

SPRAWL AND THE MANAGEMENT OF URBAN GREENINFRASTRUCTURE

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ABSTRACT: Sprawl and associated developments create new opportunities and challenges for the management of green infrastructure across the urban to rural landscape. This paper outlines these opportunities and challenges.

Introduction

As people and developments move across the landscape, the boundary between what is considered urban or rural blurs. Rural areas become more urban as the infrastructure needed to support new populations is built. Urban areas may become greener as vacant lots are restored, and infill developments are designed with urban nature in mind. What is highly valued in both urban and rural areas is the forest or open space intermingled with residences. Sometimes this vegetation is called greeninfrastructure.

Forested environments across the landscape are appealing to people, but creation of new residential developments that provide them is challenged by (1) the constraints associated with building within forest environments, or (2) creating green infrastructure in areas that are not forested. Building homes and associated infrastructure in a forest almost always requires protecting natural resources and processes. When homes are built where forests do not exist, such as lands that recently produced agricultural crops or were the site of intensive urban development, the challenges include successfully incorporating natural elements into the landscape. And where homes are rebuilt, replaced, or infilling occurs; the challenge includes protecting existing natural resources during demolition and construction.

To the extent that urban redevelopment, reconstruction, and infilling are successful in providing desirable residences, there may be less urban sprawl. Growth boundaries and subdivision regulations may shift potential residents away from urban fringe areas, putting increased pressure on development within the city boundaries. Thus policy makers may influence the movement of people across the landscape. This power must be carefully considered, as decisions have direct and indirect effects across the regional landscape.

Opportunities and Challenges for Resource Management Across the Landscape

Development-associated resource management challenges are being encountered in ever expanding areas across the landscape from inner-city to rural areas. As people move from the central city to outer suburbs and adjacent areas, vacant housing and commercial and industrial property may be left behind. This creates opportunities for converting vacant urban areas to natural environments; providing benefits such as biodiversity, parks, storm water storage, and wildlife habitat that were not a part of the initial development.

Establishing, rehabilitating, or restoring natural resources on vacated urban sites comes with a number of challenges. These sites often have modified and sometimes impervious soils, large amounts of invasive and non-native vegetation, and toxic materials. Adding to the management challenges is the lack of a widely accepted goal for these areas. What emphasis should be placed on restoring natural resources and ecosystems versus other goals?

Other complexities emerge with the reconstruction of buildings on already developed sites or with the development of "open" lots in residential areas. Both activities can pose threats to existing natural resources and processes. Demolition and reconstruction of existing homes are likely to change the vegetation that previously surrounded the home, as the new homes are almost always larger. 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 lengthens the establishment period for new plants. The practice of "infilling" also brings challenges of lost greenspace or construction on lots that were previously avoided due to drainage or other problems such as deposition of toxic substances.

Management of commonly-held areas associated with residential developments may be difficult due to the effects of construction, the presence of ponds, wetlands, or other riparian resources, the influence of nearby developments, and high levels of resident scrutiny. Among the management issues that must be addressed with open space developments are the encroachment of property owners on commonly held areas. These lands may be threatened by new homeowners' desire for additional lawns, garden, refuse dumping, or playground space (Marans et al., 2001).

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In some wildland-residential areas the risk of wildfire is an important management consideration. This adds another dimension to the complex influences of trees and forests on the residential environment such as energy conservation, protection from solar radiation and wind, scenic beauty, moderation of flow from storm events, wildlife habitat, and a range of psychological benefits (Dwyer et al., 1992; Nowak and Dwyer, 2000). In many instances, the idea of maintaining defensible space around homes to reduce loss from fire runs counter to the owner's ideas for landscaping (McCaffrey, 2002), and may be inconsistent with subdivision regulations. Many of these management considerations require a landscape perspective that goes well beyond the residential development (Dwyer et al., 2000).

