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Long before modern engineering created air conditioning, sewer systems, and water and air purification technology, nature provided similar services through shade trees, grass, wetlands, and forests. Practicing good stewardship of our natural world improves the ability of future generation to eat fresh food, breath clean air, drink healthy water, and enjoy open space.[1]

I. INTRODUCTION

In addition to producing economically valuable *goods* (e.g., lumber, bananas, fish, etc.), ecosystems are essential for providing *services* that are vital to individual and community well-being. The term that captures this principle, "ecosystem services," refers to "a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life." [2] At its base, the

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1. BALTIMORE CITY PLANNING COMMISSION, BALTIMORE SUSTAINABILITY PLAN 70 (2009), *available at* http://www.baltimorecity.gov/LinkClick.aspx?fileticket=DtRcjL%2fIBcE%3d&tabid=128.

2. Gretchen Daily et al., *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, 2 **ISSUES IN ECOLOGY** 1, 2 (1997). Robert Costanza and his colleagues define the term with a similar appeal to functionality: "Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human

ecosystem services perspective transforms our understanding of nature "from amenity to living technology,"[3] by valuing nature and its processes by virtue of the economic, social, and spiritual benefit attributable to ecological functionality. Recognition of the value of ecosystem services is driving new research into ecosystem structure and function, new concepts in the economic valuation of nature, and new methods of regulating the interaction between ecosystems and the built environment.[4]

This article explores the relevance of the ecosystem services perspective to environmental regulation at the local government level. At the outset, it might appear that the assertion of any such relationship might be strained. Indeed, in the early decades of modern environmental law, local governments retained their prerogative over community design and other essentially local matters, but were largely excluded from the national debate on environmental policy.[5] More recently, however, environmental lawyers have reignited the question of how and where the local government regulation of land use impacts intersects with environmental quality.[6] Notable in this trend is that as the

populations derive, directly or indirectly, from ecosystem functions." Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 **NATURE** 253, 253 (1997).

3. E. Gregory McPherson, *Accounting for Benefits and Costs of Urban Greenspace*, 22 LANDSCAPE & URBAN PLANNING 41, 41 (1992).

4. Although the term "ecosystem services" is new, and both the character and use of information being gathered under this approach is novel, "the notion that natural ecosystems help to support society probably traces back to the time when our ancestors were first able to have notions." Harold Mooney & Paul Ehrlich, *Ecosystem Services: A Fragmentary History*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 11, 11 (Gretchen C. Daily ed., 1997).

5. *See* John R. Nolon, *In Praise of Parochialism: The Advent of Local Environmental Law*, 26 HARV. ENVTL. L. REV. 365, 371-72 (2002) ("Perhaps the recent advent of local environmental law is an acknowledgment of [the nonpoint source problem], and suggests a strategic solution to the problem of imposing federal environmental solutions on local and state land use decision-making."); *see also* Robert L. Fischman & Jeffrey B. Hyman, *The Legal Challenge of Protecting Animal Migrations as Phenomena of Abundance*, 28 VA. ENVTL. L.J. 173, 217 (2010) ("Despite its pervasive importance in achieving environmental policy goals, land use control has received little attention from lawmakers in the United States.").

6. Nolon, *supra* note 5, at 376 (discussing the "gradual evolution toward environmental sensitivity in local land use controls").

national dialogue has turned to the importance of local governments in achieving environmental quality goals, there has been a corresponding emergence of an ecosystem services approach to understanding nature.[7] It is also interesting to note how many of the stories of ecosystem services – successes, explanations, and illustrations – take place in local governments and in community decision-making.

Section II introduces the topic by contrasting local governance to the goals of federal environmental law. This section argues that the value embedded in ecosystem services is commensurable with local regulation and, more fundamentally, local governance: perhaps by coincidence, but likely due to design, local environmental law and ecosystem services have evolved in a complementary manner. Section III illustrates the relationship between local governance and ecosystem services, as well as the opportunities presented by this relationship, by examining some of the ways that local environmental law has embraced the advantages of an ecosystem services perspective. This article concludes that local governments are leaders in the implementation of ecosystem services-based regulation, that communities are the direct beneficiaries of such action, and that this is exactly as it should be.

II. LOCAL ENVIRONMENTS AND ECOSYSTEM SERVICES

Local environmental law generally involves a complex system of legislative and administrative procedures, parochial values, overlapping jurisdictions, and often conflicting priorities.[8] Local

7. *See* J.B. Ruhl & James Salzman, *The Law and Policy Beginnings of Ecosystem Services*, **22** J. LAND USE & ENVTL. L 157, 158-61 (2007) (identifying 1997-98 as the emergence of ecosystem services analysis).

8. This article loosely refers to "local environmental law" and "local government" to include municipal, county, and regional governmental entities, in recognition of the different ways that local ecologies may challenge different types of local governments. *See* Jamison E. Colburn, *Localism's Ecology: Protecting and Restoring Habitat in the Suburban Nation*, 33 Ecology L.Q. 945, 966 (2006) (identifying difficulties in defining "local government").

environmental law is young; the term did not exist[9] throughout the eighty-five years since the *Euclid* decision,[10] and it was not until recently that environmental and land use lawyers realized how many local governments had taken on the responsibility of experimenting with innovative and far-reaching regulatory strategies of environmental protection.[11] Since that time, interest in the subject matter has been growing steadily. A significant body of local environmental law has grown, despite tensions in local politics and frequent lack of scientific sophistication at the local level.

Tracking the relationship between federal and local environmental law helps in understanding how the development and implementation of the ecosystem services converges with local environmental regulation. Federal environmental law (as we know it today) is itself relatively new, largely a product of a flurry of federal statutes and policies adopted in the early 1970s in response to the failures of past practices and laws to maintain adequate controls on environmental quality.[12] It could be maintained that many of the more recent methods of regulating land uses evolved in parallel to the evolution of federal controls. On the other hand, local governments are vigorously participating in the regulation of public and private uses of land,

9. John Nolon attributes the term "local environmental law" to Jeffrey LeJava. *See* JOHN R. NOLON, OPEN GROUND: EFFECTIVE LOCAL STRATEGIES FOR PROTECTING NATURAL RESOURCES iv (2003) ("The author gratefully recognizes the contributions of . . . Jeffrey LeJava, for taking time from his busy law practice to help research and write parts four and five and for first coining the term *local environmental law* as a second-year law student.").

10. *See generally* Vill. of Euclid v. Ambler Realty Co. (*Euclid*), 272 U.S. 365 (1926).

11. In some sense, this recognition has come late. Local governments have long been regulating land uses and conduct that affects environmental quality. *See generally* Nolon, *supra* note 5 (discussing the traditional tools of land use regulation as tools for environmental regulation). However, the character of local governments' contemporary contributions to environmental protection is more robust and focused than the local laws of the past. As such, there is some question about whether the phrase, "local environmental law" should associate local environmental concerns with the body of state and federal law classified as environmental law.

12. *See, e.g.*, Union Elec. Co. v. EPA, 427 U.S. 246, 256 (1976) ("The 1970 Amendments to the Clean Air Act were a drastic remedy to what was perceived as a serious and otherwise uncheckable problem of air pollution.").

air and water, but in ways that illustrate type, not token, differences.

A. Questioning the "Failures" of Local Environmental Law

Although federal environmental law and local environmental law may have similar goals in mind, the association between the two is often made for the purpose of illustrating the failures of local governments to engage in a unified effort to control environmental degradation. [13] The question that is begged by this treatment of the subject is: have local governments succeeded in closing the gaps in environmental protection left by federal environmental law? In the common narrative, local governments have failed to appropriately and adequately control the pollution problems that were thought of as inherently local problems or incapable of uniform control at the federal level. As Dan Tarlock states:

> The regulation of private land use to achieve environmental protection objectives remains the weakest link in modern environmental law. Many of the major environmental challenges such as the control of non-point source water pollution, the conservation of biodiversity, and the limitation of automobile emissions, including carbon dioxide, are at the core of land use regulation problems. Yet, in the main, we continue to develop and abuse land, regardless of environmental stresses that development causes. As environmental protection once again rises on the political agenda, the need to address the gap between land use regulation and environmental protection is becoming more critical; the regulatory gap impedes or cancels much of the progress that we have made to improve the conditions of our air sheds and watersheds—let alone confront the linked challenges of biodiversity conservation and adaptation to global climate change.[14]

13. *See, e.g.*, A. Dan Tarlock, *Land Use Regulation: The Weak Link in Environmental Protection*, 82 WASH. L. REV. 651, 654-57 (2007).

14. *Id*. at 652.

The early federal environmental statutes adopted substantive goals of clean water, air, and soils, and attempted to provide some uniformity based on health-based assessments of the interactions between humans and the environment. In large part, federal environmental law used technology-forcing and information-gathering mechanisms to set minimum permissible standards in such a way that polluting sources would be forced to innovate to meet the standards. To manage the shift toward pollution control, agencies with expertise in environmental impacts were charged with the responsibilities of understanding the physical needs of the ecological community, assessing the chemical and biological impacts from particular activities on the environment, and otherwise guaranteeing environmental quality. The resulting legal regime focused on reducing, or eliminating, externalities through uniformity and technology.

The federal scheme suffered limitations that are particularly relevant to a study of local environmental law. First, the federal government's authority over particular activities was subject to jurisdictional limitations stemming from the Tenth Amendment[15] and Commerce Clause.[16] Second, early environmental laws largely took the practical approach of curtailing pollution activities from larger sources, such as domestic sewage treatment,[17] industrial pollution to air (by stationary and mobile sources)[18] and water (industrial discharges into streams and

15. *See, e.g.*, New York v. United States, 505 U.S. 144, 188 (1992) (federal government may not commandeer the state decision making process).

16. *See, e.g.*, Solid Waste Agency of N. Cook Cnty. v. U.S. Army Corps of Eng'rs, 531 U.S. 159, 173 (2001) (invalidating regulations that asserted jurisdiction over isolated wetlands). *But see* Nat'l. Ass'n of Home Builders v. Babbitt, 130 F.3d 1041, 1057 (D.C. Cir. 1997) (rejecting Commerce Clause challenge to the Endangered Species Act); *see also* United States v. Olin, 107 F.3d 1506, 1509 (11th Cir. 1997) (rejecting Commerce Clause challenge to the Comprehensive Emergency Response, Compensation, and Liability Act).

17. *See* Navigation and Navigable Waters Act, 33 U.S.C. § 1345(e) (2006) (requiring regulatory compliance for any "disposal of [sewage] sludge from a publicly owned treatment works or any other treatment works treating domestic sewage.").

18. *See, e.g.*, Clean Air Act, 42 U.S.C. §§ 7401-7431, 7521-7574 (2006) (defining air quality and emissions limitations in general and for moving sources).

rivers),[19] the application of chemicals into the ground, and releases of hazardous substances into the environment.[20] Nonpoint sources of pollution, such as street runoff, were problematic for this scheme.[21] In addition, ignoring development and pollution activities of a smaller scale (smaller wetlands and smaller streams, smaller spills and underground storage tanks, etc.) proved to be a more substantial gap in environmental protection than might have been suspected. However, local governments were not given a formal role in the formulation of early environmental policy of the implementation of environmental quality goals.[22] Instead, it was expected that local governments would exercise their prerogative to control these pollution sources.[23]

The anticipated role of local governments in the project of environmental law was to curtail the smaller, more diffuse sources of pollution, as well as control the cumulative impacts arising from incremental landscape changes. However, local governments have not accomplished this goal, or at least, have not done so according to the technological expectations of the

19. *See, e.g.*, Clean Water Act, 33 U.S.C. §§ 1251-1387 (2006) (providing for a permit program and authorizing the Environmental Protection Agency to regulate discharges of pollutants into waters).

20. *See* Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9628 (2006) (providing for liability and compensation for releases of hazardous substances by certain parties); Resource Conservation and Recovery Act, 42 U.S.C. §§ 6921-6925 (2006) (allowing for regulation of hazardous waste from generation to disposal or storage); Toxic Substances Control Act,15 U.S.C. §§ 2601-2692 (2006) (pertaining to the control of toxic substances).

21. *See* Nolon, *supra* note 5, at 365 (discussing the challenges posed by nonpoint source pollution).

22. Dan Tarlock explains the reasoning behind this:

> Environmental protection represented the progressive evolution of responsibility from lower to higher levels of government. Local government's role in controlling nuisance-like activities such as smoke pollution was recognized. However, local pollution ordinances were lumped in the same category as state regulatory programs and common-law nuisance actions as examples of piecemeal, ineffective strategies.

