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Open space system as an armature for urban expansion: evaluation of landscape ecological spatial concepts as a model for improving resilience in urban systems

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Introduction

Urbanization alters several attributes of natural resources, degrading ecosystems and causing them to lose their ability to maintain their structure and function. As a result, native ecosystems in territories subject to urban expansion lose qualities important to their self-organization and may, in certain cases, disappear altogether. Actions that protect or strengthen the resilience of these native ecosystems in the face of urban development may offer increased capacity for these native ecosystems to survive and endure.

Landscape ecology aims to understand the relationship between spatial patterns and ecological processes across scales (Wu, 2008) considering the interaction with human activities (Naveh & Lieberman, 1984). A landscape is a kilometers-wide area (Forman & Godron, 1981), comprising a heterogeneous area where ecosystems are repeated in similar form and interact (Forman, 1995b; Forman & Godron, 1986; Forman & Godron, 1981).

Wu argues that a landscape ecological perspective is more comprehensive than other approaches for a number of reasons: consideration of operational scales (watershed or metropolitan area); hierarchical and integrative ecological basis; trans and interdisciplinary approaches to study nature-society interactions; theories and methods for studying relationships between spatial pattern and biophysical and socioeconomic processes; methods and metrics to asses sustainability; and "theoretical and methodological tools for dealing with scaling and uncertainty issues" (Wu, 2008).

My concern is primarily with how the spatial arrangement of urban land use and land cover influences the survival of ecosystems as cities expand. I propose to address one over-arching question, with two sub-questions within it. The over-arching question is:

Does applying landscape ecological spatial concepts in the design of urban open space systems have an effect on resilience of ecosystems as they experience urbanization?

Urban open space system is defined here as *the network of areas in a city that provide habitat for native wildlife and the connections among them; comprised of riparian forests, patches of native vegetation, and woodlots.* As urban places, these areas also

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offer opportunities for people. *They provide recreational opportunities and amenities; include parks, plazas, and streets*.

There is a biophysically-related sub-question: *What are the key biophysical processes that are important to address to minimize loss of native biodiversity in urban open spaces?* There is also a culturally-related sub-question: *What are the urban expansion policies and actions that, if applied to open space planning, will minimize loss of the patterns and processes necessary for native ecological processes to endure in the face of urbanization?* This article is a first step to answer the second question. First, it presents a review of landscape ecological approaches as have been investigated and applied in landscape planning and an examination at how spatial solutions have been proposed for landscape planning. Second, a case study is chosen; a review of state of Oregon's and Portland Metro's approach to managing urban expansion.

