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Movement of people across the landscape: a blurring of distinctions between areas, interests, and issues affecting natural resource management

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Abstract

The spread of development from cities into surrounding forests and farms continues to receive a great deal of attention from the media and resource managers in the US and other countries. However, suburban sprawl is just one of many inter-linked components of the movement of people across the landscape that influence resource management. Substantial changes are taking place in urban areas, fringe areas, and rural recreation/amenity areas. In this paper, we describe these changes, explore their commonalities and interconnectedness, and discuss the implications that they may have for natural resource management. What emerges is a blurring of the distinctions between what have traditionally been considered "urban" or "rural" problems with respect to natural resource issues, interest group concerns, and resource management strategies. Our findings suggest prospects for substantial changes in resource management and the public and private programs designed to support it. Among the emphasis areas for natural resource management that emerge with the changing distribution of people over the landscape are changes in management situations, management processes, and research needs. The changing management situations include increased emphasis on interface and intermix areas, restoring human-impacted natural areas, and addressing complex ecosystem problems. Changing management processes include adaptive forest management, working collaboratively with diverse landowners and other partners, interacting with citizens on a regular basis, and taking a landscape perspective on natural resources and their management. Questions for policy and program development and for research focus on a better understanding of linkages among management activities across the urban to rural landscape.

Keywords: Urban sprawl; Natural resources management; Landscape change

1. Introduction

Recent changes in preferences, technology, transportation, jobs, and costs of desirable housing have all influenced the migration of people across the landscape. Although much of the attention has been on suburban sprawl, people are moving to and from many areas of the landscape ranging from the inner city to remote rural areas. At the same time that opportunities for desirable housing are increasing, working people are less tied to public transportation, standard office hours, and office presence. This gives people more flexibility than ever in determining where they want to live. In addition, the baby boomer generation is

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retiring or considering impending retirement—often with more disposable income than past generations. Many are building permanent or seasonal homes in amenity areas near mountains, lakes, and other aesthetically pleasing, recreation-oriented settings. Others choose to purchase or renovate homes in urban areas closer to cultural resources and medical services.

This changing distribution of people across the landscape has important implications for the management of natural resources. Some implications are tied to specific areas of the landscape, such as expanding fringes of urban areas or the growth of rural recreation/amenity communities. However, there are important linkages between these and other changes that are taking place across the landscape, as well as common resource management themes and issues. The differences between what has traditionally been considered urban and rural are tending to blur over time. Many of the changes affect public and private programs that support resource management.

Our purpose here is to explore the possible implications of these changes for the management of natural resources. Our observations draw heavily from our own experiences and those of our colleagues represented in this volume, and while this body of work is based largely in the midwestern US, much of what we present has wider applicability. We begin with a look at some areas that are often "hotspots of change," where people/natural resource interactions are likely to undergo significant changes. We then examine some key linkages and commonalities among these hotspot areas. We close with possible implications and questions for natural resource management, policy and program development, and research.

2. Hotspots of change

Patterns of human movement across the landscape have been identified through the study of US Census data on population and housing density (e.g. Hammer et al., in press) and land use and land cover data (e.g. Alig et al., 2004). While there are often significant regional differences in the rates of this movement (Alig et al., 2004), three within-region hotspots of change are also apparent. These include urban areas, suburban fringe areas, and rural recreation/amenity areas.

2.1. Urban areas

A dominant pattern of landscape change in many metropolitan areas continues to be movement of people from the central city to outer suburbs and adjacent non-metropolitan areas. In some instances, people may leave behind vacant housing, and where the closing of a factory or business precipitated or followed their move, there may be vacant commercial property as well. This creates opportunities for converting vacant urban areas to natural areas, providing a range of benefits such as biodiversity, open space, storm water storage, and wildlife habitat that were not considered in the initial development of these areas. However, these conversions can also bring challenges associated with establishing, rehabilitating, or restoring natural resources on sites that generally have been highly impacted. These include highly modified and sometimes impervious soils, large amounts of invasive and non-native vegetation, and, in some cases, toxic materials. Adding to these management challenges is the lack of widely accepted goals for these areas. What emphasis should be placed on restoring natural resources and ecosystems relative to other goals such as economic revitalization through development (Westphal, in press)? How can these newly created areas help fill in the gaps in the existing urban forest (Nowak et al., 2001)? Government officials and developers are often willing to take on these challenges, and increasingly see trees, parks, and natural areas as keys elements in reducing "urban flight" and attracting people and economic activity back into urban areas. "Mayor Daley's Greenstreets" program in the City of Chicago and other urban greening programs in cities around the US are noteworthy examples of efforts to improve the livability of urban residential areas by upgrading the green infrastructure. Examples of efforts to restore natural resources in commercial and industrial areas in central city areas include the corridor of the Chicago river (Gobster and Westphal, 1998) and the Lake Calumet area of southeast Chicago (City of Chicago, 2002).