Natural resources may play a key role in helping to restore and revitalize communities ranging from inner cities to small rural towns. Enhanced natural resources may increase the desirability of these areas for residences, businesses, and offices (Kaplan, 1993). Involvement in the management of urban natural resources may be a catalyst for other community improvements (Dwyer and Schroeder, 1994; Westphal, 1999).

Development of residential areas in forests 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 may include changes in air and water quality, as well as in the surrounding landscape and its flora and fauna. Close scrutiny by nearby residents that comes with residences in forest environments complicates the active vegetation management needed to sustain these areas.

Efforts to enhance the management of green infrastructure in areas being developed or redeveloped involve a wide range of groups with diverse interests. This includes local governments, developers, individual homeowners, and associations, firms, and organizations (including volunteers) that manage natural resources in residential environments. Meeting the needs of these groups is difficult and complex. In the next section we identify questions that can help focus decision makers on this complex task.

Questions for Policy and Program Development

Important questions emerge from urban sprawl and associated changes in green infrastructure across the landscape. Many of these questions revolve around the level of synergy among the diversity of programs focused on the health and sustainability of open space and vegetation. Specific questions we feel are worthy of careful thought and consideration are listed below:

- Should programs to reduce sprawl encourage urban redevelopment, rebuilding, and infilling?
- How can urban redevelopments make existing neighborhoods more livable?
- Should greening programs such as urban forestry, ecological restoration, and urban gardening be integrated into comprehensive efforts (Dwyer and Childs, 1998)?
- Should urban forestry programs extend to open space and recreation/amenity subdivisions?
- Should urban forestry programs be a part of efforts to restore rural communities that are losing population and economic activity?
- Should increasing attention be given to ecological restoration for managing disturbed lands across the landscape?
- Should programs that provide resource management assistance to landowners in rural areas expand to help residential subdivisions manage commonly held natural resources?
- With the fragmentation of forest ownership in the urban-wildland intermix, should agencies that provide assistance to rural landowners orient a portion of their programs to owners with smaller acreages? Should there be a minimum acreage below which public assistance is not given?
- 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 education programs in urban areas take a comprehensive view of natural resource management?
- Should natural resource programs, which are traditionally classified as urban or rural, work towards blurring the urban/rural boundaries?

Implications for Research

In addition to policy and programmatic questions, there are a number of questions that can guide research efforts to increase the effectiveness and efficiency of the management of natural resources amid urban sprawl. Among these questions are the following:

- To what extent will improving urban greeninfrastructure make it more likely that individuals will stay there or move their residences and businesses to these areas?
- To what extent can trees and other vegetation help make more "compact" residential developments (i.e., smaller lot sizes) more attractive environments?
- What are the best management strategies for commonly held natural resources in residential developments?
- How do private landowners in the wildland-urban intermix make decisions concerning the management of their holdings? How likely are they to respond to resource management strategies that promise to achieve objectives at the landscape scale?
- What strategies show the most promise for managing small forest holdings in the wildland-urban intermix?
- What are the promising approaches for building coalitions of landowners, managers, and other interested groups in managing urban-wildland intermix areas?
- 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?

Conclusions

Urban sprawl and associated changes in the landscape have important implications for the management of greeninfrastructure, particularly in central cities, suburban and urban fringe areas, and recreation/amenity areas. Changes across the landscape are often linked. What happens in one area may influence and be influenced by what takes place elsewhere. Similar issues and concerns often emerge across the landscape.

The distribution of people over the landscape brings changes in management situations and processes. Changing management situations include emphasis on intermix areas, protection of existing forest environments and the creation of new ones, and the restoration of human-impacted areas. Changing management processes include working collaboratively with diverse landowners and other partners, taking a landscape perspective on natural resources and their management, and re-thinking the roles of and linkages among traditional resource management programs.

With urban sprawl the lines between what was traditionally considered urban and rural are blurring over time and space. This 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 designated as urban or rural efforts, such as urban forestry and rural community development. It will be increasingly critical to look across the urban to rural landscape in developing policies and programs for management of greeninfrastructure.

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