Title:
Section 3: Contested Landscapes--The Ecological Structure of City Regions - From the Sanitary City of the Twentieth Century to the Sustainable City of the Twenty-First

Journal Issue:
Places, 19(1)

Author:
Pincetl, Stephanie

Publication Date:
2007

Publication Info:
Places

Permalink:
http://escholarship.org/uc/item/2w481185

Acknowledgements:
This article was originally produced in Places Journal. To subscribe, visit www.places-journal.org. For reprint information, contact places@berkeley.edu.

Keywords:
places, placemaking, architecture, environment, landscape, urban design, public realm, planning, design, sanitary, city, twentieth, century, twenty-first, contested, landscape, ecological, structure, Stephanie Pincetl

From the Sanitary City of the Twentieth Century to the Sustainable City of the Twenty-First

Stephanie Pincetl

Least obvious, at any rate to modern urbanized man, is the effect of our present highly complex fauna and flora, organized as they are into communities, upon the environment itself. Through reaction upon habitat, these communities not only insure an orderly cycle of material and energy transformations but also regulate the moisture economy, cushion the earth's surface against violent physiographic change, and make possible the formation of soil. In short, man is dependent upon other organisms both for the immediate means of survival and for maintaining habitat conditions under which survival is possible. —P.B. Sears[1]

A major challenge for the United States as it continues to urbanize is how to make cities more livable while reducing their environmental impacts: how to urbanize more sustainably. Urban areas have substantial environmental impacts on air and water quality and on habitat; they consume high rates of energy and materials, especially in developed countries; and they contribute significant fossil-fuel emissions.[2]

Yet, in some ways the call for sustainability is simply the most recent iteration of an historic, environmentally oriented critique of the industrial city. Among its forms have been the Garden City Movement at the turn of the twentieth century, the Regional Plan Association of the 1920s and 1930s, Ian McHarg's *Design With Nature*, and present-day calls for smart growth and urban limit lines.[3] Maintaining the health of natural systems in urban areas is thus not a new problem. Yet it has remained a relatively intractable one.

One reason for this difficulty is that the benefits people obtain—or might obtain—from ecosystems are not well taken into account. Natural systems are either subsumed into real estate transactions (as unacknowledged aspects of a piece of land); operate as a common good that may or may not be subject to regulation, such as air or water quality; or are viewed as an engineering challenge, such as water purification.

Whatever the case, no value is assigned to them. An important component of moving toward greater urban sustainability is thus lost. Better ways must be found to value natural services in urban and metropolitan fiscal policy and planning.

Understanding Human Impacts on Nature

Estimates suggest that humans now directly control 25-40 percent of the total primary production of the planet's biosphere, and that this is having significant effects on global climate and Earth's ozone shield.[4] In other words, humans have directly transformed up to 40 percent of the Earth's natural systems to provide for their sustenance. The Millennium Assessment further argues human conditions are now a prime driver of ecosystem change.[5]

Such a new reality establishes the basis for greater intentionality in human activities in the use of ecosystem services to mitigate negative environmental effects. In other words, a more humanely engineered planet can include intelligent use of existing ecosystem services to both improve human well-being and reestablish ecosystem functions.

Cities are an especially important element in human-induced change, especially now that that more people live in them than in the countryside for the first time in history. For cities to function, a substantial mastery of natural ecosystems is necessary, including such activities as flood prevention, development of water supplies, water purification, sewage treatment, waste management, and so forth. Thus, urbanization, especially the rise of large industrial cities, relies on explicit practices toward nature and powerful, scientifically derived techniques to control and direct it.

To understand urban ecosystems, ecological data of various types and scales has only begun to focus on metropolitan regions. But it has so far produced a mixed bag of findings, influenced both by a desire to develop practical approaches to improving the urban environment and a desire to better understand the environmental impacts of urban systems. It is worth noting several promising areas of research, however.

One such area has been urban forestry, which has so far demonstrated the value of urban tree cover to reduce heat-island effects, sequester stormwater, and mitigate air pollution.[6] Both the nonprofit American Forests and the U.S. Forest Service have developed GIS-based tools for assessing the actual ecosystem services provided by trees in cities, and their inferred market value. These values are now referred to in justifying urban forestry programs.[7]

Another important area of research is the effect of urban ecosystems on larger-scale processes, such as the North American carbon cycle. This has included attempts to understand underlying drivers of fossil-fuel emissions as well as biological sources and sinks of carbon.[8] Developing data on the direct and indirect impacts of land conversion, for example, is beginning to provide information on organic carbon pools in soils. Knowledge about commuting distances can also be used to study fossil fuel emissions and assess effects on the carbon cycle, city by city.