In contrast to the dominant pattern of movement outside the city, an increasing number of individuals in search of a new home are choosing to renovate or rebuild older structures within cities. In other instances, new structures are being built on vacant city land. In both cases, this renewed interest for living

in the city can help to rebuild the urban tax base and restore vitality to existing neighborhoods. However, without careful planning there can also be losses to the green infrastructure of these areas. Renovation and rebuilding efforts almost always increase the size of the structure originally occupying the site, and result in the removal of existing trees and a loss of space for vegetation, leisure use, and absorption of storm runoff. Overdevelopment of city lands that were formerly vacant can also result in lost opportunities for neighborhood space for parks, greenways, community gardens, and the like. In both situations, the operation of construction equipment, compaction of the soil, changes in drainage, and the addition of fill generally impede the ability of existing trees and plants to thrive, and lengthen the establishment period for new plants. Protecting existing vegetation during the construction process, and establishing additional vegetation around a new or renovated home are major challenges for homeowners and resource managers (Watson and Neely, 1995).

2.2. Suburban fringe areas

A second hotspot of change in metropolitan areas lies with the newer suburbs at the outer fringe. Here the major issue is sprawl, the spread of low-density residential developments into previously undeveloped areas (Dwyer and Stewart, 1998). This growth is attributed, in part, to the attractiveness of the natural and social environments, access to good transportation and schools, and financial advantages (Vogt and Marans, 2004). Concerns sometimes associated with urban sprawl include the loss of forests and farms to housing and related development. The cost of infrastructure in sprawling areas can be a major concern to local units of government. Visible impacts of urban sprawl on natural resources include the loss of large trees and remnant forested areas, and the planting of new trees and restoration of natural communities on former agricultural lands as a part of the creation of new residential environments.

Migration of people to the suburban fringe can also mean that more and sometimes different people become involved in planning and development activities, as well as in managing natural resources in these areas (Austin, 2004). New owners can redirect a community's long-held land use goals, making planning a major challenge. Development and homeowner associations can serve as a forum for discussions among these diverse residential interests. The increasing number of local and non-local individuals, groups, and interests involved often complicates and burdens public assistance efforts aimed at working with landowners and managers.

Alternatives to the expansion of traditional housing developments in suburban fringe areas sometimes involve large lots and open space subdivisions. Extensive developments with lots ranging of 5–10 acres (2–4 ha) and larger spread people and infrastructure over a large land area, require the substantial expansion of infrastructure, and create more individual landowners responsible for considerable amounts of open space. The challenge for resource managers is to provide appropriate guidance and assistance to these owners, many of who may not readily visualize their property as a natural resource to be managed.

In other instances, an open space subdivision may be created where the new residential lots are smaller, clustered in a development, and natural features become an integral part of the development, held jointly by community residents (Kaplan and Austin, in press). These commonly held areas may be managed jointly—sometimes by community volunteers, and often with the help of a professional natural resource manager or management firm—or not managed at all (Austin, in press). In addition to management responsibility, issues of conflicting ideas over use, desired level of maintenance, and appropriateness of plant materials may parallel those associated with community-held areas in more urban settings, such as community gardens.

2.3. Rural recreation/amenity areas

In rural recreation/amenity areas, hotspots of change are often associated with the development of residential and recreational enclaves, as well as the influence of these developments on adjacent public lands. Homes developed in vacation or amenity areas include both seasonal and permanent homes (McGranahan, 1999; Stewart, 2001), with many of the former converted to permanent status as owners retire or move their job to the area (Stynes et al., 1997). Homes that are replaced or upgraded to meet new needs can lead to resource management challenges

similar to those discussed previously for reconstruction in urban areas. In other instances, infilling may take place, particularly where choice sites are concentrated within an area, such as lakeshores or hillsides with exceptional views. These developments pose many of the same opportunities and challenges that have been associated with infilling in urban and suburban areas. Fire management can also be an important issue in these environments, given strong owner preferences for a home "in the woods."

