technically demanding and requires considerable computing time, but anyone interested in assessing the significance of a definition change they wish to make in creating a custom, local WUI map may contact the authors for details about the procedures involved.

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