Fire in the wildland-urban interface in the USA South

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Abstract

Population and urbanisation are rapidly expanding in the southern US, increasing human influences on forests that are considered highly productive and essential for supplying future wood and non-timber benefits. Challenges created in the wildland-urban interface relate to changing biodiversity, wildfire protection and mitigation, invasive species movement, and increased forest fragmentation, among others. The South has the fastest population growth in the US with a 13.7 percent increase in population between 1990 and 2000. This growth rate threatens the sustainability of Southern forests. In this region, Florida is the most acutely impacted state with a projected population of nearly 25 million by 2020. In 1998 alone, wildfires cost Florida over US$ 600 million in fire suppression, timber and home losses, and business disruption in the urban interface. In response to this situation, the US Department of Agriculture (USDA) Forest Service, the University of Florida and the Southern Group of State Foresters formed a partnership to create the Southern Center for Wildland-Urban Interface Research and Information. The Center addresses needs identified in a south-wide assessment of the wildland-urban interface. The critical problem of fire in the interface was chosen to be the first focal point of the Center. A suite of projects is addressing landowner risk assessment, post-fire assessment, structure and flammability of native plants and options for fuel management in the interface. A website (www.interfacesouth.org) was created and a fact sheet series initiated to facilitate technology transfer to end-users. Literature analyses and research designs for generating information for reducing risks in the wildland-urban interface are discussed.

Key words: flammability, forest fuels, forest landscapes, risk-assessments.

1 Introduction

The southern United States (US), which stretches from Texas to Virginia, is undergoing change unlike any other region in the US. As population and urbanisation expand in the region, human influences on southern forests are increasing. These areas of increased human influence and land use conversion are termed the wildland-urban interface. The trend to move to the outskirts of urban centres near to more natural settings has led to the partitioning and fragmentation of forested lands and wildlife habitat. The fragmentation of forests and other factors, such as increased recreational demands in wildlands, are impacting the cha-

racter and health of forests. Ultimately, air and water quality is affected. The end result is a threat to the values that attract people to the wildland-urban interface.

Natural resource managers are faced with critical management challenges in the interface, such as changing biodiversity, watershed management and protection. Perhaps the most critical challenge in the interface is that of managing fire in the wildland-urban interface. In 1998 alone, wildfires cost the state of Florida over $600 million in fire suppression, reduced tourism, and damage to commercial timber, businesses, and homes (Mercer et al. 2000). These challenges have a direct impact on public policy, safety, welfare, and quality of life. Furthermore, natural resource managers, policy makers, and communities often do not have adequate information and technology to make science-based resource decisions about these issues.

This paper first describes key wildland-urban interface issues and needs identified in a region-wide assessment of the Southern US. It then describes approaches that the US Department of Agriculture (USDA), Forest Service and University of Florida with guidance from the Southern Group of State Foresters are jointly undertaking to address wildland-urban interface fire research needs and information dissemination.

2 Methods

To address this need for new research and information, the USDA Forest Service conducted an assessment of the wildland-urban interface, titled »Human Influences on Forest Ecosystems: The Southern Wildland-Urban Interface Assessment« (Macie & Hermansen in press). This assessment identified factors driving change, consequences of change, and resulting research and information needs.

2.1 Factors driving change

Among the major factors influencing rapid urbanisation in the South, population growth and changing demographics are the social trends that will likely have the most profound effect on forest ecosystems and their management. The South is the fastest growing region in the US, with a 13.7 percent increase in population between 1990 and 2000. The South's population is projected to increase by 24 percent over the next 20 years, from 91 to 114 million. Florida is the most acutely impacted State with a projected population of nearly 25 million by 2020 (www.floridainformation.com). These changes will create greater demands and pressures on southern forests.

The ageing of the US population also has important implications. Average life expectancy has increased from just below 70 years for people born in 1950 to around 74 for males and just over 80 for females when born in 2000. This is significant because forested and other natural areas are popular as retirement, second home, and recreation destinations, all potential causes of new interface areas. Additionally the influx of people from other nations is helping to create a society that is more culturally and ethically diverse. People from diverse backgrounds and age groups have different perspectives, values, and attitudes with respect to the use and management of forests.