A. Dan Tarlock, *The Potential Role of Local Governments in Watershed Management*, *in* JOHN R. NOLON, NEW GROUND: THE ADVENT OF LOCAL ENVIRONMENTAL LAW 213, 219 (2003).

23. Tarlock, *supra* note 13, at 657.

federal regime. Sprawl has resulted in a suburban housing abundance that has overtaxed water supplies and infrastructure, whittled away at remaining open spaces, displaced wildlife, altered ecosystems, and otherwise burdened nature in irreversible ways. The nonpoint source problem has been most prominently illustrated by municipal sewage treatment failures, combined source overflows ("CSOs"), and increased impervious surfaces.

Although these circumstances undoubtedly demand attention, it really should be asked whether they reflect on *local* failures. Indeed, the perceived inability of local governments to complete the federal program might be understood less as a *failure* than a *circumstance*, especially when considering the zoning power as the means through which local governments identify and protect local environmental resources. Arguably, local governments do not operate in a way that reflects on pollution prevention: local governments simply are not equipped to engage in technology-dependent pollution prevention efforts that emphasize uniform standards.[24] In contrast to the federal regime, through zoning and planning, local governments have traditionally engaged in the community building process of *pollution location*. As such, federal environmental law and local environmental law occurred not in a parallel or even complementary evolution, but in entirely different schemes.

To protect the public health, safety, and general welfare, local governments have long relied on zoning regulations and the police power.[25] Zoning allows local governments to manage social, economic, and environmental challenges in light of local values, priorities and needs, whether in the form of traffic congestion, population distribution, school and open space access, recreation, or police and fire services. Through zoning, local

24. *See* Colburn, *supra* note 8, at 966 ("Local government is not a miniature version of federal or state governance, and if premised upon that misunderstanding of the local public as 'sovereign,' localism is surely an ecological bust.").

25. Chanhassen Estates Residents Ass'n. v. Chanhassen, 342 N.W.2d 335, 340 (Minn. 1984) ("[W]hen a city designates a specific use as permissible in a particular zone or district, the city has exercised its discretion and determined that the permitted use is consistent with the public health, safety, and general welfare and consonant with the goals of its comprehensive plan.").

governments create intentional communities by arranging land uses according to their characteristics, associations and impacts. Yet, the Euclidean zoning scheme was also designed to be flexible and adaptive,[26] in recognition of the fact that communities grow.[27]

Zoning, of course, can easily be understood to contemplate many of the types of environmental challenges felt by local governments. For instance, among other things, the Standard Zoning Enabling Act ("SZEA") proposed that local governments be authorized to establish districts "to lessen congestion in the streets," and "to secure safety from fire," "to provide adequate light" and "to avoid undue concentration of population."[28] The SZEA also allowed local governments to design communities in light of property values by "conserving the value of buildings," and by "encouraging the most appropriate use of land throughout [the] municipality."[29] The authority proposed in the SZEA was employed to create homogenous neighborhoods, the benefits of which would be felt on a community-wide basis. The SZEA justified, as the "most appropriate use of land," the establishment of particular locations for the more intensive, "dirty" land uses. Zoning allowed local governments to locate pollution in defined areas of a community.

The "pollution location" approach to local environmental law emphasizes three important points about local regulatory capacities. First, the pollution location model emphasizes the parochial nature of local environmental law. While Congress sought uniform health standards based on technical expertise,

26. Charles M. Haar & Michael Allan Wolf, *Euclid Lives: The Survival of Progressive Jurisprudence*, 115 HARV. L. REV. 2158, 2197-98 (2002).

27. *Euclid*, 272 U.S. 365, 386-87 (1926) ("Regulations, the wisdom, necessity, and validity of which, as applied to existing conditions, are so apparent that they are now uniformly sustained, a century ago, or even a half century ago, probably would have been rejected as arbitrary and oppressive.").

28. Advisory Comm. on Zoning, Dep't of Commerce, A Standard State Zoning Enabling Act: Under Which Municipalities May Adopt Zoning Regulations § 3 (1926)*; see* Ruth Knack et al., Commentary, *The Real Story Behind the Standard Planning and Zoning Act of the 1920s*, LAND USE L., Feb. 1996, at 3, *available at* http://www.planning.org/growingsmart/pdf/LULZDFeb96.pdf.

29. Advisory Comm. on Zoning, *supra* note 28, § 3.

local governments were creating livable communities.[30] One purpose behind land use districts was to protect the more sensitive land uses: the public welfare would be served by separating incompatible land uses and identifying areas in which an industrial, commercial, or other more intensive use would be "like a pig in the parlor instead of the barnyard."[31] The "cumulative" zoning scheme adopted in the Village of Euclid illustrates the manner in which zoning could be used to locate pollution by aggregation. The Village established use districts, under which it located industrial, commercial, multi-family and single family residential development, in order to avoid nuisances.[32] When appropriately located, single-family residential neighborhoods could be protected from industrial and other intensive uses. As a result of the decision in *Euclid*, local governments were given vast authority to consider environmental quality as an unseverable component of community quality and local character.

Second, the pollution location model also suggests why local environmental law fails according to the federal environmental law regime. While federal environmental law aims at scientific standards, expert agency administration, and preventing industrial and domestic externalities from affecting human health, local environmental law under this model is answering an entirely different question. This is not just a question of the competency necessary to administer a technical environmental law program[33] (which the local government typically does not

30. Of course, to some, this is exactly the problem that environmental law should have been designed to resolve. *See*, *e.g.*, ROBERT H. FREILICH, FROM SPRAWL TO SMART GROWTH 240 (1999) ("The nation's land use problems and the states' failure to reclaim some of their authority delegated early on to localities in the land use field points to the need for efficient and comprehensive planning at the state level."); *see also* Michael Allan Wolf, *The Prescience and Centrality of Euclid v. Ambler*, *in* ZONING AND THE AMERICAN DREAM: PROMISES STILL TO KEEP 253, 253 (Charles M. Haar & Jerold S. Kayden eds., 1989) (identifying parochialism as a problem of "exclusion, anti-competitiveness, parochialism, and aestheticism.").

31. *Euclid,* 272 U.S. at 388.

32. *Id*. at 380.

33. As noted by the Florida Supreme Court, "[i]t would be difficult, if not impossible" for the legislative body to have the technical expertise necessary to

possess), but whether local governments have incentives to adopt and enforce such a program. Notably, the decision to adopt zoning districts was one for *local governments* to make: the courts would not intrude into the workings of city design unless the scheme was wholly arbitrary. In *Euclid*, Justice Sutherland approved of zoning by finding that local visions of community, where supported by a "fairly debatable" legislative scheme, would not be second-guessed by the courts.[34] Local governments have enjoyed this deference, which allows them to act locally, protectively, and even as market participants. Note the subject of the deference: courts will not intrude on the process of visioning the community, protecting community assets, or more generally, identifying those physical and intangible characteristics that are locally cherished as contributing to the quality of life.

Asking local governments to replace their focus on quality of life with a basis in the hard sciences, as well as sacrifice the deference historically enjoyed in such decisions, may have been too grave a request. Of course, a plausible fear may have been that a regulatory scheme, which centralizes scientific sophistication, could operate to trump local preferences and local voice. More importantly, though, was the fact that land uses with significant externalities (e.g., industrial uses, such as auto manufacturers; natural resource extraction, such as oil, gas and mining; and commercial uses, such as commercial centers, banks, retail establishments) were historically treated as indicators of economic growth. Local governments have an interest in the continuation of existing externalities, in the sense that they are seen as necessary byproducts of a thriving economy. This does not mean that local governments are necessarily prone to accommodate pollution or land uses that involve significant externalities, but that the process of regulating and realizing local concerns legitimizes local borders and what is happening inside these borders:

> Zoning laws change in response to changing community values, and the community's cultural values are affected by the

adopt a successful regulatory program. *Avatar Dev. Corp. v. State*, 723 So. 2d 199, 207 (Fla. 1998). Clearly, local governments feel this impossibility.

34. *Euclid,* 272 U.S. at 388.

> structures that an earlier era of zoning laws first permitted and then discouraged. The process is synergistic. The process by which the city decides which icons it will save and how it will save them is a process in community self-searching and self-knowledge.[35]

Self-searching and self-knowledge, in the local government arena, can be as compelling as any scientific insight. As such, in many ways, "local government regulation is more appropriate to handle the more nuanced, specifically local externalities that buildings force onto their local communities."[36]

The third point to be made about local regulatory capacities, which will become more relevant below, is that the process of community design through pollution location required local governments to face local ecological circumstances and, where appropriate, to reap the benefits of local ecologies as an element of their community design decisions. As Sarah Schindler notes, an accounting of the drivers of green building regulations—including "conserving local supplies of water and energy, encouraging the use and reuse of local building materials and supplies, contributing to the better indoor and outdoor environmental air quality, healthier city residents, and happier building occupants"—will often involve "inherently local responses to purely local concerns."[37] Likewise, the process of matching land uses to appropriate areas of a region involves a determination of the most suitable ecological, hydrological, and geological locations for the specific use. Land uses that require access to commercial transportation might be situated in riparian areas, whereas residential land uses might be located on lands that have accessible aquifers and soils capable of supporting septic systems. The local government analysis of such suitability involves a component that is characteristic of local environmental law, but foreign to the federal scheme: when local government

35. *See* Lea S. VanderVelde, *Local Knowledge, Legal Knowledge, and Zoning Law*, 75 IOWA L. REV. 1057, 1075 (1990).

36. Sarah B. Schindler, *Following Industry's LEED: Municipal Adoption of Private Green Building Standards*, 62 FLA. L. REV. 285, 302 (2010).

37. *Id*. at 300.

values an environmental attribute, its acts to protect a home, a community, a friend, or a family, and each of these has a name.[38]

Given the foregoing, it is not surprising that local governments have not played a central role in a scheme of environmental regulation that focuses on uniform, scientific standards governing how land uses are performed. Local governments approach the environment in a different way. An accurate proposition may be that the environmental laws of the 1970s failed in a number of important respects, but whether the failure is attributable to local governments is debatable.

B. Praising Parochialism

A more parochial understanding of local environmental law might not see local regulation as a failure; rather, local governments have successfully combined baseline objectives for health and the environment with control over the identification of critical and locally important environments. Recent scholarship has identified local governments as critical to environmental quality, not only because local governments use their own voice, but also because they have voices to contribute:

> While the United States as a whole speaks through the federal government, the voices and actions of local governments are critical to achieving truly sustainable communities, especially in the climate change arena. Although a coordinated national policy on climate change should be developed, initiatives at the state and local government level, even standing alone, have the potential to dramatically contribute to the international effort to slow the pace of global warming.[39]

Local voice, which might be understood as local expression of community identity, typically involves engaging the public in the

38. *Id.* at 302 (arguing that land use controversies evoke local responses and concerns, "impacting citizens in ways that sweeping environmental legislation (and problems) does not.").

39. Patricia E. Salkin, *Can You Hear Me Up There? Giving Voice to Local Communities Imperative for Achieving Sustainability*, 4 ENVTL & ENERGY L. & POL'Y J. 256, 258 (2009).

exercise of envisioning communities through zoning and the comprehensive plan.

Local governments have historically thrived in the community-building exercise. Through zoning and planning, local governments have engaged in a self-identification process and implemented community visions in the process of designing communities.[40] These traditional tools allowed local governments to understand the local environment as a help and a harness for the public welfare and required communities to consider the relationship between the local environment and their goals. As John Nolon describes:

> Communities have long used large-lot zoning as a crude way of protecting open space and its associated natural resources. Upzoning occurred in some suburban areas, aimed principally at lowering development densities to control population growth, maintain residential property values, and contain the cost of servicing development while, incidentally, limiting water use, preventing aquifer contamination, and containing nonpoint source pollution. As the environmental movement evolved and matured in the 1970s and 1980s, the sensitivity of local lawmakers was raised and early signs of the adoption of local environmental law became apparent. These signs emerged from a variety of sources, including the National Flood Insurance Program, which required local governments to adopt and enforce floodplain management programs as a prerequisite to local eligibility for national flood disaster assistance payments. Catastrophes influenced the movement towards increased regulation at the local level, leading to storm water management measures and stringent setback requirements along the coasts of barrier islands that are particularly vulnerable to hurricane damage. The 1990s saw the advent of local laws clearly designed to protect environmental functions and these, in the aggregate, now constitute a significant body of law.[41]

40. *See* VanderVelde, *supra* note 35, at 1059 ("The world is composed of local neighborhoods. Recognizing the parochial character of each one, even the most seemingly cosmopolitan, is important and interesting because it highlights the cultural contingency 'of place, time, class, and . . . accent' that imbues every perspective.") (citations omitted).