The movement of people across the landscape can also affect the management of public lands that are near new or changing residential and recreation developments (Gobster and Rickenbach, 2004). Homes and subdivisions in recreation/amenity areas are often built in close proximity to public lands to take advantage of the natural and scenic environments that these lands provide. In fact, proximity to public natural resources is often a key marketing message for nearby homes and subdivisions. Expanding nearby development presents public land managers with a multitude of opportunities and challenges as they must respond to the increasing influence of residents, landowners, and developers; often with strongly held and diverse views of appropriate land use and management (for example, see the Urban National Forests website at http://www.fs.fed.us/recreation/permits/urban/). Conflicts over access roads, fees, hunting, and timber cutting, as well as disruption of access to public lands and trails, can be important concerns with nearby public lands.

3. Linkages and similarities across the landscape

Our previous discussion has outlined three areas of the landscape where people/natural resource interactions are likely to undergo significant changes. Interactions in urban, suburban fringe, and rural recreation/amenity areas tend to be interrelated due to significant physical, biological, and social linkages and similarities. Thus, there are important implications for natural resource management policies and programs as well as educational activities that span the boundaries of location, stakeholder interests, and issues.

The most obvious similarities and linkages are associated with the direct movement of resources such as water, air, and wildlife. Residential and associated commercial/industrial development and infrastructure can have significant impacts on water quantity and quality, air quality, and the number and diversity of wildlife. These influences may extend across the landscape to varying degrees depending on the type, location, and extent of residential development, the landscape in which it occurs, and the natural resources affected. The implications of resource management activities in one area of the landscape for the management of other areas may be substantial. Examples include damage to trees in northeastern US forest areas from ozone generated by automobile commuters in sprawling midwestern metropolitan areas, threats to urban surface water supply from increased development in headwater areas, and the proliferation of urban wildlife such as deer (*Odocoileus virginianus*) and coyotes (*Canis latrans*) due to urban park naturalization efforts and the development of long distance metropolitan greenway corridors.

Development may also influence the visual character of the landscape over substantial areas. Depending on topography, a particular development may alter the view from a number of important vantage points across the landscape. Alterations to scenery may generate significant public attention and create significant management challenges, especially in close proximity to public lands and amenity developments (see Palmer, 2004).

People can be important agents of change across the landscape in other ways. Many people move between several different landscapes over the course of their lives, and thus may experience a number of different ways in which natural areas are managed and used. At the same time, increasing media coverage of natural resource issues, from timber harvesting in remote forest areas to farmland preservation at the suburban fringe, exposes people to a wide range of values and perspectives. With this acquired knowledge and experience, people may transfer ideas and practices from one landscape to another. Sometimes this can result in promising insights and actions, while at other times the transference can be problematic. Either way, these efforts can have a significant effect on resource management. While surprisingly little attention has been given to documenting these important linkages in people's experiences, perceptions, and activities across landscapes, the following examples,

drawn largely from the authors' experiences, illustrate some of the possibilities:

- Many people in the Chicago area have been observed trying to grow non-native trees such as white birch (*Betula papyrifa* Marsh), mountain ash (*Sorbus americana*), and spruce (*Picea* spp.) in their yards, in part because they want to re-create the look of the "North Woods" (i.e. forested areas of northern WI, MI, and MN) where they have vacationed or lived. But with different climate, soil, and disease conditions, these efforts often meet with mixed success.
- In a reversal of the previous example, some seasonal homes in the "Northwoods" are owned by urban residents who landscape their vacation property much like their yard back home. This may include a manicured lawn mown right to the property line or lake edge and horticultural varieties of shrubs and flowers planted around the foundation of the home. To some long-term residents of northern Wisconsin this is sarcastically referred to as an "Illinois lot," given that many of the homeowners with these landscapes are seasonal residents who have permanent homes in Illinois (personal communication with Susan I. Stewart, USDA Forest Service North Central Research Station, Evanston, IL).
- In equating the starkness of a forest management activity to a more familiar urban setting, a person from the Chicago area who participated in research that evaluated people's responses to photographs of various tree-cutting methods likened a clearcut area to a burned out urban neighborhood (personal communication with Joanne Vining at the University of Illinois, Urbana-Champaign, IL).
- When responding to questions about forest management options in the Upper Peninsula of Michigan, another person from the Chicago area participating in a research project recalled the controversy that had ensued over ecological restoration of forest preserves in the Chicago area (personal communication with Deborah Carr, University of Michigan, Ann Arbor, MI).
- In a study of the owners of homes in open space subdivisions in Michigan, some respondents indicated that the ample nearby natural environment and opportunities for outdoor recreation made it less likely that they would purchase a second home in the Northwoods (Marans et al., 2001).