Significant is the rate at which rural land is being converted to urban uses. More rural acreage is converted to urban uses in the South than any other region in the US Out of the 10 states in the US that are experiencing the greatest total acreage of land developed for urban uses between 1992 and 1997, 6 were in the South. Also significant is that the majority of land in the South is in private ownership. And while the number of landowners is increasing, not surprisingly the tract sizes of land are decreasing. Of the South's approximately 432 million acres of rural land, 78 percent is in individual private tracts or corporate ownership, with 66 percent owning less than 500 acres. A 12 % increase in forest landowners was observed from 1978 to 1993 (Wear & Greis in press). Smaller tract sizes, more diverse management objectives, and increases in absentee and retiree ownership are creating unique challenges and opportunities for natural resource professionals.

Economic conditions and tax policies also greatly influence the rate of land-use change in the wildland-urban interface. The Southern economy has shifted from being based primarily on agriculture and natural resources, to being dominated by service, industry, and computer manufacturing sectors. Largely due to this shift, 4 out of every 10 jobs gained in the US since 1978 have been in the South. This has helped to fuel migration to the region and the unprecedented growth of many cities both large and small.

Land use planning and policy is another major factor driving change in the South. Some public policies have created incentives for urban development and further expansion of the wildland-urban interface. For example, the US Federal Government subsidised the creation of the National Interstate Highway system, which opened up vast areas of previously rural land to urban development. However, there are also numerous Federal policies that attempt to conserve and protect natural resources. The Clean Water Act, for example, was created to decrease water pollution.

While federal policy can influence land-use planning, authority to guide land use decisions lies mainly with each State, which may choose to delegate this power to local governments. Among Southern States, only Florida has a comprehensive growth management plan, but this has not been successful in preventing sprawling development. Local zoning decisions in Florida, as elsewhere, favour low-density and large-scale developments, further expanding the interface.

2.2 Consequences of change

The most obvious direct influence of urbanisation and other human activities on forests is the reduction of total forest area and fragmentation of remaining forest parcels. Human influences indirectly alter forest ecosystems by modifying hydrology, altering nutrient cycling, introducing non-native species, modifying disturbance regimes, and changing atmospheric conditions. These changes significantly affect forest health and modify the goods and services provided by forest ecosystems.

These urban influences, along with decreases in tract size, increases in land ownership, and more diverse forest management preferences, are setting the stage

for new challenges, as well as new and innovative approaches to forest resource management in the interface. Specifically, managing forests for traditional forest products and managing fire are becoming increasingly complex.

Southern forests are an important national source of timber, making up 40 percent of US timberland (Faulkner et al. 1998). The management and conservation of these forests, however, become increasingly difficult in the interface. Production costs are higher due to higher land costs, which can discourage landowners from making investments in forestry. Selling and subdividing the land can be more profitable, and the rapidly changing land use patterns that are characteristic of the interface may discourage landowners from making long term forest investments. Furthermore, Southern forest landowners increasingly have a variety of reasons for owning forests. Landowners are placing higher values on aesthetics, wildlife, soil, and other non-timber forest resources. Only 7 % of Southern landowners emphasise making money as their primary management objective. Forestry agencies need new skills and approaches for meeting these diverse management objectives.

Decades of fuel build-up and population growth in the interface have created many challenges for managing fire in the wildland-urban interface. Using fire to enhance ecological processes is increasingly difficult, which heightens the challenges associated with preventing and suppressing fire. Negative public opinion regarding fire is one of the biggest obstacles that fire agencies must overcome. People may not understand the benefits of fire or may be concerned about public health and safety. For these reasons fire management cannot be the same in the interface as in rural areas. Different firing techniques and ignition patterns may be needed. Weather and fuel characteristics that are optimal for prescribed fire in rural areas may not be practical in the interface due to concerns over excessive smoke production and risk to structures. Thus, smoke management becomes more of a priority due to increased health, safety, and liability concerns near urban environments.