41. Nolon, *supra* note 5, at 374.

Of course, this is not the process of federal environmental law: in contrast to the federal scheme, in which purportedly objective standards dictate the manner in which types of land uses are permitted to interact with the environment and impact human health, the local process casts the environment as a situation, a resource, and often as a challenge, but invariably as a local choice made to further local identity. Yet, Nolon's point is that parochialism in this context is not to be feared. Instead, concern over local environments has served to consider seriously the benefits of local environmental quality.

More recently, local governments have adopted forms of Smart Growth and Sustainable Development—schemes that focus the police power on environmental consequences as a direct target, instead of an incidental benefit. As Gabor Zovanyi notes, the development of growth management programs as an evolving and expanding umbrella of programs to derail a wide array of community needs:

> Growth management has been offered as a solution to a broad array of social problems attributable to sprawl, starting with environmental decline, inefficient provision of facilities and services, and loss of community character. Over time, growth management has moved on to represent solutions for the loss of open space, resource lands, and rural landscapes; worsening congestion; unaffordable housing; the revival of declining cities; and inadequate economic development.[42]

Smart Growth implements environmental protection outside of property and jurisdictional boundaries.[43] Smart Growth tools, such as open space preservation mandates and tiered growth models implemented in urban growth boundaries, engage local governments in the process of envisioning community character. More importantly, Smart Growth expands the scope of relevant factors that affect quality of life.[44]

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42. Gabor Zovanyi, *The Role of Initial Statewide Smart-Growth Legislation in Advancing the Tenets of Smart Growth*, 39 URB. L. 371, 374 (2007).

43. *See generally* Janice C. Griffith, *Smart Governance for Smart Growth: The Need for Regional Governments*, 17 GA. ST. U. L. REV. 1019 (2001).

44. Brian W. Ohm, *Reforming Land Planning Legislation at the Dawn of the 21st Century: The Emerging Influence of Smart Growth and Livable*

Smart Growth programs often involve a "top-down" approach to planning by mandating specific elements and standards to be addressed in local comprehensive plans, while providing sufficient flexibility to local governments for the development of local planning priorities and needs. For instance, both Washington and Oregon land use laws require that growth management plans be led by what appear to be vague and often seemingly contradictory standards.[45] Oregon's planning goals require local governments to apply appropriate safeguards from natural hazards, to provide a safe, convenient and economic transportation system, and to diversify and improve the economy.[46] Likewise, Washington's Growth Management Act includes planning goals such as "protect the environment," "encourage the availability of affordable housing," "encourage efficient intermodal transportation," and "the property rights of landowners shall be protected from arbitrary and discriminatory actions."[47] What is important is that the planning process is intended to demonstrate that these otherwise political, rhetorical devises can guide planning as complementary aims.

While Smart Growth requires cooperation between conceptions of private and public in visions of urban growth, "sustainability" broadens the analysis to include costs from many

Communities, 32 URB. L. 181, 189 (2000) (describing the quality of life focus of Smart Growth as a balancing approach between economic development and environmental quality).

45. *See* Hong N. Huynh, *Administrative Forces in Oregon's Land Use Planning and Washington's Growth Management*, 12 J. ENVTL. L. & LITIG. 115, 125-30 (1997).

46. Oregon's model land-use regime began in 1973 with the legislature's adoption of Senate Bill 100. S. 100, 1973 Leg. Assem., Reg. Sess. pt. 2 (Or. 1973). Under Senate Bill 100, each local government was required to design and enforce comprehensive land-use criteria to implement state-wide planning goals including, among others, encouraging public collaboration, setting urban growth boundaries, providing for housing, protecting farm and forest lands, conserving natural resources and stimulating economic growth. *See* OR. REV. STAT. § 197.175(2)(a) (2007) (requiring each local government to "[p]repare, adopt, amend and revise comprehensive plans in compliance with goals approved by the commission"). Local governments are required to periodically review, revise and resubmit their land use planning for review. *See also* OR. REV. STAT. § 197.646 (2009); *see generally* Robert Liberty, *Planned Growth: The Oregon Model*, 13 NAT. RESOURCES & ENV'T 315 (1998).

47. WASH. REV. CODE § 36.70A.020 (2011).

perspectives, across geography, and inclusive of future generations. Like Smart Growth, sustainability has avoided a single definition.[48] The basic concept, however, is common among those who use it: sustainability is intended to engage governments and communities in a cooperative framework for formulating long-term solutions for the challenges of the present and encompasses broad environmental, economic, and social considerations. Sustainability requires that economic development and environmental quality be seen as compatible and complementary. In other words, "sustainability means pursuing economic activity *while* promoting sound environmental management."[49]

In the context of sustainability initiatives at the local government level, the uncertainty and variation in the meaning of the term is both understandable and encouraged, as there may be no single model of the sustainable society.[50] Sustainability is given meaning in context, in the local and cultural values of specific communities.[51] Recognizing the local nature of sustainability is essential, as "[t]he battle for sustainable development will almost certainly be decided in cities . . . [w]e need cities in good shape, wisely using their resources in an

48. *See* Joyeeta Gupta, *Non-State Actors in International Governance and Law: A Challenge or a Blessing*, 11 ILSA J. INT'L & COMP. L. 497, 497 (2005); Bosire Maragia, *The Indigenous Sustainability Paradox and the Quest for Sustainability in Post-Colonial Societies: Is Indigenous Knowledge All That is Needed?*, 18 GEO. INT'L ENVTL. L. REV. 197, 198 (2006).

49. Maragia, *supra* note 48, at 204 (emphasis added); *see* Keith H. Hirokawa, *A Challenge to Sustainable Governments?*, 87 WASH. U. L. REV. 203, 204 (2009) ("Sustainability converges economic, environmental, and social concerns into policies and practices that prioritize human long-term needs in our present-day infrastructure, residences, offices, and other consumer-based decision-making processes. Hence, sustainability is not aimed at causing the economic regicide that some may have feared: sustainable practices do not compel the cessation of economic growth, or that we cease constructing buildings or extracting resources.").

50. As James Kushner notes, "[s]ocial sustainability will differ for each community: in some communities it will reflect the region's cultural and economic history; other communities will highlight their geographic resources; while still other communities might structure their social sustainability around sports and recreation or arts and entertainment." James A. Kushner, *Social Sustainability: Planning for Growth in Distressed Places-the German Experience in Berlin, Wittenberg, and the Ruhr*, 3 WASH. U. J.L. & POL'Y 849, 851-52 (2000).

51. Maragia, *supra* note 48, at 204.

innovative and sustainable way, cities for all, for us today and for future generations."[52] In the urban area, sustainability takes on elements and issues that might cede from views in the wilderness. In urban areas, sustainability:

> [E]ncompasses subjects as diverse as architectural design, preservation of cultural patrimony, new urbanism and smart growth, green cities, transportation policy, energy efficiency, technology pushing strategies, environmental justice, job creation, economic growth, poverty, renewable resource use, generation and disposal of biodegradable and non-biodegradable wastes, water supply, sanitation, health care, air pollution, migration, affordable housing, secure tenure, green spaces and parks, city ecology, security, and so on. That the list of potential sustainable development concerns of the city is seemingly endless should not be surprising, given that the concept requires attention to the three important dimensions of economy, environment, and equity.[53]

Smart Growth and sustainable development initiatives at the local level have established the robust role, responsibility, and potential of local governments in contributing to environmental quality. Sustainable initiatives include attention to building and neighborhood design, water and infrastructure planning, and population distribution, all of which require local governments to seek proposals in which private and public, environment and property, and growth and conservation are less competitive.

C. Parochialism and Ecosystem Services

Recognizing the commensurability of concepts like sustainability to local government interests supports a critical

52. *Sustainable Cities*, EURACTIV.COM, http://www.euractiv.com/en/sustainability/sustainable-cities/article-175936 (last visited Mar. 22, 2011); *see also* MIKE DAVIS, PLANET OF SLUMS 134 (2006) ("Cities in the abstract are the solution to the global environmental crisis: urban density can translate into great efficiencies in land, energy, and resource use, while democratic public spaces and cultural institutions likewise provide qualitatively higher standards of enjoyment than individualized consumption and commodified leisure.").

53. Ileana M. Porras, *The City and International Law: In Pursuit of Sustainable Development*, 36 FORDHAM URB. L.J. 537, 576-77 (2009).

observation of local environmental law: where parochial concerns converge with an opportunity to realize local advantage, local governments have been eager to lead. The convergence reflects on the relevance of a sense of place to a particular locality, its needs and priorities. In this sense, local environmental law is first local. Local governments are *always* environmentally situated, and ecosystems are always locally felt;[54] as Ashira Ostrow notes, "[l]and, by its nature, is inherently local."[55] In addition, local governments confront ecosystems precisely in the manner they are portrayed in the ecosystem services analysis—as natural capital that provides services of ecological, economic, and social importance.[56] The ecosystem services approach reflects on each of these needs.

54. It is significant that even urban life depends upon the sustainability of functioning ecosystems: "[t]he energy for our transport, raw materials for our gadgets, food in our homes and restaurants, convenient disposal of our wastes, all depend on biological resources." THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY (TEEB), MAINSTREAMING THE ECONOMICS OF NATURE: A SYNTHESIS OF THE APPROACH, CONCLUSIONS AND RECOMMENDATIONS OF TEEB 18 (2010), *available at* http://www.teebweb.org/LinkClick.aspx?fileticket=bYhDohL_TuM%3d&tabid=924&mid=1813; *see* Charles P. Lord et al., *Natural Cities: Urban Ecology and the Restoration of Urban Ecosystems*, 21 VA. ENVTL. L.J. 317, 329 (2003) ("Understanding the ecology of cities is the first step towards improving the quality of life for all of its living inhabitants.").

55. Ashira Pelman Ostrow, *Process Preemption in Federal Siting Regimes*, 48 HARV. J. ON LEGIS. (forthcoming 2011) (manuscript at 13, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1719050##).

56. The EPA has recognized that something special occurs at the community level, where self-identification, character, and nature blend:

> We live among, and are deeply connected to, the many streams, rivers, lakes, meadows, forests, wetlands, and mountains that compose our natural environment and make it the beautiful and livable place so many of us value. More and more often, human communities realize that the health and vibrancy of the natural environment affects the health and vibrancy of the community and vice versa. We value the land, air, and water available to us for material goods, beauty, solace, retreat, recreation, and habitat for all creatures. Throughout the nation, communities are engaging in efforts to protect these treasured natural resources and the quality of life they provide.

U.S. EPA, OFFICE OF WATER, COMMUNITY CULTURE AND THE ENVIRONMENT: A GUIDE TO UNDERSTANDING A SENSE OF PLACE 2 (2002), *available at* http://www.epa.gov/care/library/community_culture.pdf.

At this point, it is well settled that ecosystems play important roles toward human well-being, and also that ecosystems add value to communities by providing substantial economic benefit.[57] As dynamic and complex systems of interaction between living organisms and the non-living environment, ecosystems "provide basic life support for human and animal populations and are the source of spiritual, aesthetic, and other human experiences that are valued in many ways by many people."[58] Ecosystem services, however, is a relatively new approach[59] to understanding and valuing ecosystems that recognizes not only the commodity values of goods produced by ecosystems, but also services that ecosystems provide, which are unquestioningly essential to human well-being.[60] These services, and the accompanying values of the ecological processes that produce such goods and services, have not historically been valued in the marketplace.[61] Previously, consideration of capital

57. Ecosystem services is quickly becoming a mainstream approach to understanding the value of functioning ecosystems. The Department of Agriculture has established the Office of Ecosystem Services and Markets (currently called the Office of Environmental Markets). *See* U.S. DEP'T OF AGRIC., SECRETARY'S MEMORANDUM 1056-001 (Dec. 15, 2008), *available at* http://www.ocio.usda.gov/directives/doc/SM1056-001.htm. The Environmental Protection Agency has launched the Ecosystem Services Research Program. *See* EPA, *Ecosystem Services Research*, http://www.epa.gov/ecology/ (last visited Feb. 27, 2011).