As these examples show, the transference of knowledge and experience across the landscape can have positive and negative consequences. In the context of policy to protect natural resources, it is critical that decision makers consider the direct and indirect effects of different options at the regional landscape level.

4. Emphasis areas for the future

Changes in the distribution of population over the landscape are likely to increase the importance of several areas of resource management. These are grouped into the following categories: management situations, management processes, and questions for programs and policy development and for research.

4.1. Management situations

4.1.1. Managing interface and intermix environments

The movement of people across the landscape and the creation of homes, associated developments, and infrastructure, as well as the restoration of natural resources on former commercial and industrial areas, increases the interfaces and intermixes between people, development, and natural resources. Interfaces between developments and natural resources are found at scales that range from a single home and an adjacent urban park, to a community or subdivision and an adjacent National Forest. An intermix environment is created where homes and other developments are interspersed among natural environments. Interface environments differ from intermix environments in that homes and other developments are immediately adjacent to natural resources, and there tends to be a higher density of residential development than with an intermix. In both cases, however, people tend to congregate at these interfaces and intermixes as residents and visitors. High levels of use, plus involvement of a wide range of managers, users, and uses, generates a need for special management strategies for interface and intermix areas which tend to be expanding in many areas.

While creating preferred environments for home sites, some types of outdoor recreation, and some

species of wildlife, interface and intermix areas often restrict other forest uses that require an uninterrupted forest environment. This in turn may place stress on forest health due to high levels of use, soil compaction, introduction of exotic invasive plants and animals, and other activities. Indirect impacts brought by development may take the form of changes in air and water quality, as well as in the surrounding landscape and its flora and fauna. Fire can be a particularly troublesome issue in some interface and intermix areas.

Forest health can be a significant challenge amid stresses brought on by disruption from developments and high levels of use, as well as associated problems with insects, diseases, fire suppression, and invasive plants and animals in interface and intermix environments. Close scrutiny by nearby residents concerning these problems and their solutions complicates management. The difficulty of trying to address such problems, particularly when a significant residential population is present, makes it especially desirable to avoid the creation of these problems in the first place. This can be accomplished by emphasizing efforts to enhance forest health and thereby reduce the prospects of damage by pests and associated problems (Dwyer et al., 2001, 2002).

4.1.2. Restoring human-impacted natural areas

Restoration of natural areas, processes, and health is a critical challenge that is often associated with change across the landscape, from abandoned inner city residential and industrial areas, to marginal rural agricultural and rangelands, to mismanaged and overused forests in remote wildland areas. The goal of restoration (e.g. ecological restoration) efforts is generally to restore the natural functions, processes, and health of these areas. Invasive plants and animals that may accompany past land use practices often add to the issues associated with restoration. When residential or recreational populations are nearby, management practices are likely to receive close public scrutiny, particularly those that involve removal of vegetation and use of fire or herbicides (Gobster, 1997). Important management questions include the effectiveness of various management practices, the costs involved over time, what and how to restore particular areas (including priorities for restoration efforts), and how to maintain/sustain the restored areas over time (Dwyer and Childs, 1998; Gobster and Hull, 2000).

Rehabilitation of industrial sites, while often associated with central city areas, can and does occur across the landscape. Important examples in the Chicago metropolitan area include the conversion of the 15,000 acre (6000 ha) Joliet Arsenal into the Midewin National Tallgrass Prairie (USDA Forest Service, 2002; see also Stewart et al., 2004), and the ongoing work to restore the ecology and economy of the Calumet Region (a total of 100,000 acres or 40,500 ha) (City of Chicago, 2002). Both the Midewin and Calumet efforts are being replicated around the country as former military and industrial areas are being converted to natural areas, and their ecological processes are at least partly restored. Other re-developments of commercial and industrial areas are occurring across the landscape on a smaller scale.