Because wildland-urban interface fires combine characteristics of wildland fires and structural fires, they present unique challenges to fire suppression personnel. Federal and state agencies are charged to first protect human life and structures, then natural resources. However, wildland fire fighters do not usually have sufficient training in structural fire fighting, and municipal fire departments are not usually equipped or trained for wildland fire suppression (Davis 1986). The challenge in the interface lies in combining fire fighting expertise in both areas and providing cross-training opportunities.

Many other critical management challenges exist in the interface, such as managing water resources, recreation, and wildlife. New adaptive strategies for managing these resources are essential.

2.3 Research and information needs

Four main areas of needed wildland-urban interface research and information were identified in the Assessment.

- *Explaining and adapting to human influences on forest ecosystems.* The influences of land use conversions, pollution, forest fragmentation, and invasive species on

forest ecosystem structure, function, composition, and process needs to be better understood. Research in this area would not only help us understand the effects of urbanisation on forest ecosystems, but also help with development of management techniques for multiple, small-scale ownerships.

- *Identifying the influences of public policy on forest ecosystems and their management.* The relationships among public policy, land use change, and resulting changes to forest ecosystems are still poorly understood. Research in this area could help us to better understand the roles, strengths, and weaknesses of various policies at different governmental levels that affect natural resource management and conservation in the interface.
- *Identifying and reducing risk to ecosystems and people in the wildland-urban interface.* Fire, invasive species, groundwater contamination, and other environmental changes present risk for human and forest communities. Controlled experiments, historical studies, modelling, and long-term monitoring are needed to better understand, predict, and avert risk.
- *Understanding and communicating public attitudes, values, and perceptions.* Information about the preferences, values, and attitudes of the diverse Southern society with respect to resource management and conservation is a critical element of any natural resource program. Research in these areas will lead to a better understanding of how differences in age, ethnicity, and cultural backgrounds influence public use and management of forests.

3 Outcomes

A Southern Center

To address these research and information needs, a partnership was created between the USDA Forest Service, the University of Florida, and the Southern Group of State Foresters to establish the Southern Center for Wildland-Urban Interface Research and Information. The Center opened in January 2002 in Gainesville, Florida, with an initial focus on research and technology transfer needed to address fire in the wildland-urban interface in the Southern US. The center's goal is to develop, apply, and exchange information about critical interface issues, serving as a clearinghouse of information. Utilising an integrated, customer-driven approach, the Center hopes to serve a diverse audience including natural resource agencies, planning departments, local policy-makers, and private forest land and home owners. Taking an interdisciplinary approach, the center will expand its focus in future years to include social, economic, policy, land use planning, forest resource management, and other issues identified in the assessment.

The Center's interactive web site, Interface South (www.interfacesouth.org) provides a wide array of information about fire and other interface issues and will help to coordinate and facilitate exchange of information across the Southern US. One of the main features of the web site is the literature database, which includes references and abstracts from over 1,000 journal articles and other publications that were collected for the Southern Wildland Urban Interface Assessment. The web site also features a month-by-month calendar of interface conferences and events; brochures, related web links, and much more. In the future the assessment publication and brochures, as well as other Center publications, will also be added.

The Southern Wildland Urban Interface Network (SWUINET) electronic mailing list (instructions for joining are on the site) provides an opportunity to exchange ideas and information, share opportunities for funding and collaborative projects, facilitate networking, and build a base of information about the wildland-urban interface.

A series of fact sheets about wildland-urban interface issues was initiated as a second vehicle to disseminate information. The first three fact sheets in the series focus on fire issues and will provide basic information that will assist homeowners in assessing and mitigating fire risks on their property.

The first fact sheet, entitled »Understanding fire behaviour«, describes the key factors controlling fire movement and fire intensity, and outlines how interface landowners can use such information to develop home protection strategies. »Considering fire in Florida's ecosystems«, outlines the role of fire and associated fire risks in nine Florida ecosystems. This fact sheet will serve as a precursor to more specific hazard assessment procedures that are currently being developed. A third fact sheet is currently being developed that outlines the key characteristics of fire-resistance in plants. Scientific literature to date includes no species-specific lists on flammability of plants in the southeastern US. Therefore, this fact sheet focuses on general characteristics of plant flammability or fire-resistance, and describes how regular maintenance of landscape plants can lower flammability regardless of species.