58. U.S. EPA, SCI. ADVISORY BD., VALUING THE PROTECTION OF ECOLOGICAL SYSTEMS AND SERVICES 8 (2009).

59. Harold Mooney and Paul Ehlrich have noted that "Plato understood that the deforestation of Attica led to soil erosion and the drying of springs." Harold Mooney & Paul Ehrlich, *Ecosystem Services: A Fragmentary History*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 11, 11 (Gretchen C. Daily ed., 1997).

60. Proponents of ecosystem services are typically driven, "not from any hippyesque desire to save plants and animals; but because they believe it could make good economic sense." David Black, *Dollar Trees Line Conservation Road*, BBC NEWS, Jan. 6, 2011, http://www.bbc.co.uk/news/science-environment-12121077.

61. In addition to the scant attention given to ecosystem services by the market, the Environmental Protection Agency (EPA) has recently acknowledged that its regulation of environmental quality has largely omitted the analysis involved in the ecosystem services approach. U.S. EPA, SCI. ADVISORY BD., *supra* note 58, at 8 ("Despite the importance of these ecological effects, EPA policy analyses have tended to focus on a limited set of ecological endpoints, such as those specified in tests for pesticide regulation (e.g., effects on the survival,

included only manufactured stocks. Natural capital was thought to be inexhaustible, or at least human productivity was thought to "[operate] at too small a scale relative to natural processes to interfere with the free provision of natural goods and services."[62] Moreover, as pointed out by Robert Costanza and Herman Daly, one explanation for our ignorance of the value and importance of natural capital "has been the tenet of neoclassical economic theory that human-made capital is a near-perfect substitute for natural resources, and hence for the natural capital that generates the flow of natural resources."[63] At this point in time, however, "we are . . . entering an era, thanks to the enormous increase of the human scale, in which natural capital is becoming the limiting factor."[64] As has been noted, "in 1909, more nets and fishing vessels (built capital) were needed to increase fish production. Today, to increase fish production would require more fish (natural capital)."[65]

One reason to identify local environmental law as an ecosystem services opportunity relates to scale. For instance, the regulation of soils illustrates that, at some variable but generally elusive scale, the process of connecting ecosystem services with a specific regulatory system can be a complex task, but perhaps less so when it occurs in local governments. Soils provide a variety of supporting and regulatory ecosystem services.[66] The valuable

growth, and reproduction of aquatic invertebrates, fish, birds, mammals, and terrestrial and aquatic plants) or specified in laws administered by the Agency (e.g., mortality to fish, birds, plants, and animals).").

62. Robert Costanza & Herman E. Daly, *Natural Capital and Sustainable Development*, 6 CONSERVATION BIOLOGY 37, 39 (1992).

63. *Id.* at 40.

64. *Id.*

65. DAVID K. BATKER, WATER, ECOSYSTEM SERVICES, AND OPPORTUNITIES FOR SEATTLE PUBLIC UTILITIES 12 (2010), *available at* http://www.eartheconomics.org/FileLibrary/file/Reports/Puget%20Sound%20and%20Watersheds/Earth%20Economics%20Study%20for%20Seattle%20Public%20Utilities.pdf.

66. *See generally* MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS (2005), *available at* http://www.maweb.org/documents/document.356.aspx.pdf (dividing ecosystem services into four categories to include "provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.").

services provided by soils include providing physical support for the surface (including vegetation), nutrient cycling, hydrological regulation, waste disposal and organic decomposition, and maintenance of soil productivity.[67] Because so many important ecosystem processes and functions rely on the nutrient cycling services provided by soils, the role of soil "cannot be fully substituted by human-made solutions, and operates at multiple, overlapping scales, so it is difficult to arrive at an accurate economic value for these services."[68]

The loss of productive soils may be challenging as a cumulative process, rather than a single event, as it is difficult to track the impacts of soil disturbance on soil functions. The typical scale of soil disturbance activities (grading for a new driveway or garden, excavation for construction a home) may obscure the nexus between soil-impacting activities and the loss of the services provided by soils.[69] What is clear, however, is that the loss of productive soils (resulting in failing vegetations and agriculture, loss of soil functions relating to groundwater, etc.) in one region may be negligible on a national scale, even if terrifying at the local level. The impacts of ecosystem services loss are pronounced at a local level, and regulation by local governments

67. Gretchen C. Daily et al., *Ecosystem Services Supplied by Soil*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 113, 117 (Gretchen C. Daily ed., 1997). Ian Hannam and Ben Boer point out that soils primarily serve functions related to ecological, cultural, land use needs. IAN HANNAM & BEN BOER, INT'L UNION FOR CONSERVATION OF NATURE, LEGAL AND INSTITUTIONAL FRAMEWORKS FOR SUSTAINABLE SOILS: A PRELIMINARY REPORT 10 (IUCN Envtl. Pol'y & L. Paper No. 45, 2002), *available at* http://data.iucn.org/dbtw-wpd/edocs/EPLP-045.pdf. In addition to providing the foundation for organisms to live, soils balance of nutrients and water, filter and buffer between the atmosphere, groundwater, and plants, protect the natural heritage and landscape, and provide space and support for structures, raw materials, and farming. *Id.*; *see also* Alexandra M. Wyatt, *The Dirt on International Environmental Law Regarding Soils: Is the Existing Regime Adequate?*, 19 DUKE ENVTL. L. & POL'Y F. 165, 169-78 (2008) (recognizing services of soil as: agriculture and food security, biodiversity, water quality, and climate regulation).

68. EARTH ECONOMICS, A NEW VIEW OF OUR ECONOMY: NATURE'S VALUE IN THE SNOQUALMIE WATERSHED 45 (2002).

69. Grading and changing natural topography can impair habitats, alter aesthetic resources, change the direction of groundwater flow, change storage capacity and flow within stormwater basins, and impair the filtering and cycling services provided by soils.

may be the most effective way to slow or mitigate the degree to which the built environment interferes with soil functions. Regulation of grading – even at a local, individual scale – serves the purposes of public health and welfare by preserving natural assets in soil, maintaining aesthetic features, preventing land and water pollution, and promoting soil stabilization.[70]

What binds local governments to an ecosystem services analysis, and what solidifies the relationship between ecosystem services and local governance, inheres in the approach as a means to apply a common basis to value a broad spectrum of goods and services. Ecosystems display complexity among ecosystems and ecosystem functions. The ecosystem offers a variety of essential services and, depending on location and context, presents an array of different values among goods and ecosystem services. By offering a means of comparing various services on common grounds and compelling local governments to recognize ecosystem services scarcity, the ecosystem services analysis allows local governments to customize the menu of achievable ecosystem benefits and prioritize as a method of resource conflict resolution. In this scheme, the regional and contextual needs of the community arise as criteria used to determine local environmental value.[71]

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70. The City of Keen, New Hampshire, regulates earthwork under its "Earth Excavation Ordinance." KEEN, N.H., CODE §102-1351 (2010). The regulation is supported by a ban earth resources master plan, and is intended to protect soil stability, prevent pollution, and "preserve and protect those natural assets of soil, water, forest, wetlands, wildlife, and wildlife habitat located in the vicinity of the area being excavated." *Id.* The regulation authorizes the city to deny excavation permits "when the excavation would substantially damages any known aquifers, or future well sites, or surface water supplies." *Id.* §102-1359(7).

71. It is important to recognize the relevance of location to both local perspective and ecosystem services benefits. J.B. Ruhl observes that, at the core of ecosystem services, three disciplines merge:

> [E]cology, to understand the ecological structures and processes that produce and deliver ecosystem services; economic, to understand how those delivered ecosystem services provide value to human beneficiaries; and geography, to understand where the 'natural capital' providing services is located, where the beneficiaries of ecosystem services are located, and how the services flow from the former to the latter.

J.B. Ruhl, *Ecosystem Services and Federal Public Lands: Start-up Policy Questions and Research Needs*, 20 DUKE ENVTL. L. & POL'Y F. 275, 277-78 (2010).

Of course, the authority to monitor and regulate environmental quality and the relationship between environmental and human health is widely distributed across many levels and types of governmental entities.[72] However, local governments are ultimately responsible for planning the layout of lots and neighborhoods, providing essential governmental services, and determining how both green and grey infrastructures will serve community needs. Local governments must determine how to comply with the environmental mandates of higher levels of government and how to pay for environmental solutions. Local communities provide the locations where drought and floods occur, homes submerge, and landslides demolish. Local communities are the most profoundly impacted by the cooling effect of tree shade, wetland impacts on hydroperiods, and the quiet of an isolated species population in a fragmented habitat. Local governments determine the location of fences and trees, the size and number of new homes, and traffic speed. As John Nolon explains:

72. Local authority to regulate ecosystem services may depend on the mechanics of federalism and state authority. Local governments in many instances derive their authority or duty to regulate environmental impacts from state delegation, yet in other instances they are empowered under "Home Rule authority" or the police power to protect the general welfare from environmental degradation. In some states, local environmental decisions may be subject to state oversight or appellate review, while in others such decisions are reviewable only in court. No two systems are alike, and as such, this section only introduces the subject with a brief account of the framework in which local environmental decisions are made. Nolon, *supra* note 5, at 385-86. Some courts have observed that ecosystem services protection arises under the general police powers, instead of the more restricted delegation of authority to local governments over land use control. *See, e.g.*, N.J. Shore Builders Ass'n. v. Twp. of Jackson, 970 A.2d 992, 992 (N.J. 2009) (finding that the protection of ecosystem services from tree canopy was justified under the Township's police powers and was not restricted under the state's general land use law). Of course, the analysis in this Article concerning the distance between interest and attachment of governmental entities to ecosystem services values might be extended further to encompass the overlapping and often conflicting spheres of authority over the environment. Notably absent from this Article are the varieties of environmental regulation undertaken at the state level. Although consideration of the roles that states play in environmental regulation has become increasingly critical to understanding the subject matter (including actions of states that affect local environmental regulation), such consideration will be left for future research.

> One of the lessons learned from examining the wide variety of adopted local environmental laws is how varied local environmental conditions are. The diversity of local conditions such as climate, terrain, hydrology, and biodiversity, suggests that centralized approaches to environmental protection are not necessarily desirable when dealing with environmental problems. By supporting innovation at the local level, citizens are encouraged to determine for themselves what is acceptable in their communities. Their local environmental laws will define the linkages between what is built and what is natural and the separations needed between the two. By codifying environmental expectations in local law, today's citizens will establish and pass along their understanding of environmental protection through the local development patterns and the preserved landscapes that their laws create.[73]

From the ecosystem services perspective, this means that local governments bear the burden of ecosystem value: functioning ecosystems serve local environmental conditions first, and as such, may be conflated to symbolize local economic advantages.[74]

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73. Nolon, *supra* note 5, at 415. The EPA has also observed that the relationship between local environmental circumstances and local identity, culture, and community is inevitable:

> It is important to note that all community characteristics are inextricably linked and influence each other. For example, the geographic boundaries of a rural community surrounded by mountains or a river might strongly influence residents' level of environmental awareness and values. People might live there because they enjoy and appreciate the natural environment. The value they place on the natural beauty of the mountains might influence their art, their community celebrations, even how their schools and businesses operate. Because they want to live in this area, residents might be willing to be underemployed, have seasonal employment schedules, or commute to job centers outside the community.

U.S. EPA, OFFICE OF WATER, *supra* note 56, at 49.

74. *See* VanderVelde, *supra* note 35, at 1059 ("local law is of particular relevance because many Americans are affected more directly by local zoning law than by more remote federal laws"). For instance, an ecosystems service analysis of water provision reveals the relationship between a functioning green infrastructure and the local costs of maintaining a built infrastructure:

> [E]cosystems are able to naturally both supply and then filter water for human use. One way to understand the economic value of intact watersheds is to compare it to the cost of building and maintaining

When local governments incorporate the value of ecosystem services into their governance, they can capture the value of ecosystem services and "maximize the efficient use of natural capital."[75]

As Lea VanderVelde has noted, "[f]ew things excite individuals as greatly as the affairs of their immediate community."[76] Local governments are answerable to their residents for public expenditures on infrastructure and environmental hazard response, and also must account for the new ecosystem impacts caused to green and grey infrastructure from the approval of new development. Although this is a different notion of "voice" discussed above, it is nonetheless an issue pervading local government decision-making. Taking seriously Carol Rose's warning about the responsiveness of land use regulations to local voice means recognizing that communities largely participate in politics through their local governments.[77] Where residents do not feel their voice is being heard locally, their resolve amounts to exit, an attack on local governmental legitimacy. The recent wave of compensation legislation, adopted both through state legislative bodies and voter initiatives, could be explained as attempts to exit the local government process.[78]

Based on the foregoing, it is here suggested that the ecosystem services approach is friendly to the operations of local

> water supply and treatment facilities. To the extent that loss of ecological systems results in reduced supply, value can also be ascertained through the cost of having to import water from elsewhere.