4.1.3. Addressing complex ecosystem problems

The movement of people across the landscape and the creation of new residential development often triggers complex issues related to the management of ecosystems. Residential development is often undertaken in areas with significant natural resources such as forests, water, and wetlands. In these instances, development can have far-reaching implications for the natural environment. Implications for water (Wear et al., 1998), air, wildlife (Theobold et al., 1997), land cover (Turner et al., 1996; Johnson, 2001; Radeloff et al., 2000), wood supply (Wear et al., 1999), and scenery (Sullivan, 1994; Ryan, 2002) may extend across the landscape and are often poorly understood. The social component of the ecosystem is also changed by development as well (Egan and Luloff, 2000; Smith and Krannich, 2000), and this affects both the characteristics of management problems and the possible solutions. Resolving important issues calls for a wide range of expertise, and often the coordinated involvement of a number of public and private agencies working together on collaborative approaches to resource management problems across the landscape. In many cases, these efforts tax the resources of local governments and public and private agencies.

4.2. Management processes

4.2.1. Practicing adaptive forest management

Adaptive forest management will be critical in dealing with complex issues and continuous changes

over time in the physical, biological, and social environment of areas where populations are changing. Change is the rule with the shifting of people across the landscape, and these changes can affect a wide range of attributes of the natural environment and the quality of life. This calls for rigorous efforts to monitor change over time, and to adapt management strategies when there are prospects for changes that are seen as undesirable by residents and other important stakeholders. Furthermore, limited knowledge of complex interface situations and processes creates uncertainty about management practices and programs, and makes it especially critical to monitor decisions to see if they result in the expected outcomes. Adaptive management is often the watchword in interface and intermix areas, and it is critical that there are regular and comprehensive resource inventory programs to guide and support that management. Adaptive management is often a challenge to local governments, given a scarcity of funds and expertise necessary to carry it out. An analysis of the Northwest Forest Plan (Stankey et al., 2003) identified a number of barriers to adaptive approaches to management: an institutional and regulatory environment that stymies innovation, increasing workloads coupled with declining resources that constrain learning-based approaches, and lack of leadership. These barriers may well extend to other efforts to encourage adaptive management (for additional discussion of adaptive management see, e.g. Holling, 1978; McLain and Lee, 1996; Chavez, 2002).

4.2.2. Working collaboratively with diverse landowners and other partners

Natural resource specialists in urban and rural areas often find that with new residential developments they are working with different landowners than in the past, as well as with other agencies and groups that are concerned with the development of natural resources and associated impacts. These "new" groups include regional planning agencies, transportation planners, and environmental protection agencies. Many of the new landowners, concerned individuals, or involved groups may not be particularly easy for natural resource specialists to contact, and with new situations and challenges many may be unaware of where to go for information and assistance concerning management of natural resources. Many small communities lack the time, expertise, and information systems necessary to deal with growth, and may not be within states where land use planning is a priority, well funded, or creatively handled.

Many state natural resource agencies and extension organizations were designed to provide one-on-one assistance. Since there were historically a few large landowners in rural areas, this method worked relatively well. As land is increasingly subdivided, with more "novice" landowners holding smaller tracts of land, one-on-one assistance may not be feasible. Furthermore, these new clients may expect different types of information and methods of communication than what is ordinarily provided by those who are available to help them. Some clients may need help in visualizing their land as a resource to be managed. Collaborative management approaches involving diverse individuals and groups are likely to be critical to address significant issues concerning the management of natural resources across the changing landscape. Sustaining forests and associated resources across the landscape is likely to require a combination of collaborative and adaptive management (Aplet et al., 1993; Selin and Chavez, 1995; Clark et al., 1997; Dwyer et al., 2003).

4.2.3. Interacting with the public on a regular basis

Public interaction is a key part of managing natural resources, but particularly in interface and intermix situations, given changes in the environment over time and the increasing numbers of people who may live, work, and play there, or otherwise know and care about the area and its development. There are likely to be significant shifts in the individuals involved in resource management over time, as well as changes in values across the population (Bengston, 1994; Bengston et al., 1999). Some of these changes are likely to be associated with demographic changes, while others are likely to extend across most demographic groups (Dwyer, 1994; Chavez, 2000). Economic changes also have a significant influence on decisions to buy land and to develop residences and other structures. A continuous dialogue with a wide range of changing partners is an integral part of collaborative and adaptive management of changing areas (Dwyer et al., 2000). Maintaining a dialogue with the public under these situations is likely to be a major challenge and require new methods and approaches. That dialogue is critical to mutual trust

in management. Natural resource organizations may need additional staff to keep up with their increasing clientele and with their diverse and changing needs. Interacting with part-time or seasonal residents can be a huge challenge for local land managers.