Future fact sheets on fire will incorporate data from a study currently being conducted through the Center titled »Assessing and mitigating fire risk for landowners in the southern wildland-urban interface«. Similar extension series on other important wildland-urban interface issues, such as invasive species and land use planning and policy, will be developed in the future.

Fire research projects implemented

Homeowner risk assessment

In order to respond appropriately to the potential fire danger in the wildland-urban interface (WUI), homeowners must be able to understand and assess their individual risk. A variety of guidelines for risk assessment have been produced in the past by both private and public agencies, at national, state and local levels. Most of the guidelines apply to the western US and attention has only recently begun to focus on the Southeast. Risk assessments vary in detail, but most include some evaluation of vegetation around homes or other structures. Common variables included in the assessments are the general vegetation type (e.g., shrubs, forests or landscape plants) and proximity of vegetation to structures. More detailed assessments may recognise some aspect of the density or size of the natural vegetation (or try to differentiate between native and non-native plants). Most assessment procedures are modelled after the hazard rating systems outlined in the National Fire Protection Association publication »NFPA 299: Standard for the Protection of Life and Property« (NFPA 1997).

Risk assessment procedures often incorporate existing guidelines for WUI fire protection, including information about the appropriate size of defensible space. Defensible space refers to an area between homes and adjacent wildlands where

vegetation has been removed or modified for fire protection (NFPA 1997). Defensible space guidelines are based on research on the effects of radiant heat (e.g. Cohen 2000) and surveys of homes threatened by WUI fires (e.g. Abt et al. 1987; Graham 1988). However, the geographic distribution of this research is limited, as are the ecosystems in which it was conducted. Few studies have been conducted in the southeastern US.

In 2000, a general brochure (Monroe & Long 2000) was disseminated, which gives homeowners some general descriptions of surrounding natural vegetation that would be considered low, medium or high risk in the case of an approaching fire. Our current research will take that general approach and expand it to major vegetative ecosystems across the southeastern US, ranging from wet hardwood forests, to dense pine stands, to open grasslands and pastures. Within those ecosystems, WUI residential areas represent a continuum of vegetation patterns and associated fire risk that cannot be readily classified into a few risk categories by simply measuring the distance to, and size of, surrounding vegetation.

We are taking a somewhat unique approach to this classification. For each of the general vegetative ecosystems and physiographic regions in the southeastern US, we will define the most critical fire weather conditions that might occur in that region. Those weather conditions will be used as inputs to standard fire behaviour models for Southeast fuel types. Model outputs will include fireline intensity and rate of spread for a wide variety of fuel loads and conditions. These fire behaviour results can then be aggregated into groups of ecosystems and fuel conditions that represent several categories of fire risk. This unique approach to defining WUI home fire risk will also allow us to provide more prescriptive recommendations for mitigating risk, depending on whether the risk is from fire intensity, rate of spread or a combination of the two.

Post-fire assessment

A critical area of fire research in the wildland-urban interface examines the multiple factors that influence the survivability of homes threatened by wildfire. Most studies to date on structural survival are based on field observations of homes that were threatened by fire, examining both houses that burned and those that survived. Using single factor and regression analyses, these observational studies help us to identify the most important factors determining structural survival. Multiple studies have been conducted in the US and in Australia following major wildland-urban interface fires, with most research focusing on the western US. In addition, a few controlled experiments have examined structure ignition in the western US (Cohen 2000).