EARTH ECONOMICS, *supra* note 68, at 39. When local governments recognize and act on such knowledge, they can serve as driving forces in the transition to ecosystem services. *See* Colburn, *supra* note 8, at 982-83 (noting that "it is in their entrepreneurialism of place that suburban and exurban municipalities represent perhaps the surest source of countervailing power to an increasingly globalized mass market economy.").

75. TEEB, *supra* note 54, at 19. Experience is showing that "the valuation of ecosystem services has stimulated the implementation of policies that reward those responsible for protecting those services." *Id.* at 20.

76. *See* VanderVelde, *supra* note 35, at 1060.

77. *See* Carol M. Rose, *Planning and Dealing: Piecemeal Land Use Controls as Problem of Local Legitimacy*, 71 CAL. L. REV. 837, 883–86 (1983).

78. For this suggestion in the context of compensation legislation, see generally Keith H. Hirokawa, *Property Pieces in Compensation Legislation: Law's Eulogy for Oregon's Measure*, 38 ENVTL. L. 1111 (2008).

government. The approach allows local governments some degree of latitude in identifying the types of advantages (ecological, economic, and social) that suit their communities. Where ecosystems can fill an economic need, local governments have set examples in their innovative regulatory schemes aimed at capturing the advantages of ecosystem function.[79] In addition, because this analysis is situated, and is therefore local, local governments can adopt an ecosystem services perspective without risking a sacrifice of discretion over the identification of local needs.

III. ADVANCING THE (LOCAL) PUBLIC WELFARE BY PROTECTING ECOSYSTEM SERVICES

The point made in the preceding section – that local governments are ecologically dependent, and so local environmental law will bear a relationship to the given community context – is illustrated in the types of environmental regulations that are found in local regulatory schemes. Of course, not every local ordinance is driven by the capture of ecosystem services: the approach remains young, and although several of the regulations reported in this article are commonplace, others are quite novel and represent innovative methods of relating to ecosystems. As such, there is no single way to implement the ecosystem services approach,[80] a point that is made poignant by the range of ecosystem needs that arise in local politics, local development, and local economics. Although the ecosystem services presented here by no means exhaust the range of ecosystem benefits that are felt locally in communities, and although the tools discussed herein merely scratch the surface of contemporary local environmental law, these examples illustrate

79. This article does not address the more incentive-based tools that are being used to foster an ecosystem services-based understanding of multi-functionality in ecosystems, their conversion, and their use. *See*, *e.g.*, J.B. Ruhl, *Agriculture and Ecosystem Services: Strategies for State and Local Governments*, 17 N.Y.U. ENVTL. L.J. 424, 429 (2008) (discussing the potential of "transferable development rights" (TDR) and "payments for ecosystems services" (PES) programs to protect multifunctionality).

80. WORLD RES. INST., ECOSYSTEM SERVICES: A GUIDE FOR DECISION MAKERS 2 (2008).

the variety of ways that local governments have occupied the regulatory arena to protect local values, landscapes, and quality of life derived from ecosystem services.

A. Planning for Ecosystem Benefits

As a general matter, a study of effective local environmental laws should begin at how local governments can address ecosystem services through planning. For the most part, local governments are familiar with the process of memorializing long-term community visions in a comprehensive plan.[81] Communities have benefitted from the local exercise of planning and zoning powers to insure quality of life and anticipate social, economic and environmental changes. From the ecosystem services perspective, planning is the process of identifying, securing, and enjoying ecosystem services on a community-wide scale.

In the comprehensive planning process, local governments can inventory community assets and opportunities, organize the interaction of different community elements, manage changes in the community, and defray the costs of new growth. Consider John Nolon's description of land use planning:

> City planning is a science and an art concerned primarily with the city's ever-changing pattern. As a pure science, it examines causes (history and etiology) and reciprocal influences of man and environment (urban geography and ecology). As applied science, it synthesizes these findings with those of the economic, sociological, and political sciences as well as the technological branches of statistics, civil and sanitary engineering, architecture, landscape architecture, and other pertinent branches of human knowledge, in an attempt to thoroughly understand conditions and their contexts and trends. As an art, it utilizes these materials, instructs or organizes citizens, molds

81. The police power has long supported a local prerogative in designing communities. *See, e.g.*, *Euclid*, 272 U.S. 365, 387-88 (1926).

> events, and thwarts or guides trends to bring about the changes in city design which it contemplates.[82]

Planning is the essential starting point for ecosystem services analysis, and it is a familiar tool for many local governments.

For most ecosystem services decisions, local governments can improve the receipt of ecosystem benefits by engaging in the planning process. In many communities, ecosystem services have been placed at the forefront of the planning agenda where the capture of ecosystem benefits can be coordinated with the community's vision for land use, economic development, housing, infrastructure, and other community elements. For instance, urban forestry (often considered an ecosystem services exercise)[83] has been defined as "a planned and programmatic approach to the development and maintenance of the urban forest, including all elements of green infrastructure within the community, in an effort to optimize the resulting benefits in social, environmental, public health, economic, and aesthetic terms, especially when resulting from a community visioning and goal-setting process."[84] From this perspective, urban forestry is practiced as a community-building exercise: local governments seek understanding, participation, and consensus on the manner in which this ecosystem feature is valued in the community.[85]

The planning process provides three distinct advantages over non-planning approaches to local environmental law. First, as one of the most important and far-reaching consequences of ecosystem services planning, local governments may use the planning process as an opportunity to inventory and integrate ecosystem services information with a comprehensive assessment of challenges to ecosystem integrity that may be found in the local government's plans for future growth. This may include the relationships between development trends, legal protections for

82. John R. Nolon, *Comparative Land Use Law: Patterns of Sustainability*, 37 URB. L. 807, 818-19 (2005).

83. Urban forestry is more concerned with services than goods. CITY OF SEATTLE URB. FOREST COAL., URBAN FOREST MANAGEMENT PLAN 13 (2007).

84. Cheryl Kollin & James Schwab, *Bringing Nature Into the City*, *in* PLANNING THE. URBAN FOREST: ECOLOGY, ECONOMY, AND COMMUNITY DEVELOPMENT 1, 3 (James Schwab ed., 2009).

85. *Id.* at 18.

destructive activities, and failing ecosystems. An accurate and appropriate inventory of local ecosystem services can help to identify circumstances in which education, regulations, or ecosystem acquisition become necessary elements in a strategy to maximize ecosystem services benefits.[86]

For instance, the City of Baltimore drew up and adopted its Sustainability Plan in 2009 as an element of its Comprehensive Plan.[87] The city conceived its sustainability plan as an opportunity to assess the city's environmental health, engage the community in visioning the city's well-being, and coordinate its sustainability opportunities with land use and infrastructure planning. Through such coordination, Baltimore was able to contemplate a pluralistic strategy designed to minimize the impact of urban life on the city's natural capital (such as reducing carbon emissions, water pollution, and indoor and outdoor air quality),[88] enhance the city's natural environment to improve its natural capital base, and maximize the city's ecosystem services benefits by prioritizing ecosystem investments to suit the city's needs.[89] An analysis of watershed regulation on private lands might encourage local governments to adopt land use regulations to curtail private interference with ecosystem services, but it might also compel local governments to purchase (through negotiation of eminent domain) interests in such lands to insure uninterrupted services from the relevant properties. Likewise, incorporation of the region's water supply needs into the comprehensive planning process helps to insure that new growth does not overappropriate the water needed over the lifespan of the plan.[90]

86. *See* Ruhl, *supra* note 71, at 282-83 (explaining the importance of establishing ecosystem services baselines); *see also* Lord et al., *supra* note 54, at 338-39 (discussing how the Charles River Watershed Association in Newton, Massachusetts, sought to "turn the planning paradigm on its head" by starting the planning process with an ecosystem inventory).

87. BALTIMORE CITY PLANNING COMMISSION, *supra* note 1, at 14.

88. *Id.* at 40-47.

89. *Id.* at 70-81.

90. For instance, the Water Conservation Plan prepared by the City of Greeley, Colorado designs future actions based on an assessment of existing and projected local water needs and supplies, compared to the existing and projected land uses in the region. PETER MAYER & RUTH QUADE, WATER CONSERVATION

Second, the planning process affords an opportunity to publicly recognize the economic value that local ecosystem services add to the community. For example, Roanoke, Virginia cooperated with American Forests in the preparation of an Urban Ecosystem Analysis to inform the locality's future land use decisions.[91] The analysis, which was intended to supplement the Urban Forestry component of the City's comprehensive plan,[92] measured the attractiveness (e.g., property value and tourism) and function (e.g., storm water retention, shade, erosion control, and pollution mitigation) of the City's urban forest. In addition to recognizing the positive correlation between urban trees and property value,[93] the City found substantial value in stormwater control services retention capacity at $128 million, and pollution sequestration potential at an annual value of $2.3 million.[94] Roanoke subsequently adopted a goal of increasing tree canopy coverage from 32% to 40% within ten years. Roanoke is not alone. In many cases, such as the protection of the Bull Run watershed by Portland, Oregon, evidence of the substantial

PLAN - CITY OF GREELEY, COLORADO 5-6 (2008), *available at* http://greeleygov.com/Water/Documents/CONSERVATION_PLAN_FINAL_3-9-09.pdf. In coordination with the city's Urban Growth Boundary, the plan provides an inventory of present and future water sources and demands and identifies several strategies for reducing overall demand by a targeted 8%. *Id.* The plan is integrated with the city's water waste ordinance and provides for funding, public education, incentives for using water efficient appliances, water use monitoring, reclaimed water use, and free water efficiency audits for residents. *Id.* at 25, 28. It was adopted pursuant to COLO. REV. STAT. § 37-60-126. *Id.* at 40.

91. *See generally* AM. FORESTS, URBAN ECOSYSTEM ANALYSIS: ROANOKE, VIRGINIA: CALCULATING THE VALUE OF NATURE 10 (2002), *available at www.americanforests.org/downloads/rea/AF_Roanoke2.pdf*.

92. *See generally* URB. FORESTRY TASK FORCE & ROANOKE DEP'T OF PARKS & RECREATION, URBAN FORESTRY PLAN: AN ELEMENT OF THE VISION PLAN (2001), *available at* http://www.roanokeva.gov/85256a8d0062af37/CurrentBaseLink/8D2C6A9F1AD34DE5852576040062E281/$File/Urban%20Forestry%20Plan.pdf.

93. *Id.* at 1. The plan's introduction states that what once constituted quality of life for its citizens has changed since the City grew in the "middle 1900s." As "wide paved streets" and "asphalt, cement and utilities" were important at that time, the City now planned to "to direct public resources to such issues as, removal of toxins, stormwater runoff reduction, and protection of our rivers." *Id.*

94. AM. FORESTS, *supra* note 91, at 4 (finding that the urban forest provided stormwater retention services equivalent to $128 million in built facility services and pollution sequestration potential at an annual value of $2.3 million).

economic value of local ecosystem services compels local governments to engage in ecosystem investments.[95] In others, such as the watershed investments made by New York City in the Catskills, past investments are demonstrating their worth.[96]

Third, regulatory programs that are supported by the planning process are more likely to produce effective ecosystem service tools: the local planning process is generally flexible and adaptive. Seattle's urban forest planning experience provides an example. For over a century, Seattle benefitted from a host of private and public beautification projects, including tree plantings in street medians in 1903, the 1962 Seattle World's Fair, and "Operation Green Triangle" projects in 1967.[97] In 1994, the city specifically identified trees as infrastructure assets[98] and began a productive history of local and regional partnerships aimed at educating the public and populating the area with trees.[99] Then, in 1999, American Forests was retained to analyze and report on the city's canopy cover. The report concluded that Seattle lost approximately 46% of its dense tree cover and 67% of its medium tree cover in the years between 1972 and 1996.[100] It was estimated that this loss in canopy amounted to approximately $1.3 million annually in stormwater control and

95. The City of Portland, Oregon spends almost $1 million annually to protect the Bull Run watershed to maintain the filtration benefit to Portland's water supply. In contrast, operating costs of water filtration facilities can reach $750,000 in Portland, Maine, $3.2 million in Salem, Oregon, and even $300 million in New York City. DOUGLAS KRIEGER, ECONOMIC VALUE OF FOREST ECOSYSTEM SERVICES: A REVIEW 10 (2001).

