

# **Society and Natural Resources**

## **A Summary of Knowledge**

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## The Wildland-Urban Interface

Increasing  
Significance,  
Complexity and  
Contribution

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During the past two decades, presentations at International Symposia on Society and Resource Management (ISSRM) have covered an increasingly broad scope of topics on natural resource issues. The wildland-urban interface (WUI) was a key topic of discussion at the ninth ISSRM in 2002: a reflection of the response by social scientists to increasing residential development in wildland environments and fire management in the WUI. The dialogue included the causes, effects and policy implications of expanded residential development in wildland areas. This dialogue is certain to continue and become more dynamic, especially as ISSRM continues to evolve.

Although much of the WUI discussion at the 2002 ISSRM was related to fire policies, the implications of WUI management go well beyond wildfire. Historically, many WUI-related topics have been discussed at ISSRM (although not always in the specific context of the WUI), including: urban growth and influence, ecosystem health, restoration, wildfire, fragmentation, collaborative and adaptive management, communities, acquisition and management of public lands, and linkages across the landscape. Effectively addressing these and other important topics within the context of the WUI will call for the application of the full range of social sciences, as well as integration at multiple scales with the physical, biological, and ecological sciences. The landscape scale is an increasingly essential focus in efforts to address key policy issues concerning natural resource management and use. As with other subjects that have received significant attention at ISSRM, it is likely that discussion of the WUI will continue to evolve to include a widening range of significant management and policy issues, and areas of scientific inquiry.

After an initial focus on the definition, spatial configuration, and dynamics of the WUI, this chapter discusses several other key topics, with particular

emphasis on WUI's evolution and possible changes in the future. It concludes with a discussion of future issues and implications, including how ISSRM can continue to address the needs of WUI research and management.

### Changing Definitions

The term *wildland-urban interface* first appeared as a session title at the second ISSRM in 1990. Presentations in that session focused on managing interface lands on U.S. National Forests in southern California, with particular emphasis on outdoor recreation use by Hispanic Americans. The WUI next arose as a session topic in 1996 with a session on natural resource issues of the rural-urban interface. Other previous ISSRM paper topics with a similar or related focus include: urban-rural interface, residential-rural interface, urban-forest interface, peri-urban interface, urban-edge, urban-proximate, urban-forest fringe, residential forest, urbanizing landscape, urban sprawl, and rural-urban fringe. What these titles share is a focus on an interface or intermix environment involving residences and open or natural areas. Technically, the term *interface* refers to the edges of urban areas that are expanding into the wildland, while *intermix* refers to structures (e.g., residences) scattered throughout natural areas. Although the predominant term in current usage is *wildland-urban interface*, the term *wildland-urban intermix* is likely to increase; intermix areas are much more common than interface areas throughout the United States.

Interfaces and intermixes exist at many scales across the WUI. In these landscapes, the arrangement of natural resources, residences, and infrastructure has become increasingly important to critical management and policy issues. The spatial pattern of the area helps define the character of places where people want to live, visit, and recreate. Spatial factors also affect interactions between elements of the landscape and ecosystem functions, ultimately influencing landscape value and sustainability.

Although currently they are not generally perceived as part of the WUI, agricultural lands are likely to become an important part of the WUI discussion as residential development continues to expand into areas where agriculture is a dominant land use (Sullivan, 1992a, 1992b). Changes in management of crop and pasture lands, such as increasing use of trees and other perennial plants, tend to blur the distinctions between farms and natural areas. The addition of croplands and other non-wild lands to the discussion of residential interfaces and intermixes complicates the analysis of many landscape functions, and makes the spatial configuration of resources particularly critical. While the prospects for the spread of wildfires may be reduced by croplands and pasture in the landscape, issues such as animal habitats, exotic plants and animals, biodiversity, water quality, and plant and animal health may increase in importance and complexity.

Agricultural issues have received significant attention at ISSRM since the first meeting in 1986. Since that time, the range of agricultural issues addressed has broadened, and more recently included the sustainability of agriculture and how agriculture fits with other land uses at the landscape level. Sustainability of complex landscapes that include agriculture may well become a key dimension of future policy discussion for the WUI and beyond. It is likely that in many areas of the United States, the future will bring integrated management of natural areas, agricultural areas, and residential developments across the landscape. It is not clear what the resulting

composite landscape will be called, as it goes beyond wildland cover; perhaps terms such as *residential open land intermix* will be useful to describe these lands.