Several factors have consistently been shown to influence structural survival in wildland-urban interface fires. Fire intensity, vegetation clearance, and building construction properties, such as roofing, are of primary importance (Wilson & Ferguson 1986; Abt et al. 1987; Foote & Gilless 1996; De Witt 2000). With high intensity wildfires, fire services can do little to protect homes at the head of the fire (Roussopoulos & Johnson 1975). Only changes in weather conditions or fuels can alter the fire's path. Most observational post-fire research includes some measure of landscape vegetation, often simply recording the clearance distance of flammable plants. Data from these studies support the common recommendation

that a minimum area of 30 feet (1 feet equals 30.3 cm) around structures be cleared of flammable vegetation (Howard et al. 1973; Wilson & Ferguson 1986; Abt et al. 1987; Foote & Gilless 1996; NFPA sa a; b; c). Living and dead vegetation serves as the primary fuel in wildland fires, and by clearing flammable vegetation around homes, fire behaviour can be altered and the associated risk of structural ignition reduced (Cohen 2000).

When wildfires come within a critical distance of structures, building materials can significantly influence structural survivability (Cohen 2000). While heat from an approaching fire or direct flames can ignite structures, floating burning embers (referred to as firebrands) are also a common source of structural ignition. In wildland fires, the roof is often the most vulnerable part of a home (Wilson 1962; Wilson & Ferguson 1986; Graham 1988; NFPA sa b). Other characteristics of building construction may, however, also be important, including window type and exterior siding (Wilson & Ferguson 1986; Ramsay et al. 1996).

Many natural resource agencies have developed documents for homeowners, developers, fire services, and politicians with information on protecting homes from wildfires. However, most guidelines contain no documentation of how they were developed and are often based on publications developed in other states or at the national level. While recent studies have attempted to validate current home protection strategies, more observational data on structural survival must be collected to test current guidelines (De Witt 2000).

One example of a mitigation practice that may warrant modification is the common recommendation of 30 feet of defensible space. The factors that influence the effectiveness of defensible space, including fuel type, fuel loading, and topography, vary significantly geographically. In recognition of this variation, the state of California developed an ordinance, Public Resource Code 4291, which requires a minimum of 30 feet of defensible space around homes in high fire hazard areas, but the law allows local regulatory agencies to increase the required area up to 100 feet under certain conditions (e.g. steep slope). However, in Florida, as in many other states where wildfires occur, the recommended area of defensible space is 30 feet regardless of local conditions. Testing current fire hazard mitigation recommendations under a variety of local conditions will help fire professionals identify potential improvements and supply policy makers with the empirical data required to develop and implement public policy focused on fire prevention.

In this research project, post-fire assessments are being conducted to improve our understanding of factors determining structural survival during wildfires. The methodology being implemented was based on past observational studies on the subject; however, our characterisation of the vegetation around homes will be more detailed incorporating spatial arrangements and species. Improving basic knowledge of the relations between vegetation landscaping and structural fire hazard is one of the studies primary goals.

Preliminary data were collected in 2002 in Florida communities that had multiple homes threatened by wildfire and at least one home damaged. Plans are underway to expand this study in 2003 to other states in the southern US. Each threatened

and/or damaged home is visited immediately following the fire, and field data are collected on multiple variables associated with structural loss. Measured variables include structural properties, landscaping characteristics, and community design/layout. Fire reports on weather and defensive actions that were taken are obtained from fire service agencies. Homeowners of threatened or damaged homes are also interviewed for information on the use of preventive or defensive actions and to better characterise the property prior to the wildfire event.

Finally, all vegetation is described and mapped within a 100-foot radius of each threatened house. By collecting detailed information on the landscape vegetation and layout, the study was designed to examine the fire risks that accompany individual plant species and mulches, as well as their spatial arrangement.

Flammability of shrub species from Pinus sp. flatwood and hardwood hammock ecosystems

Residents in interface areas are instructed to remove flammable vegetation as part of defensible space strategies for wildfire protection. However, lists describing the flammability risk of different plant species are rarely available. The lists that do exist in the Southeast US are from unknown origin or were generated using data from different geographic regions. Many characteristics are known to affect flammability, making it difficult to generalise flammability based on a few characteristics. To complicate the situation further, no standard method of quantifying plant flammability exists, therefore comparing results from plant flammability studies is difficult. In many cases, the landscaping around interface homes includes many species native to the surrounding ecosystem. The brush or shrub clearance is an important factor determining structural survival during wildfires in the Southeastern US (Abt et al. 1987; De Witt 2000). Determining the flammability of shrub species will help in defining defensible space strategies specific to ecosystems.