96. TEEB notes that "the cost of this choice, between US$ 1 billion and US$ 1.5 billion, contrasts with the projected cost of a new water filtration plant at US$ 6 billion to US$ 8 billion, plus US$ 300 million to US$500 million in estimated annual operating costs. Water bills for New Yorkers went up by 9%, rather than doubling as they would have if a filtration plant had been built." TEEB, *supra* note 54, at 20.

97. CITY OF SEATTLE URB. FOREST COAL., *supra* note 83, at 15.

98. *Id.*

99. *Id.* at 49-50 (detailing the cooperation of the city with the Weyerhaeuser Company, the Seattle Chamber of Commerce, the Cascade Land Conservancy and others).

100. *Id.* at 18 (citing the American Forest Group's 1999 analysis of urban tree cover).

$226,000 in healthcare costs related to air pollution.[101] Based on an analysis of tree services and a projection of benefits, Seattle estimated that an increase in canopy coverage from 18% to 36% would more than double the environmental and economic benefits accruing to Seattle residents.[102] In the final version of Seattle's Urban Forest Management Plan, the city adopted a canopy cover goal of 30% by 2037. Importantly, this aggressive goal was informed by an inventory of planting and canopy coverage capacity by land use type.[103] The plan also adopted guiding principles to help direct the improvement goals and incorporated collaboration and public education components into the plan.[104]

Although Seattle's plan was aggressive, its most important characteristic was flexibility; the plan was intended to be adaptive.[105] In 2009, the Seattle City Auditor reviewed the City's forest management efforts and identified major challenges to the plan's implementation.[106] Among other things, the Auditor was concerned with the lack of centralized control of the program, a need for a more accurate inventory of city-owned trees, and inadequate regulations for protecting tree canopy. In addition, the Auditor noted a lack of public understanding for the value of

101. *Id.* The following year, Cascadia Consulting prepared a "Sustainability Matrix" for Seattle's urban forestry efforts and concluded that American Forests might have underestimated the ecosystem services value. CASCADIA CONSULTING GROUP, SEATTLE URBAN FOREST ASSESSMENT: SUSTAINABILITY MATRIX 5 (2000) ("Urban forest systems contribute tremendous value to the City of Seattle. Seattle's asset basis is conservatively estimated at $635 million. In addition, Seattle' trees increase assessed property valuation by up to $630 million, thus boosting city property tax revenues to approximately $131 million. Finally, trees provide ecological services. It is estimated that $42 is the estimated annual savings in air quality and storm water management remediation provided by existing trees.").

102. CITY OF SEATTLE URB. FOREST COAL, *supra* note 83, at 20.

103. *Id.* at 59-94.

104. *Id.* at 55-58.

105. *See* Robin Kundis Craig, *"Stationarity is Dead" – Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 9 (2010) (arguing, in part, for informed and principled flexibility when dealing with climate change impacts).

106. URBAN FOREST MANAGEMENT PLAN: 5-YEAR IMPLEMENTATION STRATEGY 8 (2010), *available at* http://www.seattle.gov/trees/docs/5%20Year%20Implementation%20Strategy%202010-2014.pdf.

trees in the community.[107] Also, in 2009, a canopy analysis revealed a .4% increase in coverage from 2002 to 2007. Such modest gains suggested that the 30% goal would not be met, and that a shorter planning horizon was needed to realize an effective implementation strategy.[108] Given these challenges, it was concluded that Seattle's Urban Forest Plan was in need of a shorter planning horizon to remain effective.

The perspective needed to recognize the shortcomings and needed revisions is one that arises in the planning context. Seattle's foresight and planning approach allowed the city to respond to this type of news. The interdepartmental group tasked with managing urban forest progress makes annual reports to the city and annually revises its work plan to accommodate needs and resources.[109] The City also approved the creation of an Urban Forestry Commission to review the City's regulations, investments, and opportunities.[110] The Commission has indicated that its involvement will increase the City's appreciation for ecosystem services.[111]

Finally, because of the importance of municipal boundaries to local needs of economic development, the economic opportunities presented by ecosystem goods, and the relationship of boundaries to local identity, local governments that engage in ecosystem services planning are more apt to recognize that too political or parochial (in the bad sense of the term) a perspective on boundaries may serve as an obstacle to the continuing receipt of ecosystem benefits. This is especially so where ecosystems

107. *Id.* at 8.

108. *Id.* at 1.

109. *See* Seattle reLeaf, *Work Plans*, SEATTLE.GOV, http://www.seattle.gov/trees/workplans.htm (last visited Apr. 7, 2011).

110. Seattle, Wash., Ordinance 123,052 (Aug. 3, 2009), *available at* http://www.seattle.gov/trees/docs/TREE%20CMSN%20ORDINANCE%20FINAL.pdf. For the Commission's vision and workplan, see generally SEATTLE URB. FORESTRY COMM'N, FIVE-YEAR WORK PLAN (2011-2015) (2010), *available at* http://www.seattle.gov/trees/docs/Commission_docs/SUFC_Work_Plan%202011_2015%20Approved%20110310.pdf.

111. For the Commission's comments on the City's proposed tree regulation revisions, see Letter from Seattle Urb. Forestry Comm'n, to Richard Conlin, Chair, Reg'l Dev. & Sustainability Comm. (Oct. 20, 2010), *available at* http://www.seattle.gov/trees/docs/Commission_docs/Adopted_TPO_letter_Final_102010.pdf.

interact beyond political boundaries, in which the functionality of ecosystems may be dependent on management decisions made by entities in other jurisdictions. Such circumstances call for cooperation and collaboration between neighboring local governments, as seen in the Green Infrastructure Plan prepared in Saratoga County, New York:

> The plan builds upon local conservation goals and efforts to create regional priorities. This plan advances the concept of "borderless communities" in Saratoga County. Green infrastructure resources, such as rivers, wetlands, and even farmlands, do not always follow local municipal borders. In fact, the resources and economics of the region are more often unifying and cohesive, rather than divisive and fragmented. Often, it makes sense for several communities to collaborate to conserve a regional resource such as a greenway or natural area. This plan helps to identify these regional resources and provides a framework for communities to work together, with county leadership, to achieve a common goal.[112]

In many cases, forest, wetland, or watershed services may provide a more direct benefit to a particular community or local government. The fear, then, is that extra-jurisdictional dynamics will toll against cooperation in the management of ecosystem function. Yet the planning experience in Saratoga County illustrates that cooperation can enable local governments to maximize the benefits of ecosystem services, and that where local governments adopt models of regional governance to face ecosystem needs, they can do so without shedding their parochial perspective.[113]

112. SARATOGA CNTY., N.Y., GREEN INFRASTRUCTURE PLAN FOR SARATOGA COUNTY ii (2006).

113. Obviously, there will be instances in which regional cooperation will be complex, such as in those instances in which future land use plans propose changes that threaten ecosystem services that have historically benefitted other, neighboring jurisdictions "for free." Yet, the ecosystem services perspective improves the status quo by compelling the benefitting community to value the services (and their potential loss) and recognize the value of participation with neighbors in furtherance of protecting ecosystem function.

B. Regulating Ecosystem Services

Although land use planning should play a vital role in setting the goals of ecosystem services regulations, much of local environmental law recognizes that ecosystem services goals are set in a context of balancing property boundaries and exclusionary rights with the ecological processes occurring in stormwater basins and watersheds. Indeed, in many cases, the continuing receipt of ecosystem services will depend on the manner in which local governments regulate land use activities and their impacts on private lands. Some local governments have designed their regulatory programs for the specific purposes of protecting ecosystem functions and preventing private interference with the public receipt of ecosystem services.

This section offers examples in which the importance of ecosystem services has been integrated into local regulations and decision-making.[114] Local wetlands regulations illustrate an opportunity to recognize that both ecosystem structure and function are relevant to local concerns. Urban forest planning has become an accessible means of associating green communities with economically advantageous ones. Riparian ecosystem protection, particularly by buffering riparian areas from the impacts of the built environment, produces a variety of co-benefits[115] to the community. Watershed protection illustrates how local governments can think outside of jurisdictional boundaries and outside of regulation to insure local well-being. Finally, the local regulation of special places illustrates the variety of ways that communities identify with local ecosystems.

1. Environmental Structure, Ecological Function, and

114. Although important, this article does not address the local interest in payments for ecosystem services ("PES") or a variety of interesting tools that may be fruitfully used in ecosystem services regulation, such as transferable development rights ("TDR").

115. Andrew Long, *Integrating Non-State Governance and Public International Law in Climate Forests: A Proposal for Certification to Trigger Public REDD Funding for Adaptation Cobenefits*, 41 ENVTL. L. (forthcoming 2011) (analyzing the importance of accounting for co-benefits in a consideration of public and private investment strategies in climate change adaptation strategies).

Wetlands

One of the important features of ecosystem service protection – one that is relevant to local environmental protection – involves grasping the relationship between the terms "ecosystem structure" and "ecosystem function."[116] A discussion of ecosystem structure focuses on the component parts of a given ecosystem. Ecosystem function describes the processes of ecosystem components, including how the various parts work together and relate to what is produced by ecosystems. Working together, ecosystem structure and function comprise the ability of an ecosystem to deliver goods and services.

Environmentally-protective laws have historically focused on maintaining the integrity of ecosystem structure: past environmental laws have insisted on defining wetland boundaries, counting and marking trees, protecting particular wildlife, and so on.[117] In some ways, the local appreciation of

116. A recent National Research Council publication explains the features of ecosystem services as follows:

> *Ecosystem structure* refers to both the composition of the ecosystem (i.e., its various parts) and the physical and biological organization defining how those parts are organized. A leopard frog or a marsh plant such as a cattail, for example, would be considered a component of an aquatic ecosystem and hence part of its structure. *Ecosystem function* describes a process that takes place in an ecosystem as a result of the interactions of the plants, animals, and other organisms in the ecosystem with each other or their environment. Primary production (the process of converting inorganic compounds into organic compounds by plants, algae, and chemoautotrophs) is an example of an ecosystem function. Ecosystem structure and function provide various *ecosystem goods and services* of value to humans such as fish for recreational or commercial use, clean water to swim in or drink, and various esthetic qualities (e.g., pristine mountain streams or wilderness areas).

NAT'L RESEARCH COUNCIL, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISION-MAKING 1 n.1 (2004).

117. As Robin Kundis Craig notes, "regulatory fragmentation . . . . Is a prominent feature of environmental and natural resources law." Craig, *supra* note 105, at 60; *see also* Keith H. Hirokawa, *Three Stories about Nature: Property, the Environment, and Ecosystem Services*, 62 MERCER L. REV. (forthcoming 2011). From the ecosystem services perspective, ecosystem structure is merely an indicator for ecosystem functionality, and the regulation of ecosystem function will not always provide effective protection of ecosystems.

ecosystem services bears the structural focus that is characteristic of federal environmental law. Many local regulations are concerned with specific, discrete, and conceptually severable environmental units: common local environmental laws regulate the taking of a tree or pushing soil. However, some local governments have crested the fragmented perspective to regulate ecosystem function in a performance-based manner, where regulations are triggered by the significance and extent of an activity's impacts on ecosystem processes. In these instances, local governments provide more effective protection of ecosystem services by regulating ecosystem functionality.[118]

Wetland regulation provides an example of the need to incorporate both structure and function into the regulatory system. Wetlands[119] store and transport water, support plants

The problem is in identifying an appropriate proxy. Hence, the practice of counting trees or nests, or measuring the linear width or acres of habitat, will not necessarily provide evidence of an activity's impact on ecosystem functionality. *See* Bradley C. Karkkainen, *Bottlenecks and Baselines: Tackling Information Deficits in Environmental Regulation*, 86 TEX. L. REV. 1409, 1439 (2008) (describing the "piecemeal" regulation of individual stressors and allocation of decision making authority "among a variety of mission-specific agencies and resource-specific management regimes.").

118. It is similarly important to recognize the differences between the terms "ecosystem services" and "ecosystem function." As explained by the EPA Science Advisory Board, ecosystem functions and ecosystem services are not co-extensive, but they are interdependent:

> Ecosystem processes and functions contribute to the provision of ecosystem services, but they are not synonymous with ecosystem services. Ecosystem processes and functions describe biophysical relationships that exist whether or not humans benefit from them. These relationships generate ecosystem services only if they contribute to human well-being, defined broadly to include both physical well-being and psychological gratification.