### Critical Issues in WUI

As changes in people, natural resources, and their interactions across the landscape accelerate, there is likely to be increasing interest in the dynamics of the spatial extent of the WUI. Building on presentations at the ninth ISSRM (Bengston, Fletcher & Nelson, 2002; Dwyer, 2002; Stewart, Hammer & Radeloff, 2002), future sessions are likely to focus on changing human migration and settlement patterns, changing patterns of housing growth, characteristics of residents and communities, and the associated implications for public policy. Remote imagery can be highly useful in tracking physical landscape changes; the Natural Land Cover Data has been particularly useful in this respect. Linking demographic and physical changes across the landscape can be particularly revealing to policy-makers and researchers in understanding the complex dynamics of the WUI.

Traditionally, most natural resource management discussion has focused on rural areas. However, in more recent times, increasing attention has been given to the influence of urban residents on natural resources, in both rural and urban areas. This has been reflected in several previous ISSRM: a paper on the social functions of urban open space at the first meeting in 1986, a workshop on urban forest management at the second ISSRM in 1988, and a substantial session devoted to urban forestry at the third symposium in 1990. The management of natural resources like parks and river corridors in urban areas has also received increased attention as it has become clear that these resources have a significant influence on urban environments and quality of life (Kaplan, Austin & Kaplan, 2002). The management of urban ecosystems, including their human dimensions, also is emerging as an important topic area (Grove & Burch, 2002; Wilson, Grove, Boumans & Burch, 2002).

As urban residents' use of resources on public and private lands has grown, their influence on the management of those resources has also increased. At the 1992 ISSRM, Ewert (1992) presented a paper entitled *Urban-proximate Wilderness: Managing for Difference*. This was followed by Stedman's (1994) presentation two years later, *Urban and Rural-based Hunters: An Exploration of the Culture of Hunting*. With expansion of residential areas into wildland settings, due in part to amenity and retirement migration and the establishment of seasonal homes, research on urban residents has expanded to include the WUI landscape (Constance, Denq & Kirkoon, 1998; McLeod, Kruse, Wolrhay & Inman, 1998; Nelson & Kalmar, 1994; Stewart, Williams, VanPatten & Watson, 2000). This builds on previous research that focused on urban landowners and seasonal residents in rural areas, as well as the interactions between urban residents and the urban forest. Research on the interactions between urban residents and natural resources is beginning to focus more broadly on ecosystems, landscapes, and sustainability in the WUI and beyond.

#### *Ecosystem Health*

There has always been some attention given to ecosystem health at ISSRM, but the linkages with resource management issues, policies, and programs have not always



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been explicit. Ecosystem health and sustainability are important WUI issues as many of the activities associated with expanding residential areas, such as house and infrastructure construction, can have a significant influence on ecosystem health. Important concerns include changes in drainage and stormwater flows, introduction of exotic plants and animals, and increased air and water pollution. Affected ecosystems can include a range of environments such as forests, savannas, wetlands, prairies, and (human) communities within the WUI. Water (quantity, quality, and timing) and biodiversity are likely to be critical policy issues, with exotic invasive plants and animals posing a significant threat. Fire and restoration also are key components of forest health and sustainability in the WUI that are discussed in more detail below. In addition, human health can be an important consideration; individuals may move to a WUI area seeking a more healthful environment, but significant health risks can emerge such as Lyme disease and West Nile Virus.

#### *Restoration*

Restoration is emerging as a significant natural resource management issue. It includes the rehabilitation of areas that were previously used for farming or commercial and industrial purposes, and the ecological renovation of areas damaged by invasive plants, animals and, in some cases, fire. Such damage tends to be accelerated in the WUI as widespread interactions between people and natural resources disrupt locally-evolved natural processes. As interest in the WUI increases, residential areas and other sites may be the focus of significant restoration activities, which may be a growing component of the creation of open-space residential subdivisions. In addition, as more residents and users are exposed to damaged or disrupted natural areas, they may demand substantial restoration work, as occurred

in the Midewin National Tallgrass prairie southwest of Chicago (Stewart, Larkin & Liebert, 2002). In that area, the USDA Forest Service is working to restore native prairie to a 15,000 acre landscape that was significantly altered by agricultural and industrial use.

#### *Fire*

Fire is a major issue in the WUI; there are a number of critical issues to consider. Information is especially needed regarding the identification of high-risk fire areas, most effective ways to reduce fire risk and protect important values (e.g., houses, watershed), how to best allocate efforts to mitigate risk, and the best provision of protection and suppression capabilities. Other important concerns include the portion of fire management efforts, particularly fuels reduction, that should be allocated to the WUI; how fuels reduction in adjacent areas affects fire risk and damage; how to best engage residents in reducing risk; and characteristics of effective partnerships between communities and land management agencies for fire management. Although the second ISSRM in 1988 included a paper on controlled burning (McConnell, 1988), wildland fire is essentially a new topic at ISSRM with only a few papers prior to the sixteen presented at the ninth meeting. In some natural resource forums, fire has dominated the WUI issue to the exclusion of others. This has not happened at ISSRM, and is not likely to do so, given the symposia's breadth of approaches and issues.