Plant flammability can be simply defined as the ability of a plant to spread fire to surrounding vegetation or structures. More specifically, flammability is collectively ignitibility, sustainability, combustibility (Anderson 1970), and consumability (Martin et al. 1994) of a fuel. Ignitibility is defined as the time to ignition at a constant temperature. Once ignited, sustainability is the ability of a fuel to sustain fire with a constant heat source. Combustibility relates to how fuel is consumed and consumability is the proportion of the mass or volume consumed by fire. Environmental conditions, such as weather and climate, can influence the flammability of a plant. However, there are many intrinsic and structural plant characteristics that affect plant flammability.

At the chemical level, major influences on flammability are moisture content (Countryman 1974; Gill et al. 1978); percent cellulose, hemicellulose, and lignin (Philpot 1970); volatile extractive concentration (Shafizadeh et al. 1977; Susott 1982; Owens et al. 1998); and silica-free mineral content (Mutch & Philpot 1970; Philpot 1970). These components interact to influence ignitibility, sustainability, combustibility, and consumability. The arrangement of fuel on a plant also influences these components of flammability. High surface-area to volume ratio and low particle density of plant tissue increases flammability (Montgomery & Cheo 1971). Bulk density (total above ground mass per plant volume) and porosity

(canopy volume to fuel volume) also affect flammability (Rundel 1981). The chemical and structural components of fine fuels are important for flammability in the context of home landscaping as fine fuels often ignite first and facilitate the advancement of a fire front (Anderson 1970).

Structural and chemical characteristics of flammability are being studied in the context of shrub species in two Florida ecosystems with very different fire behaviour. *Pinus sp.* flatwood ecosystems have a fire-return interval of 1-8 years, whereas in hardwood hammock ecosystems the interval is 30-50+ years (FNAI 1990). The objectives for this study are 1) to develop a methodology for studying flammability of individual species, 2) to increase information on factors influencing flammability, 3) to rank the species studied by flammability, and 4) to determine if shrub species from hardwood ecosystems are less flammable than shrub species from flatwood ecosystems.

Four shrub species in each ecosystem are being analysed for structural and chemical characteristics of flammability. In addition, *Serenoa repens* and *Myrica cerifera* are being studied in both ecosystems. Species used in this study include those thought to be highly flammable: *Serenoa repens* (saw palmetto), *Myrica cerifera* (wax myrtle), and *Ilex glabra* (gallery); and those thought to be less flammable: *Vaccinium arboreum* (sparkleberry), *Calicarpa americana* (beautyberrry), and *Quercus nigra* (water oak). To control for cultural methods, data are being collected in the plants' natural settings; multiple sites of each ecosystem were used in North Central Florida. Three plants of each species are randomly selected at each ecosystem site. For each individual plant, multiple characteristics related to flammability are measured.

Data to be collected includes; litter depth and density; percent total mass in fine fuels (leaves, fallen debris, stems <0.6 cm diameter); moisture content of all plant components (litter, fine fuels, stems (>/= 0.6 cm diameter), and flowers and fruits); bulk density; specific leaf area ($cm^2 \cdot g^{-1}$); leaf volatile solids ($mg \cdot kg^{-1}$); and leaf energy content ($cal \cdot g^{-1}$). To examine the contribution of individual species to the overall site flammability, the density of each species will be measured at each site. Using ANOVA, data will be analysed to test ecosystem, site, and species effects on the characteristics measured. Further analyses may be performed using multivariate statistics. By quantifying multiple variables that contribute to plant flammability, a more complete assessment of plant flammability will be made.