U.S. EPA, SCI. ADVISORY BD., *supra* note 58, at 12. Assuming that ecosystem function is not valued for providing an ecosystem service unless the service contributes to physical well-being and psychological gratification, it can be concluded that the regulation of ecosystem services will focus on protecting those functions that result in services deemed valuable. In local environmental law, ecosystem services are subject to the additional criterion that they be valuable in a local context.

119. The term "wetland" has been defined to mean those "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

and wildlife, provide transition areas between uplands and watercourses, help capture waterborne sediments and pollutants, and help to recharge aquifers. Given the diverse functions, as well as the importance of location on these functions, an analysis of stream and wetland structure may not be able to capture the value of a wetland. Yet, in *Ohio Valley Environmental Coalition v. Aracoma Coal Co.*, the Army Corps of Engineers approved four mining operations on grounds that buried headwaters streams would be protected through mitigation of stream structure.[120] The Clean Water Act authorizes the Corps to permit the "discharge of dredged or fill material into the navigable waters at specified disposal sites."[121] Although the Corps is required to make factual determinations to ensure that the appropriate wetland values and functions have been considered,[122] the Corps merely required a one-to-one replacement of stream length. As such, the Corps' analysis of replacement of stream *structure* effectively acted as a "surrogate" for analysis of stream function.[123] The ecosystem services critique of the Corps' decision is plain: protection of linear feet of a watercourse fails to account for the loss of services provided by particular streams or wetlands, in particular locations, providing particular functions

Section 404(B)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material,
40 C.F.R. § 230.3(t) (1993).

120. Ohio Valley Envtl. Coal. v. Aracoma Coal Co., 556 F.3d 177, 187 (4th Cir. 2009).

121. Clean Water Act, 33 U.S.C. § 1344(e) (2006).

122. The Corps is required to assess impacts to both structure and function. 40 C.F.R. § 230.11(e); *see also* EPA Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 45 Fed. Reg. 85,336 (Dec. 24, 1980) (codified at 40 C.F.R. § 230.3(t)) (hereinafter 404(b)(1) Guidelines). In addition, the Corps is not authorized to permit an activity that "will cause or contribute to significant deterioration of the waters of the United States" by imposing significant adverse impacts on aquatic life, the diversity, productivity, or stability of ecosystems, or other, more distinctly human values. 40 C.F.R. § 230.10(c).

123. *Ohio Valley Envtl. Coal.,* 556 F.3d at 199. The Fourth Circuit held that, "whatever the role of headwater streams in overall watershed ecology, the Corps is not required to differentiate between headwater and other stream types in the determination of mitigation measures." *Id.* at 203.

and services. Ecosystem structure is related to, but not synonymous with, ecosystem functionality.[124]

There may be administrative, economic, or even (although it may be difficult to imagine) ecological reasons to support the Corps' approach in *Ohio Valley*. Yet, whatever those reasons may be, it is important to note that they are not coextensive with the local government's concern over wetlands.[125] For purposes of this article, it is pertinent that wetlands regulations add value, not just in an abstract or general way, but to particular regions, communities and properties. For instance, a 1990 study of the

124. Robin Kundis Craig, *Justice Kennedy and Ecosystem Services: A Functional Approach to Clean Water Act Jurisdiction After Rapanos*, 38 ENVTL. L. 101, 106-07 (2008) (examining the relationship between wetlands jurisdiction and ecosystem services under the Clean Water Act).

125. Although local governments might be inclined to follow the Corps' determination as a practical matter (and in some cases may be required to do so), it is also like that local governments may be free to follow their own wetlands regulations, especially to the extent that local regulations are more stringent than the federal scheme. *See, e.g.*, *Bd. of Trustees of Vill. of Sackets Harbor v. Sackets Harbor Leasing Co.*, 809 N.Y.S.2d 356, 359 (N.Y. App. Div. 2006) (holding that "the approval of defendant's plan by the Army Corps of Engineers to construct the new docks does not exempt defendant from the requirements of the local law."). This notion has implications throughout environmental law. In *Cary Creek Ltd. P'ship v. Town of Cary*, 690 S.E.2d 549, 549 (N.C. Ct. App. 2010), a developer challenged town ordinances requiring the preservation of riparian buffers. The North Carolina appeals court rejected the contention that state regulation of riparian buffers had a preemptive effect on the town's more stringent regulations. The court found that the statutory scheme contemplated, rather than precluded local participation in habitat regulation: the state's watershed management system requires local governments to establish the minimum protections, but local governments may implement more restrictive local ordinances. *Id.* at 552. The court also rejected the argument that watershed protection is a field in which a state or federal statute clearly shows a legislative intent to exclude local regulation. The same reasoning applies to other matters of local concern. For instance, in *Douglas Disposal, Inc. v. Wee Haul, L.L.C.*, 170 P.3d 508, 511 (Nev. 2007), the plaintiffs sought injunctive relief and damages after independent contractors began operating waste disposal businesses in an area for which the plaintiff held exclusive franchise rights for construction waste collection and disposal. The court noted that because construction waste poses public health and safety concerns, its regulation fell within county's police powers. *Id.* The Nevada Supreme Court held that the regulation of construction waste was justified within the county's police power, and that the county was authorized to enact an ordinance granting an exclusive franchise agreement to the corporation for collection and disposal of waste, notwithstanding the franchise through the state. *Id.*

Congaree Bottomland Hardwood Swamp in South Carolina showed that the eleven-thousand-acre swamp provided the equivalent pollution removal services as a $5 million waste water treatment plant.[126] In Johnson County, Kansas, voters approved a $600,000 levy for development of streamside greenways that may eliminate the need for $119 million in stormwater control facilities.[127] Flood protection services provided by wetlands have been valued between $7,830 per acre and $51,095 per acre in Lynnwood, Washington, and between $41,325 and $48,284 in Renton, Washington.[128] Although ecosystems serve needs beyond jurisdictional boundaries, it is still the case that these values accrue locally: when local governments regulate land uses that interfere with ecological processes to guarantee the receipt of ecosystem benefits, they are engaging in good governance that extends to social, economic, and ecological needs.

A stark contrast to the Corps' approach is found in Branford, Connecticut, which regulates activities that affect wetland functionality. The State of Connecticut authorizes local governments to regulate activities if they affect wetlands, even if they do not occur inside of wetland boundaries.[129] The Branford

126. EPA, *Wetlands and People*, http://water.epa.gov/type/wetlands/people.cfm (last visited Mar. 25, 2011).

127. U.S. EPA, NATIONAL MANAGEMENT MEASURES TO PROTECT AND RESTORE WETLANDS AND RIPARIAN AREAS FOR THE ABATEMENT OF NONPOINT SOURCE POLLUTION 57 (2005) (reporting on the Johnson County Streamway Park System and other projects throughout the county).

128. THOMAS M. LESCHINE ET AL., THE ECONOMIC VALUE OF WETLANDS: WETLANDS' ROLE IN FLOOD PROTECTION IN WESTERN WASHINGTON 37-38, 46 (1997); *see generally* B. Mahon et al., *Valuing Urban Wetlands: A Property Price Approach*, 76 LAND ECON. 100 (2000) (reporting on a story in Portland, Oregon, which showed a $436 property value increase for every one thousand feet closer to wetlands).

129. CONN. GEN. STAT. § 22a-41(6) (2005). The Connecticut Inland Wetlands and Watercourses Act authorizes local governments to regulate freshwater wetlands. Wetlands regulations in Connecticut illustrate an effort to recognize and protect the functions, and not just the structure, of local wetlands. "The inland wetlands and watercourses of the state of Connecticut are an indispensable and irreplaceable but fragile natural resource with which the citizens of the state have been endowed. The wetlands and watercourses are an interrelated web of nature essential to an adequate supply of surface and underground water; to hydrological stability and control of flooding and erosion; to the recharging and purification of groundwater; and to the existence of many forms of animal, aquatic and plant life." *Id.* § 22a-36. The Act was amended in

Inland Wetlands and Watercourses Regulations define regulated "significant activity" to include activities that affect wetlands or watercourses in the area in a manner that creates a human health or welfare risk, impacts surface water flows or groundwater levels, destroys areas of demonstrable scientific, educational or ecological importance, or "substantially diminishes the natural capacity of the inland wetland or watercourse to support fisheries, wildlife, or other biological life, prevent flooding, supply water, assimilate waste, facilitate drainage, provide recreation, open space, or other functions."[130] Wetlands regulation represents one of the more common areas in which local government regulation intersects with the environment, appearing in more than five thousand municipal codes nationwide.[131] Most local schemes recognize that wetlands provide significant habitat sources, groundwater recharge, research and recreational opportunities, aesthetic benefits and increases to property values.[132] Many local governments require

1995 and 1996 to provide local governments with the express authority to regulate areas that extended beyond designated wetland boundaries. *See* 1995 Conn. Acts. 95-383 (Reg. Sess.); *see also* 1996 Conn. Acts. 96-157 (Reg. Sess.).

130. BRANFORD, CONN., INLAND WETLANDS AND WATERCOURSES REGS. § 2.1(qq) (2007). Branford's regulatory approach was upheld in *Queach Corp. v. Inland Wetlands Commission of the Town of Branford*, 779 A.2d 134 (Conn. 2001). The activities in that case occurred *outside* of wetlands, such as development in buffer areas or removal of groundwater. The court responded that, although the regulations indeed required review of a groundwater withdrawal that could affect the services provided by wetlands, the relevant sections of the ordinance "regulate *impacts* on wetlands and watercourses, not groundwater per se." *Id.* at 150. The court recognized that the ecological purposes of the statute would not be served by ignoring activities that have significant *impacts* on wetlands.

131. BOULDER, COLO., WETLAND AND STREAM BUFFERS: A REVIEW OF THE SCIENCE AND REGULATORY APPROACHES TO PROTECTION 4 (2007) (citing JON A. KUSLER, PROTECTING AND RESTORING WETLANDS: STRENGTHENING THE ROLE OF LOCAL GOVERNMENTS (2007)).

132. For instance, the wetlands regulations in LaPorte, Indiana require:

> Planning to avoid or minimize damage to wetlands and lakes; to require that activities not dependent upon a wetland or shoreline location be located at other sites; . . . to make certain that activities affecting wetlands and lakes must not threaten public safety or cause nuisances by: blocking flood flows, destroying flood storage areas, or destroying storm barriers, thereby raising flood heights or velocities on other land and increasing flood damages; causing water pollution through any means [including application of pesticides, increasing erosion, or increasing runoff of sediment and surface

the long-term protection of buffers around wetland areas to protect wetland functions of pollutant removal, temperature and microclimate regulation, and aquatic habitat maintenance.[133] Some jurisdictions administer their wetlands regulations in conjunction with other regulatory schemes, such as urban forest or riparian corridor protections.[134]

2. Greening Communities with Trees

Local governments have long fostered a relationship between community identity and the goods and services of trees. In some towns, trees are specifically associated with logging opportunities, recreational lifestyles, or wildlife habitat. In other areas, trees are valuable service providers. Local governments have identified special trees or other relationships between trees and

water]; and that activities in or affecting wetlands and lakes do not destroy natural wetland functions important to the general welfare.

LAPORTE, IND. CODE §§ 82-563 to -565 (2009).

133. The wetlands protection statutes in New Jersey were adopted in 1987 to "preserve the purity and integrity of freshwater wetlands from random, unnecessary or undesirable alteration or disturbance." N.J. STAT. ANN. § 13:9B-2 (West 1987). The Act authorizes the creation of a "transition area," which is defined as "an area of land adjacent to a freshwater wetland which minimizes adverse impacts on the wetland or serves as an integral component of the wetlands ecosystem." *Id.* § 13:9B-3. Under the statute, transition areas serve several ecological functions, including controlling sediment and storm water flow, "providing temporary refuge for freshwater wetlands fauna during high water episodes, critical habitat for animals dependent upon but not resident in freshwater wetlands" and an area for fluctuations in wetland boundaries over time. *Id.* § 13:9B-16a(1). The statute prohibits certain activities in transition areas, "except for normal property maintenance or minor and temporary disturbances . . . resulting from . . . normal construction activities," or unless a waiver is obtained, including soil disturbance, dumping of filling, construction, pavement placement, certain vegetation destruction. *Id.* § 13:9B-17a.