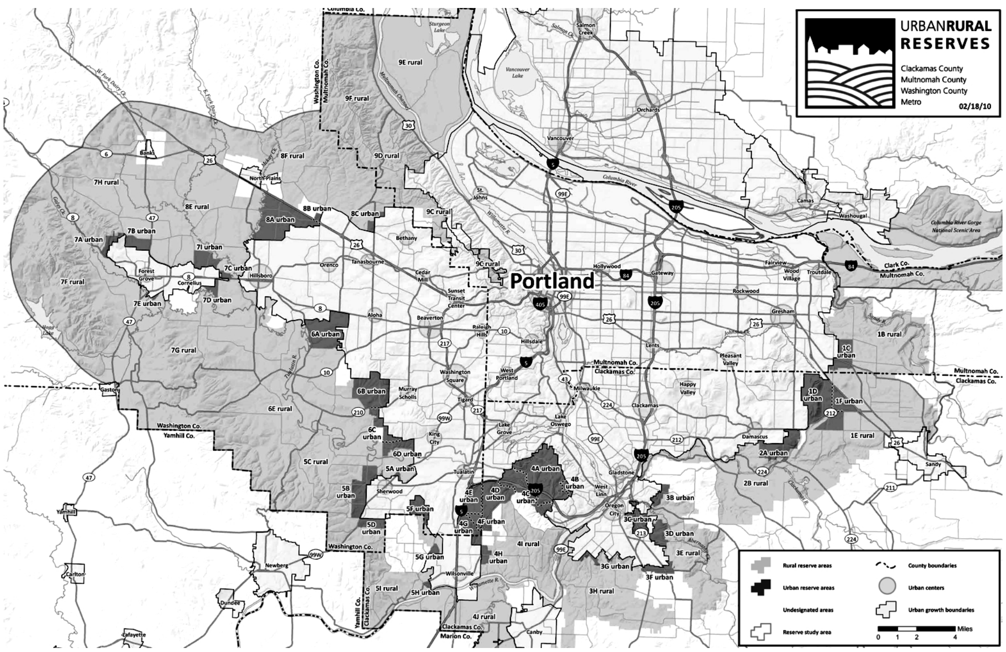

Figure 4. Portland Metro. The study area will be chosen from the proposed urban reserves (darker areas). Metro determined nine areas or groups of areas for accommodating expansion in the next 40 to 50 years (adapted from http://library.oregonmetro.gov/files//core4_regionalreserves_021610_small.pdf).

The study area is an urban reserve in the Portland Metro region created through application of Oregon Senate Bill 1011, which determines that Metro Portland and Clackamas, Multnomah, and Washington counties define together "which lands outside the current urban growth boundary are best suited to accommodate urban development over the next 40 to 50 years and which lands should be off limits to development in order to protect their values as farms, forests and natural areas during that same period" (Metro) (Figure 4 and Figure 5).

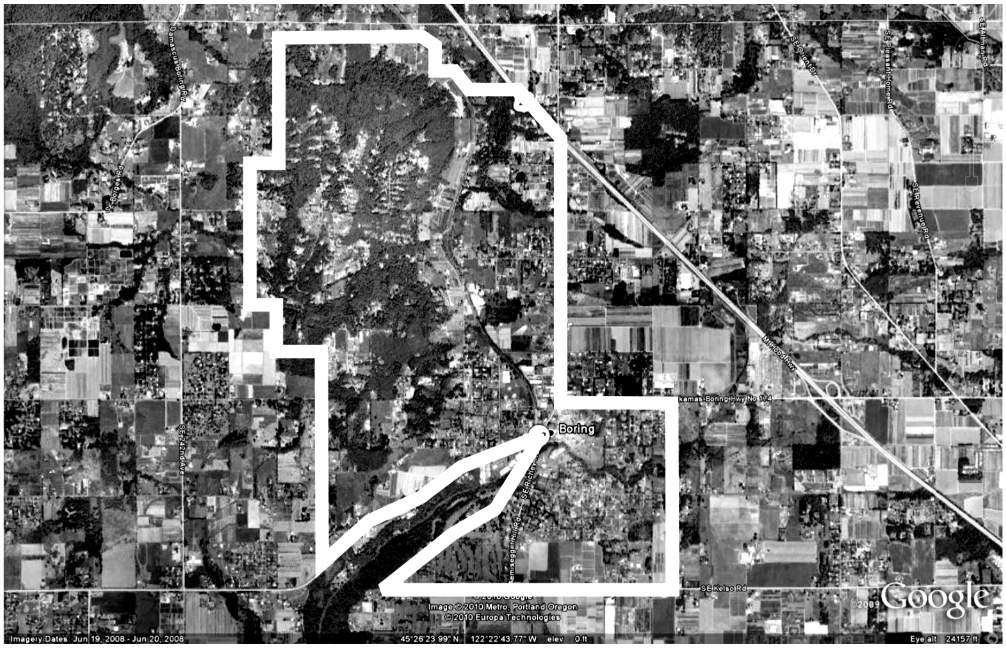

Figure 5. Example of urban reserve near Boring, Oregon as of December 16, 2009. The approximately 13 km^2-area currently supports a mix of rural residential development and active agriculture. While the UGB is intended to protect forests and natural areas, the image shows two large forested patches. How will urbanization develop? How will this patch maintain its structure and pattern of behavior in face of disturbance? (Photo source: Google Earth).