The Phoenix Long Term Ecological Research effort, funded by the National Science Foundation, is another example of serious investment in understanding the effects of urbanization. It involves a systematic gathering of data on air quality, vegetation change, climate and hydrology. This is being coupled with a study of urban growth to assess human effects on the Sonoran Desert. The research highlights an arid-land ecosystem profoundly influenced, even defined, by the presence of human activities.

The missing link in making the transition to more sustainable cities are urbanization policies that take this type of scientific information into account in planning. Such policies will also need to be funded, leading to a new type of urban infrastructure management.

Ecosystem Services and Their Valuation

There has been a great deal of progress in understanding the functions of ecosystems and in developing economic tools to attribute value to them. However, the interface between ecology and economics is complex, and depends on finding commonly agreed-upon units of measure. Moreover, neoclassical welfare economists have taken substantially different approaches than ecological economists (and in the ecology community differences in approach are also prevalent). There is today a general movement away from regulatory structures, fines and sanctions, however, and toward conventions and markets. Yet, for resources maintained for the common good, this implies new and unspecified sources of funding.

Furthermore, before prices can even be discussed, there needs to be agreement as to what should be valued. The Millennium Assessment's "Ecosystems and Human Well-Being" section divided ecosystem services according to function, including *provisioning* services (food, fiber, water, timber…); *regulating* services that affect climate, floods, water quality, and so forth; *cultural* services such as spiritual practices; and *supporting* services, such as soil formation, photosynthesis, and nutrient cycling.[9] The Assessment argues that all of these services need to valued and preserved. And so far its categories are uncontested.[10] Yet, issues of what to put where and what to count remain complex and subject to interpretation.[11]

Another route toward valuing ecosystem services is provided by environmental law, especially when the need arises to determine the costs of remediation to resolve real pollution problems. So far this field has yielded both significant scientific knowledge about ecological processes and systems and yardsticks to value intact systems. For example, enforcement of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) has required sophisticated modeling and characterization of local groundwater conditions, soils, and hydrology. To value ecosystem services, one could imagine a legal requirement to maintain a specified measurable level of performance, with its monetary quantification in part based on the projected costs of remediation.[12]

Environmental impact reports also provide a source for valuing ecosystem services. They could be modified to include far more information. Soils reports, for example, could include permeability, fertility, composition of microorganisms and their CO_2 sink functions, and so forth —making explicit what would be lost if an area were paved over for development.

There is, therefore, a potential to unify the knowledge developed through implementation of specific laws with human health goals (such as CERCLA, the Clean Air Act, and the Safe Drinking Water Act) with urban sustainability goals. Conservation laws, such as the Endangered Species Act also provide substantive local ecosystem information. The knowledge developed through these environmental laws—and its monetization as a result of lawsuits, property purchases (for the protection of endangered species), and such other actions as having to import water to prevent contamination or depletion of local water resources —provides a base from which to approach urban ecosystem management.

The translation of these known values into urban budgets should be the next step toward integrating ecosystem services into municipal infrastructure management.

The Challenges Facing Cities

Despite growing understanding of the utility of natural services and the obvious limitations of artificially engineered solutions to environmental problems, the implementation of a nature's-services approach in cities faces substantial obstacles. More than a century of modern municipal management, budgeting, and jurisdictional boundary-setting have established professional agencies and departments to provide services, ensure safety, and create the conditions for efficient business operation.

Thus, in addition to physical changes in urban infrastructure, implementation of a program of green infrastructure will require a profound change in the culture of urban management, including a reorganization of city administrations. To begin, individuals with an understanding of ecosystem functions will have to be hired. These people will also have to be trained in interdisciplinary collaboration and coordination. Just as the industrial city gave rise to sanitary engineering, the sustainable city will require a cadre of specially trained ecosystem managers. Resistance to this change can be expected in both cultural and funding terms.[13]

Clearly, for cities to become more sustainable, the services nature renders—or could render—must be protected and enhanced. Currently, the only way to do this is to make them part of urban infrastructure, just like sanitation and electrical power.

Today perhaps the most promising way to do this is to derive their value from existing knowledge gained from environmental law. After prices have been established for ecosystem functions, they can then be integrated into municipal accounts. Thereafter, developers or others wishing to change or destroy a function would be required to pay the value of that function. On these terms, an urban infrastructure designed "with nature" might gradually emerge.