When working with public groups it is critical to recognize that individuals may influence and be influenced by forest environments and associated issues across the landscape, and that they are likely to have information needs generated by a wide range of issues and environments beyond the ones that they are currently involved with (for a discussion of communication with urban groups, see Chavez, 2001).

4.2.4. Taking a landscape perspective on natural resources and their management

A landscape perspective is often critical for planners, managers, and researchers since residential developments are linked across the landscape by important physical, biological, and social ties. The management of natural resources on one holding should consider the possible interactions with the management and use of other holdings across the landscape. Key landscape level concerns range from mitigating urban heat islands to blocking sun for gardens and solar collectors, to restricting access for hunting and maintaining trail linkages, as well as the availability of timber. Residential developments also can block access to public and private lands. With the creation of subdivisions, linkages across the landscape are particularly far reaching when it comes to quantity and quality of water, air quality, the amount and diversity of wildlife, and aesthetics.

The relevant scope for the analysis of a natural resource issue in developing landscapes depends on the resources and the landscape involved, as well as the issue being addressed. In the past, we have often tended to look at issues on a site-by-site basis and have overlooked the significant physical, biological, managerial, and social linkages across the landscape. Of particular importance are the human linkages between different parts of the landscape, in that people experience and are influenced by activities in various parts of the landscape. How the landscape is managed may affect where people choose to locate their home(s) and outdoor activities, and their involvement in landscape stewardship. Such a landscape perspective is critical to effective natural resource policy and management amid the changing distribution of the population across the landscape.

4.3. Some questions for policy and program development

What are the implications of the changing distribution of people across the urban to rural landscape for programs such as urban forestry, rural development, rural community assistance, environmental education, and public outreach? With residential developments and associated infrastructure being created or changed in a number of areas across the landscape, many of the concepts and techniques developed in urban natural resource management programs could have widespread application, although some adaptation would be required. At the same time, new residents from urban areas and new residential developments, both seasonal and permanent, and associated infrastructure may become increasingly important components of rural community development. Given the prospects for these interrelated changes, some important questions concerning future policies and programs are as follows:

- Should programs that provide resource management assistance to landowners in rural areas expand to include helping open space and amenity subdivisions manage commonly held natural resources?
- Should urban forestry programs extend their efforts to include open space subdivisions and recreation/amenity subdivisions?
- With the fragmentation of forest ownership on the urban–wildland interface, should agencies that provide assistance to rural landowners orient a portion of their programs to these owners with smaller acreages? Should there be a minimum acreage below which assistance is not given?
- Should urban forestry programs assist with efforts to restore rural communities that are losing population and economic activity?
- Should our natural resource programs, which are traditionally classified as urban or rural, work towards blurring the urban/rural boundaries?
- Given that urban residents increasingly interact with natural resources across the landscape and are aware of resource management issues across those settings, should public outreach and environmental ed-

ucation programs in urban areas take a comprehensive view of natural resource management across the landscape?
- Should public and private resource management programs give increasing attention to ecological restoration activities as strategies for managing disturbed lands across the urban to rural landscape?
- Should programs to reduce sprawl and its effects include efforts to encourage and enhance urban re-development, rebuilding, and infilling?
- How can urban re-developments make existing urban neighborhoods more livable?
- Should urban greening programs such as urban forestry, ecological restoration, and urban gardening be grouped together into comprehensive efforts that focus on greening the urban landscape (Dwyer and Childs, 1998)?

A new "Backyard Woods" program being developed by the USDA Forest Service Northeastern Area, State and Private Forestry in St. Paul, MN is beginning to address some of the challenges of fragmentation by providing technical assistance to the 6 million forest land owners in its jurisdiction who have 1–10 acres (0.4–4.0 ha). This group comprises 60% of all forest owners in the US (personal communication with Tom Dilley, USDA Forest Service, Northeastern Area State and Private Forestry, Evanston, IL).