Spatial theories from landscape ecology for planning urban open space systems

Landscape ecology theory has the ability to generate prescriptive methods applicable in landscape planning. Forman compiles evidence from site-specific studies in peer-reviewed literature and uses them to propose general principles as spatial solutions to land use problems (Forman, 1995a). He organizes these solution types into four broad categories: landscape and regions, patches and corridors, mosaics and applications. Forman and Collinge defend the adoption of spatial solutions in planning as a way to conserve the most important attributes of biodiversity and natural processes in any region (Forman & Collinge, 1997) and Forman adopts the term “simple spatial models” in his proposal for Barcelona (Forman, 2004). Based on the analysis of 38 metropolitan regions worldwide, Forman proposes 121 principles for land-use planning in five categories: patch sizes, edges and habitats; natural processes, corridors and networks; transportation modes; communities and development; and land mosaics and landscape change (Forman, 2008).

Ahern asserts that landscape ecology can generate spatial concepts to offer planners “an understanding of a planning/design issue and the actions considered necessary to address it” (Ahern, 2002). Ahern defines five functions of spatial concepts in planning: cognitive (synthesis of knowledge), intentional (manifestation of insights), institutional (regulation), communicative (among actors), and action (Ahern, 2002). He later proposes a three-stage process of integration between landscape architecture and landscape ecology. The first stage articulates basic theory and explanations of how native ecosystems and altered urban systems work. From these theories, Ahern then derives a set of "first principles". In the second stage, landscape ecology research informs designers and planners with applicable knowledge testing and refining these first principles. The third stage is characterized as a two way process where landscape architecture and landscape ecology share and exchange information (Ahern, 2005), showing that the interaction of these disciplines can promote both the advance of theory and better landscapes

Dramstad et al propose a number of applicable concepts for landscape ecology to develop patches and corridors (Dramstad et al., 1996). Addressing corridors, Beier, Majka and Spencer propose 16 ways to design linkages to facilitate movement or gene flow (Beier et al., 2008).

In summary, principles from landscape ecology generate evidence-based spatial concepts concerning both natural and cultural variables that can inform the thoughtful design and planning of urban open space systems.

Local land use planning context

Projections for the Willamette Valley in Oregon, USA, point toward a population increase from 2 million in 2000 to 3.9 million people in the year 2050 (Payne, 2002), most of which is likely to occur in enlarged or densified urban areas. The Valley also supports a great portion of the state's most fertile soils farmland (Payne & Baker, 2002) and a rich variety of wildlife (White & Baker, 2002). Oregon's land use planning legislation requires cities to control their expansion through the delineation of Urban Growth Boundaries (UGBs) (Land Conservation and Development Commission, 2006). Periodical reviews attempt to guarantee a buildable land supply based on a 20-year population forecast. In order to plan the expansion of its UGB, Metro Portland establishes urban reserves – large areas designated for future urban expansion where comprehensive planning must occur prior to urbanization.

Oregon Senate Bill 100 (1973) established 14 land-use planning goals (five more were added later), for the state of Oregon. The 19 goals aimed to facilitate efficient development and preserve natural resources, these mainly understood as land suitable for farming (Knaap et al., 1992). Goal 5 addresses open space and natural resources, to protect natural resources and conserve scenic and historic areas and open spaces. Goal 6 aims to maintain and improve the quality of air, water, and land resources of the state.

Cities and counties are responsible for implementing these goals in their Comprehensive Plans. Especially as they pertain to concerns for native ecological processes, one criticism of Oregon's land use planning system is that it does not acknowledge any role for ecosystem protection inside UGBs. Another critique of the program is that in preparing the inventories of lands suited for Goal 5 protection, cities and counties are allowed to rely on existing data only, which may be outdated or lack important detail. Further, local governments are required to identify natural resources, but there are no specifications for how or how much to protect (Wiley, 2001).