Notes

My thanks to Rob Krueger, Bob Lake, Colleen Daly, Justin Timberlake, and several anonymous reviewers for their helpful comments and encouragement. I would also like to thank Robert Costanza for inviting me to participate two years running in a weeklong seminar at NCEAS in Santa Barbara devoted to many of the questions raised in this paper. And I would like to thank the Haynes Foundation for a generous grant that enabled research that laid the intellectual foundation for this article.

1. P.B. Sears, "The Processes of Environmental Change by Man," in W.L. Thomas, ed., *Man's Role in Changing the Face of the Earth* (Chicago: University of Chicago Press, 1956), p.471.
2. According to William Rees, "there is little question that how cities evolve in the 21st Century is a key to attaining a sustainable future." W.E. Reese, "The Built Environment and the Ecosphere: A Global Perspective," *Building Research and Information* 27 (1999), p. 210.
3. I. McHarg, *Design With Nature* (New York: Natural History Press, 1969).
4. P.M. Vitousek et al., "Human Appropriation of the Products of Photosynthesis," *Bioscience* 36 (1986), pp. 368-73.
5. 2005 Millennium Ecosystem Assessment, "Ecosystems and Human Well-Being: Synthesis" (Washington, D.C.: Island Press, 2005), Section XIV, p. 10.
6. See eetd.lbl.gov/HeatIsland; www.americanforests.org; and cufr.ucdavis.edu/stratum.asp. Also see H. Akbari et al., "Cool Surfaces and Shade Trees to Reduce Energy Use and Improve Air Quality in Urban Areas, *Solar Energy Journal*, 1999 (also as Report LBNL-42637, Lawrence Berkeley National Laboratory, Berkeley, CA); and "Peak Power and Cooling: Energy Savings of Shade Trees," *Energy and Buildings* 25 (1997 special issue on "Urban Heat Islands and Cool Communities"), pp. 139-148 (also as excerpts from Report LBL-34411, Lawrence Berkeley National Laboratory, Berkeley, CA).
7. See, for example, http://www.milliontreesla.org/ and http://www.sactree.com/.
8. D. Pataki et al., "Urban Ecosystems and the North American Carbon Cycle," *Global Change Biology* 12 (2006), pp. 1-11; R.V. Pouyat et al., Carbon Storage by Urban Soils in the USA," *Journal of Environmental Quality* 35 (2002), pp. 1566-75; S.T.A. Pickett et al., "Urban Ecological Systems: Linking Terrestrial Ecological, Physical, and Socioeconomic Components of Metropolitan Areas," *Annual Review of Ecology and Systematics* 32 (2003), pp. 127-57; and N.B. Grimm et al., "Integrated Approaches to Long-Term Studies of Urban Ecological Systems," *Bioscience* 50 (2000), pp. 571-84.
9. 2005 Millennium Assessment, Section XIV, p. 9.
10. See, among others, C. Kremen, "Managing Ecosystem Services: What Do We Need to Know about Their Ecology?" *Ecology Letters* 8 (2005), pp. 468-79; Boumans et al., "Modeling the Dynamics of the Integrated Earth System and of Global Ecosystem Services Using the GUMBO Model," *Ecological Economics* 41 (2002), pp. 529-60; R.S. deGroot, "A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services," *Ecological Economics* 41 (2002), pp.393-408; and R. Costanza et al., The Value of the World's Ecosystem Services and Natural Capital," *Nature* 387 (1997), pp. 253-60.
11. See, for example, J. Boyd and S. Banzhaf, "What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units," *Resources for the Future* (January 2006), DP 06-02; "The Architecture and Measurement of an Ecosystem Services Index," *Resources for the Future* (October 2006), DP 05-22; and J. Salzman, "Creating Markets for Ecosystem Services: Notes from the Field," *New York University Law Review* 80 (2005), pp. 870-959.
12. J. Salzman "Nature's Services: Societal Dependence on Natural Ecosystems" (book review), *Ecology Law Quarterly* 24 (1997), pp. 887-903.
13. See, for example, S. Pincetl, *Transforming California: The Political History of Land Use in the State* (Baltimore: Johns Hopkins University Press, 1999); and J. Musso, "Metropolitan Fiscal Structure: Coping with Growth and Fiscal Constraint," in J. Wolch, M. Pastor Jr., and P. Dreier, eds., *Up Against the Sprawl: Public Policy and the Making of Southern California* (Minneapolis: University of Minnesota Press, 2004), pp. 171-94.