4.4. Some questions for research

There are a number of questions for research that emerge from a discussion of the management of natural resources in response to the movement of people across the landscape. Some that are particularly significant deal with the implications of management and policy options across the landscape and include:

- To what extent will improving the green infrastructure of urban areas make it more likely that individuals will stay in or move their residences and businesses to these areas?
- To what extent can trees and other vegetation help make more "compact" housing developments (i.e. smaller lot sizes) more attractive residential environments?
- What are the best planning and management strategies for commonly held natural resources in permanent and seasonal subdivisions?
- How do private landowners in wildland–urban interface and intermix areas make decisions concerning the management and use of their holdings? How likely are they to respond to suggestions concerning resource management that would contribute to achieving objectives at the landscape scale?
- What strategies show the most promise for effectively managing small forest holdings in wildland–urban interface and intermix areas?
- What are the promising approaches for building coalitions of landowners, managers, and other interested groups in managing urban–wildland interface and intermix areas across the landscape?
- What are the prospects for effective education and outreach programs for urban residents that focus on resource management issues across the urban to rural landscape?

This brief sample of program, policy, and research questions underscores the importance of social science approaches in understanding how we can protect, enhance, or minimize negative impacts to natural resources in situations dealing with people's movement across the landscape. To the extent that we can integrate these "human dimensions" along with efforts aimed at understanding the physical and biological dimensions of landscape change, we will be more successful at meeting our natural resource planning, design, and management goals.

5. Summary and conclusions

The changing distribution of people across the inner city to rural landscape has important implications for the management and use of forests and associated resources throughout that landscape. Hotspots of change are often found in central cities, suburban and urban fringe areas, and recreation/amenity areas. Changes across the landscape are often linked in that what happens in one area may influence and be influenced by what takes place in other areas. Similar issues and concerns often emerge in different areas across the landscape.

A common component of landscape change is the movement of urban people. They may have learned and come to care about an area as permanent or seasonal residents, tourists, or visitors. With these movements of people across the landscape may come

residential development and associated infrastructure in a number of forms that range from urban re-development and suburban sprawl to seasonal homes in high amenity rural areas. These changes raise many of the resource management issues associated with residential development that have traditionally been associated with the expansion of urban areas. At the same time, ecological restoration of natural areas in and near urban areas brings to urban environments many of the issues that have traditionally been most closely associated with resource management in rural areas, including the use of fire, herbicides, and timber cutting. These and other changes have tended to blur traditional urban/rural differences in resource management.

The changing distribution of people across the landscape also brings more people into contact with forest resources and their management. Many of the associated people/forest interactions are in interface and intermix areas where people live in conjunction with natural resources. These are often areas where the forest is under stress due to high levels of use and development, invasive plants and animals, the influence of nearby developments, and outbreaks of insects and disease. Experiences in these areas, often through outdoor recreation, can acquaint individuals with many aspects of resource management.

While urban populations have been moving out into rural areas and influencing the management of nearby public and private lands, many management efforts have been "moving in" to urban areas to restore ecosystems. Movement along this "two way street" is bringing increased involvement by residents in natural resource management across the urban/rural spectrum.

Resource management issues involving large numbers of people tend to attract significant media attention; these issues include fires approaching interface communities, insect and disease outbreaks in urban areas, and the loss of trees due to construction and pollution. Through this attention, large numbers of individuals become acquainted with resource management issues, and some may become directly involved with them. That involvement can take the form of volunteering to work with resource managers and planners, or it may involve political activity or willingness to change management on private property.

Among the emphasis areas for natural resource management that emerge with the changing distribution of people over the landscape are changes in management situations, management processes, and questions for policy, program development, and research. The changing management situations include increased emphasis on interface and intermix areas, the restoration of human-impacted natural areas, and addressing complex ecosystem problems. Changing management processes include adaptive forest management, working collaboratively with diverse landowners and other partners, interacting with citizens on a regular basis, and taking a landscape perspective on natural resources and their management. Questions for policy and program development and for research focus on a better understanding of linkages among management activities across the urban to rural landscape.

The lines between what was traditionally considered as urban and rural are tending to blur over time and space. This blurring is reflected in the landscape, the interests around which stakeholders rally, and the resource management questions that are being addressed. These changes have important implications for natural resource management programs, many of which have traditionally been broken down into urban and rural efforts, such as urban forestry and rural community development. It will be increasingly critical to look across the urban to rural landscape in evaluating policies and programs for natural resource management.

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