#### *Fragmentation*

Fragmentation of land ownerships (e.g., parcelization) and natural resources often accompanies the development of residential areas in wildland environments. Residential structures and the supporting infrastructure, particularly roads and utilities, divide the landscape unnaturally. This has important implications for resource management and for the sustainability and diversity of the landscape. Timber harvesting, agriculture and outdoor recreation can often be difficult to undertake in small land tracts that often characterize WUI parcels. In addition, habitat fragmentation can pose major problems to the sustainability of animal and, to a lesser degree, plant species. Managing landscapes with increasingly fragmented natural areas and ownerships will necessitate adaptive and collaborative management approaches to respond to continuing changes and to the need to manage across ownerships (see the following section). At ISSRM, there have been a small but persistent number of papers on the management of non-industrial private forest lands, but not a great deal of attention to fragmentation of private ownerships in the WUI or the implications. A presentation by Kendra and Hull (2000) looking at the new owners of residential forests is a hopeful sign that ISSRM will begin to address fragmentation and the WUI.

#### *Collaborative and Adaptive Management*

To sustain dynamic and complex landscapes in the WUI, collaborative and adaptive management is important. Collaboration among managers is critical because of the many owners, partners, and interests involved with land management in the WUI, while adaptation of management is critical because of the significant changes over

time that are continually occurring. Partnerships involving communities, non-profit groups, and landowners will become critical. Current collaborative efforts to develop comprehensive strategies to reduce wildfire losses and manage watersheds are likely to expand to manage additional resources and reduce negative ecological and social impacts.

#### *Communities*

ISSRM has a long tradition of research on communities and their interactions with resource managers that can help provide a foundation for future work on issues concerning the WUI. Early discussion focused on the impact of resource management, particularly timber production and outdoor recreation, on the growth, development and stability of nearby communities, often called *resource dependent communities*. Since then, more comprehensive analyses of communities as part of regional assessments have been done to guide the implementation of ecosystem management. In more recent times, particular attention has been given to the role of communities in natural resource management, including urban and ex-urban resources. Communities are critical in the WUI, particularly with respect to fire and residential development. A paper by Selin and Chavez (1992), *From Public Input to Public Participation: Developing a Collaborative Model of Natural Resource Decision-making*, captures some of the evolution of work with communities.

#### *Acquisition and Management of Public Lands*

The acquisition and management of public lands in WUI areas will become increasingly significant issues. Often public lands play a very important role of being the largest contiguous area of greenspace in the interface. Existing public lands in the WUI may experience new uses and influences from nearby residents, as well as increasing usage by people from more distant areas. The growth and development of the WUI can greatly complicate the management of these lands, but also enhance their values. Public agencies may purchase land to prevent development, or to provide social and ecological opportunities and functions not available on nearby private lands (e.g., outdoor recreation, habitat). Prioritization for public acquisition in the WUI can be complex, given both the multiple functions that these lands can play and rapidly rising property values. What is learned from the management of these lands can be useful for other areas that experience urban pressure in the years ahead.

#### *Linkages Across the Landscape*

The linkage between the WUI and management issues across the wider landscape is reflected in a number of previous ISSRM presentations. Over time, linkages between the interface / intermix environments and more distant parts of the landscape will become critical. For instance, growth of the interface environment can contribute to loss of population, economic activity, and development in the center of urban areas (Dwyer, 2002). Partnerships between social scientists and landscape ecologists will be critical to implementing a landscape approach to future resource analysis, with geographers and others skilled in geographic information systems and spatial analysis techniques providing important contributions. The movement towards increasing attention to landscape-level analysis will hopefully continue at ISSRM,

with scientists participating in a dialogue on the WUI and its linkages with other areas of the landscape.

#### **Summary and Conclusions**

WUI emerged as a significant issue in the 2002 ISSRM and will most likely increase in significance in the years ahead. A number of issues addressed at previous symposia are significantly important. These areas include urban growth and influence, communities, and collaborative and adaptive management. Although ISSRM has given some attention to wildfire, ecosystem health (e.g., exotic-invasive species), linkages across the landscape, and ecological restoration, these issues are likely to increase in significance, in no small part due to their importance in the WUI. This will also continue a trend of integrating physical, biological, and social science work to better address significant policy issues, many of them at the landscape level. Collaboration with landscape ecologists and others who work from a landscape perspective will become increasingly critical. ISSRM is the ideal forum for developing comprehensive landscape approaches to major natural resource policy issues, and the WUI is a prime focus for such efforts. In turn, examining the WUI will help ISSRM to continue to expand the breadth and significance of natural resources issues that are presented, particularly landscape level policy issues.

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