As a product of the late 1960s and early 1970s, much recent ecological understanding has emerged since Oregon's land use planning program was initiated. Wiley recommends that the state clearly define its interests in protecting habitats; provide explicit maps of habitats to be protected; and "move toward ecosystem-based planning for natural resources" (Wiley, 2001).

While the state of Oregon debates how best to protect ecosystems in urban areas, local communities have taken further steps. The city of Eugene, for example, acquired lands within its UGB to protect and prevent urban expansion to occur over wetlands (Wiley 2001). Portland, a city with a long tradition of implementing urban open spaces (Orloff, 2004), has acquired natural areas to create an interconnected system (Portland Parks and Recreation, 2006). Metro Portland has passed in 2006 a $227.4 million bond measure to fund Metro's Natural Areas Program, a great part destined to the acquisition of 3,500 to 4,500 acres of natural areas (Oversight Committee, 2008) – over 2,400 acres of forested hills, stream corridors, wetlands and wildflower prairies have been acquired in the metropolitan region (Metro, 2010). These are continuing projects that provide for the permanence of nature in the cities while promoting human activities.

Expected Results

The previous sections present part of the framework that will support the development of future investigation. The current intent is to employ a predominantly modeling-based approach to explore the role of vegetated open space pattern as it affects the resilience of native ecosystems before and after urbanization. The results are expected to contribute to theory and practice of landscape planning. For theory, the proposed approach has the potential to contribute new knowledge about the interaction between urban functions and ecological functions in urbanizing landscapes, specifically on how to measure resilience of ecosystems affected by urbanization; for planning, it aims to develop a transferable approach to help planners create open spaces that contribute to more ecologically resilient urban areas.

Specific methodological approaches to explore how landscape trajectories evolve according to the complexity of coupled human-nature systems are in the development phase.

Discussion and conclusion

Landscape ecology provides the foundation for defining spatial concepts for the study area, relating broad spatial attributes presented in the peer-reviewed literature to those existing on the site and generate the proposed urban open space system. The investigation will evaluate the effectiveness of those concepts in face of the challenge imposed by the patterns of urbanization. Some challenges have been identified:

- What are the relationship with and connections of the urban reserve to the larger metropolitan scale?
- What are the targets? Specific species and habitats? Diversity?
- What are desirable and possible policies and tools to protect natural areas?
- What are the impediments and limitations?
- How to translate general principles (from the literature) to local ecosystems, habitats, and species?

The urban reserve shown in Figure 5 has been considered mostly for future industrial uses. Discussions continue regarding what the right approach is to protect its two forested buttes. Areas of high ecological value may coincide with those of high market value. Land conversion plays a significant role in the production of wealth. When cities expand, rural uses are converted to urban uses, which can multiply the original market value of the land by several (or many) times. Hulse and Ribe quantify the production of wealth from urban land conversion in the Willamette Valley in the mid-late 1990s (Hulse & Ribe, 2000; Hulse & Ribe, 2000). As land is reserved for urban development, it is expected that its price rises. As lands are committed to open space or for protection from development, opportunities to accumulate wealth are lost. However, proximity to open space increase values properties (McPherson, 1992), which highlights some of the issues in planning for protecting open space.

References

Ahern, J. (2002). *Greenways as strategic landscape planning: theory and application*. Wageningen: Wageningen University.

Ahern, J. (2005). Integration of landscape ecology and landscape architecture: an evolutionary and reciprocal process. In J.Wiens & M. R. Moss (Eds.), *Issues and perspectives in landscape ecology* (pp. 311-319). Cambridge: Cambridge University Press.

Beier, P., Majka, D. R., & Spencer, W. D. (2008). Forks in the road: Choices in procedures for designing wildland linkages. *Conservation Biology, 22,* 836-851.