Fuel reduction method

Because fuels rapidly build up in this region with high lightning frequencies, fires are inevitable unless an active fuels management programme is implemented. Structural characteristics of wildland fuels, beyond the landscaping that surrounds homes, often contribute to intensity and spread of wildland-urban interface fires. Fuels may include living shrubs, vines, grasses and trees of all sizes as well as dead material from these components. Dense shrub layers or continuous vertical structures often present the most difficult problems. One very important approach to reducing homeowner risk from wildfire is to reduce the amount of wildland fuels around homes; on adjacent lots; or to create larger fuel breaks through the vegetation around communities. Individual homeowners and community associations need information on how best to accomplish this task

Chemical herbicides, mechanical systems such as mowing, crushing or manual cutting and removal, prescribed burning and grazing animals have all been used for decades to reduce fuels on large wildland areas. Research has documented some of the advantages and problems associated with several of these methods (Brose & Wade 2002). For example, prescribed burning is often the method of choice because of its natural role in most ecosystems and its low cost per acre for most burns. The use of herbicides and fire are not limited by slope, as are most mechanical systems. Plants readily resprout following all treatments but herbicides. Considering fuel reduction options in the context of the WUI adds additional concerns of cost for treating small areas, public issues and safety, and invasion of a variety of exotic plants after treatment. Although many different fuel reduction methods have been used in the wildland-interface, comparisons among them are much more limited than for treatments on large wildland areas.

We have taken two approaches to addressing the need for more information on fuel management in the interface. The first was an extensive review of treatment options, including effects, and costs using published literature and agency reports. We focused on treatments that can be implemented in small areas. As this information is compiled and summarised for landowners, it will emphasise relative costs and effects of each practice as well as their application. The second approach involves the installation of side-by-side comparisons of mowing, herbicides, prescribed burning, and a no-treatment control in one of the most problematic shrub communities in Florida. The first treatments will be applied in late summer, 2002. This field study will be augmented with additional information collected at sites across Florida where one or more of these fuel treatments have been used operationally.

4 Discussion

The catastrophic fires occurring in 2002 throughout the US reconfirm the importance of understanding the problems in the wildland-urban interface and the need for their mitigation and prevention. Creating defensible space around homes has been required for years in California under its California Public Resources Code 4291. Experience has shown that many residents do not comply since they do not think a devastating wildfire could affect them. Because of the complexity of situations that have led to fuel build-ups in rural areas and conditions that have caused urban spaces to be less defensible, the problem has become much more complicated.

The Southern Center for Wildland-Urban Interface Research and Information seeks to provide useful interface information to a variety of audiences. Two methods of disseminating this information are through the Center web site and through a series of fact sheets that are made readily available to the general public.

The body of literature is also being analysed to provide guidelines for homeowners and land managers to assess their risk of wildfire and provide them with the best available methodologies for mitigating hazardous conditions. At the same time research has been initiated to better understand the conditions associated with fire risks and to serve as a basis for developing prescriptive management opportunities. Following wildland-urban fire events in the Southern US, a team is

immediately visiting the sites to make a careful post-fire assessment to document those landscape and structural features that led to or prevented fire spread. Common forested ecosystems involved in the wildland-urban interface in Florida are being characterised for flammability of key shrub species that could contribute to fire development and spread. With this knowledge, managers can devise practices to reduce the highly ignitable plants in the landscape. Armed with this information defensible space and building standards can be better defined for those living in or managing lands in the interface.

Fuel mitigation practices include the removal of vegetation in order to reduce fuel available for fire. Physical, human health, environment, or attitudinal reasons frequently limit some well-known fuel reduction procedures like forest thinning and prescribed burning. In these situations mechanical mowing and crushing or herbicidal treatments may be feasible. It is the object of this research to define the comparative advantage of each treatment for specific wildland urban interface conditions.

It is the goal of the Southern Center for Wildland-Urban Interface Research and Information to promptly transfer information from this and other research to those directly involved or affected by fire. The Centers website and fact sheet series will be refined, expanded and enriched with workshops seminar and other specialised tools for technology transfer. Problems in the wildland urban interface have existed for a long time.It is imperative that appropriate political, social and environmental solutions are addressed immediately to protect both human and forest communities as the situation is becoming increasing complex.

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