Dramstad, W. E., Olson, J. D., & Forman, R. T. T. (1996). *Landscape ecology principles in landscape architecture and land-use planning*. [Cambridge? Mass.]; Washington, DC; [Washington, D.C.?]: Harvard University Graduate School of Design ; Island Press ; American Society of Landscape Architects.

Forman, R. T. T. (1995a). Some General-Principles of Landscape and Regional Ecology. *Landscape Ecology, 10,* 133-142.

Forman, R. T. T. (2008). *Urban regions: ecology and planning beyond the city*. Cambridge, UK: Cambridge University Press.

Forman, R. T. T. & Collinge, S. K. (1997). Nature conserved in changing landscapes with and without spatial planning. *Landscape and Urban Planning, 37,* 129-135.

Forman, R. T. T. & Godron, M. (1981). Patches and Structural Components for A Landscape Ecology. *Bioscience, 31,* 733-740.

Forman, R. T. T. & Godron, M. (1986). *Landscape ecology*. New York: John Wiley and Sons.

Forman, R. T. T. (1995b). *Land mosaics : the ecology of landscapes and regions*. Cambridge [England]; New York: Cambridge University Press.

Forman, R. T. T. (2004). *Mosaico territorial para la region metropolitana de Barcelona*. Barcelona: Editorial Gustavo Gili.

Hulse, D. & Ribe, R. (2000). Land conversion and the production of wealth. *Ecological Applications, 10,* 679-682.

Knaap, G. J., Nelson, A. C., & Lincoln Institute of Land Policy. (1992). *The regulated landscape : lessons on state land use planning from Oregon*. Cambridge, Mass.: Lincoln Institute of Land Policy.

Land Conservation and Development Commission. (4-28-2006). Oregon's Statewide Planning Goals & Guidelines. Goal 14: Urbanization/OAR 660-015-0000(14). Ref Type: Statute

McPherson, E. G. (1992). Accounting for Benefits and Costs of Urban Greenspace. *Landscape and Urban Planning, 22,* 41-51.

Metro (2010). Acquiring natural areas. OregonMetro [On-line]. Available: http://www.oregonmetro.gov/index.cfm/go/by.web/id=18198

Naveh, Z. & Lieberman, A. S. (1984). *Landscape ecology : theory and application*. New York: Springer-Verlag.

Orloff, C. (2004). If zealously promoted by all: the push and pull of Portland parks history. In C.P.Ozawa (Ed.), *The Portland edge: challenges and successes in growing communities* (pp. 140-163). Washington, DC: Island Press.

Oversight Committee (2008). *A clear view* Portland, OR: Metro.

Payne, S. (2002). Urban land use. In D.Hulse, S. Gregory, & J. Baker (Eds.), *Willamette River Basin Planning Atlas: trajectories of environmental and ecological change* (pp. 106-107). Corvallis: Oregon State University Press.

Payne, S. & Baker, J. (2002). Study area. In D.Hulse, S. Gregory, & J. Baker (Eds.), *Willamette River Basin Planning Atlas: trajectories of environmental and ecological change* (pp. 2-3). Corvallis: Oregon State University Press.

Portland Parks and Recreation (2006). *Natural Area Acquisition Strategy* Portland, OR.

White, D. & Baker, J. (2002). Biotic systems - Terrestrial wildlife. In D.Hulse, S. Gregory, & J. Baker (Eds.), *Willamette River Basin Planning Atlas: trajectories of environmental and ecological change* (pp. 46-47). Corvallis, OR: Oregon State University Press.

Wiley, P. (2001). *No place for nature: the limits of Oregon's land use program in protecting fish and wildlife habitat in the Willamette Valley* Washington: Defenders of the Wildlife.

Wu, J. (2008). Making the Case for Landscape Ecology: An Effective Approach to Urban Sustainability. *Landscape Journal, 27,* 41-50.

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