134. For example, although Summit County, Ohio has not adopted independent wetlands regulations, an application for subdivision or a site plan must identify wetlands boundaries based on a wetland delineation, and where wetlands occur in riparian buffers; the county provides additional wetland buffers beyond those applicable to the riparian area according to the wetland type. SUMMIT CNTY., OHIO, CODE § 937.05(e)(3) (2002).

aesthetics.[135] Durham County, North Carolina protects tree stands for a wide variety of benefits:

> Tree coverage serves to reduce glare, noise, air pollution, and soil erosion; to moderate temperatures; to reduce stormwater runoff; to preserve remnants of Durham's native ecology; to provide habitat for native plants and wildlife; to provide a healthy living environment; and to make Durham County a more attractive place to live.[136]

To secure these benefits, local governments engage in tree planting, require new developments to incorporate landscape design into their development plans, and prohibit or regulate tree cutting and harvesting.

This process begins with an inventory of natural capital. The Forest Service took this initial step by auditing the urban forest in Brooklyn. The Forest Service's study, which focused on those ecosystem services that could be derived from the existing urban forest structure, found that approximately six hundred and ten thousand trees provide a canopy over 11.4% of Brooklyn.[137] The Forest Service set its estimate of the compensatory value of Brooklyn's urban forest at $679 million.[138] The Forest Service recognized in its appraisal the value of Brooklyn trees and shrubs' ability to remove approximately seventy-six metric tons of ozone, sixty-eight metric tons of particulate matter, sixty-three metric tons of nitrogen dioxide, thirty-three metric tons of sulfur dioxide, and fifteen metric tons of carbon monoxide each year, at a combined value of $1,309,000 in 1994.[139] The Forest Service also estimated that Brooklyn's urban forest contributes $3.5 million in carbon storage services.[140]

135. Echevarrieta v. City of Rancho Palos Verdes, 103 Cal. Rptr. 2d 165, 170 (Cal. Ct. App. 2001) (upholding the police power basis for tree regulations intended to preserve views).

136. DURHAM COUNTY, N.C., UNIFIED DEVELOPMENT ORDINANCE § 8.3.1.A (2000), *available at* http://www.ci.durham.nc.us/departments/planning/udo/.

137. DAVID J. NOWAK ET AL., BROOKLYN'S URBAN FOREST 23 (2002), *available at* http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/2002/gtrne290.pdf.

138. *Id.*

139. *Id.* at 46.

140. *Id.* at 20.

Local governments are typically the first to experience the economic benefits of maintaining functional local forest resources. Urban forests are thought to engender a sense of local identify and facilitate community building[141] and mitigate the psychological and emotional trauma of urban life.[142] Evidence suggests that urban forests enhance property values.[143] In addition, urban forests provide ecosystem services as they "aid in stabilizing the environment's ecological balance by contributing to the processes of air purification, oxygen regeneration, groundwater recharge, and stormwater runoff retardation, as well as aiding in noise, glare, and heat abatement."[144] Local governments can capture these benefits through regulations that

141. SONOMA, CAL., MUN. CODE § 12.08.010 (1998) ("[T]rees in the community and in the neighborhood provide a sense of identity and tradition and enhance property values."); MYRTLE BEACH, S.C., MUN. CODE § 903.1 (2010) (purposes of the ordinance include "to create special places that are inviting; to create a civic identity").

142. VENETA, OR., MUN. CODE § 8.10.010(2) (2008) ("[Trees] provid[] natural beauty and contrast to the built environment which contributes to the physical and mental well-being of residents."); KNOXVILLE, TN, CITY CODE § 14-27 ("The purpose and intent of this article is to encourage the preservation and protection of trees within the city because of the unique benefits they provide the community in . . . providing citizens with psychological relief from the increasing complexities of the manmade urban environment."); ISSAQUAH, WASH., MUN. CODE § 18.12.010.C.2 (2011) (purpose is to "provide visual relief from large expanses of parking areas and reduction of perceived building scale.").

143. ISSAQUAH, WASH., MUN. CODE § 18.12.010.C.6 (1978) (purposes include to "maintain and protect property values and enhance the general appearance of Issaquah.").

144. JACKSON CNTY., FLA., CODE § 74-201(3) (1996). Carbon storage and sequestration - is an additional, well-understood service provided by trees, both in general and in urban forests. *See generally, e.g.*, David J. Nowak & Daniel E. Crane, *Carbon Storage and Sequestration by Urban Trees in the USA*, 116 ENVTL. POLLUTION 318 (2002). Carbon sequestration remains a difficult service to value. However, the Intergovernmental Panel on Climate Change ("IPCC") reviewed estimates of the cost of carbon and concluded on an admittedly underestimated value of $12/ton. IPCC, *Summary for Policymakers*, http://www.ipcc.ch/pdf/assessment/ar4/syr/ar4_syr-spm.pdf (last visited Mar. 30, 2011). In 2007, the U.K. Department of Treasury offered an economic analysis in which the cost of unmitigated climate change would be equivalent of a 5% to 20% reduction in global economic output. NICHOLAS STERN, STERN REVIEW: THE ECONOMICS OF CLIMATE CHANGE vi (2006), *available at* http://webarchive.nationalarchives.gov.uk/20110218152924/webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm.

facilitate ecosystem management, and can do so in a way that has significant and positive economic consequences.[145]

Under the most common tree protection ordinance, an application for tree removal is assessed to determine the effect of the tree loss and whether the proposed removal will be appropriately mitigated. The Atlanta, Georgia tree protection ordinance, which establishes a policy of "no net loss of trees within the boundaries of the city,"[146] is triggered by moving, destroying, or injuring any protected tree located on public property without a permit, or any private tree that is six inches in diameter at breast height without a permit.[147] Under the ordinance, applicants can seek removal of a diseased tree or one that impedes on a building site[148] through the approval of a tree replacement plan.[149] The application itself must identify each tree by species, diameter, location, and characteristics and markings.[150] Likewise, the tree protection ordinance for Grand Rapids, Michigan sets out to accomplish environmental improvements in quality of life, stormwater quality, air quality, landscaped areas for shade and "visual relief," and energy

145. Of particular interest is the tree protection scheme adopted by the Township of Jackson, New Jersey. In its tree protection ordinance, the Township declares that its trees are "important cultural, ecological, scenic and economic resources" and regulates land-uses to preserve tree canopy, biomass production, air filtering and oxygen production. JACKSON, N.J., ADMIN. CODE §100:A (2003). To protect these values, tree removal applications must be accompanied by a reforestation plan may be denied where the proposed activity indicates "any negative effect upon ground and surface water quality, specimen trees, soil erosion, dust, reusability of land, and impact on adjacent properties." *Id.* The Ordinance was upheld by the New Jersey Supreme Court in *New Jersey Shore Builders Association. v. Township of Jackson*, 970 A.2d 992 (N.J. 2009).

146. ATLANTA, GA. MUN. CODE § 158-28 (2007).

147. *Id.* § 158-101(a).

148. The tree must be located within the area where the applicant can build as set out by their valid "building, landscaping, or other permit;" and/or the tree is be located in a spot that "must be used for vehicular ingress and egress;" or the tree will die from disease or injury within two years, is in "imminent" danger of falling, or is in dangerous proximity to existing or proposed buildings; or the tree "interferes with utility services in a manner that cannot be corrected by anything less than destruction or removal of the tree . . ." and/or the city arborist or city forester deems the tree a hazard. *Id.* § 158-102(3)(a)-(c).

149. *Id.* §§158-101(c)(2) to 102(a)(1).

150. *Id.* § 158-101(c)(1).

consumption required for heating and cooling.[151] The ordinance applies to construction or "any change to the use of a lot,"[152] and requires preparation of a site plan that identifies the existing vegetation, impacts, and mitigation measures.[153]

From the ecosystem services perspective, the goal of such regulation is to maximize the benefits that the community receives from ecosystem processes. Successful urban forest programs focus their efforts toward achieving forest diversity, connectedness, and health and productivity.[154] To implement urban forest planning, local governments regulate beyond individual trees or structural stability, with an eye on supporting the program by improving baseline information from inventory and monitoring,[155] coordination among agencies, collaboration among landowner types, and dissemination of information about tree benefits and tree care.

When urban forests are integrated into the land-use planning process,[156] local governments can take advantage of a broad

151. GRAND RAPIDS, MICH., CODE § 5.11.01 (2007).

152. *Id.* §5.11.02 (A).

153. *Id.* § 5.11.10.

154. John F. Dwyer et al., *Sustaining Urban Forests*, 29 J. ARBORICULTURE 49, 50-51 (2003) (discussing key elements of urban forests).

155. Kollin & Schwab, *supra* note 84, at 27 (arguing that tree inventories are critical to understand how to best plan urban forests); Greg McPherson, *Value for Money*, CHARTERED FORESTER, Winter 2009, at 14-15, *available at* http://www.fs.fed.us/psw/programs/cufr/products/cufr_787_CharteredForesterWinter2009Feature.pdf (discussing the various software tools available for estimating urban tree benefits, such as the i-TREE software suite that is designed to integrate urban forestry inventory, analysis and forecasting tools: the Urban Forest Effects Model ("UFORE"), Mobile Community Tree Inventory ("MCTI"), and the Street Tree Resource Analysis Tool for Urban forest Managers ("STRATUM")).

156. One example of this integration is in stormwater control. Local governments are increasingly turning to an emerging stormwater control device known as Low Impact Development ("LID"). LID represents a planning and engineering approach intended to control stormwater by designing development to retain the functions and services of the predevelopment hydrology. LID developments minimize stormwater pollution by avoiding impermeable surfaces that artificially collect and transport stormwater, facilitating stormwater retention and treatment instead of transport, and utilizing more natural principles in designing infrastructure. LID elements include design for median plantings and pavers and permeable surfaces instead of pavement. The LID approach accomplishes an array of goals that converge with stormwater control,

range of ecosystem services. As noted above, the urban forest planning exercise in Seattle illustrates the potential depth of the relationship between local governance, land use, and urban-ecosystem function. As Seattle notes, "because of the obvious differences between urban spaces, streetscapes, parklands, remnant forests, and other land use types, the urban forest cannot be viewed as a single unit for management purposes."[157] Indeed, different land uses will yield different benefits to urban forests and conflict with ecosystems in different ways. Therefore, Seattle identified nine different land use types to assess as separate management units. As a direct result of Seattle's approach, its urban forest plan is able to assess challenges and opportunities for canopy cover improvements – for instance, where education will yield substantial results,[158] or where incentives present the most favorable opportunity[159] – as well as identify the urban areas that will receive the greatest benefits from forest ecosystem services.

3. Protecting Riparian Habitats by Minimizing Ecosystem Impacts

Like the other ecological services discussed herein, freshwater riparian ecosystems provide an opportunity to associate communities and community needs with their local ecosystems. Riparian habitats provide essential aquatic[160] and terrestrial[161] ecosystems, despite their typically narrow corridors,

including habitat creation and retention, minimization of heat island effect, and furthering aesthetic and ecosystem goals related to landscaping and vegetation cover. *See* U.S. EPA, LOW IMPACT DEVELOPMENT (LID): A LITERATURE REVIEW 1-3 (2000), *available at* http://www.lowimpactdevelopment.org/pubs/LID_litreview.pdf.

157. CITY OF SEATTLE, URBAN FOREST MANAGEMENT PLAN 59 (2007).

158. *Id.* at 65-66.

159. *Id.* at 83.

160. K. LEA KNUTSON &VIRGINIA L. NAEF, WASH. DEPT. OF FISH & WILDLIFE, MANAGEMENT RECOMMENDATIONS FOR WASHINGTON'S PRIORITY HABITATS: RIPARIAN 6-9 (1997).

161. The Washington DFW states:

> Approximately 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities and the density of wildlife in riparian areas is comparatively high. Forested riparian

due to the ecosystem functions provided by vegetation in these areas. As noted by the Washington Department of Fish and Wildlife ("DFW"):

> Riparian habitat performs many functions that are essential to fish survival and productivity, and it is critical in supporting suitable instream conditions necessary for the recovery of imperiled native salmon stocks. Vegetation in riparian areas shades streams maintaining cool temperatures needed by most fish. Plant roots stabilize stream banks and control erosion and sedimentation, and vegetation creates overhanging cover for fish. Riparian habitat contributes leaves, twigs, and insects to streams, thereby providing basic food and nutrients that support fish and aquatic wildlife. Large trees that fall into streams create pools, riffles, backwater, small dams, and off-channel habitat that are necessary to fish for cover, spawning, rearing, and protection from predators. Pools help maintain riffles where gravel essential for spawning accumulates. Riparian vegetation, litter layers, and soils filter incoming sediments and pollutants thereby assisting in the maintenance of high water quality needed for healthy fish populations. Riparian habitat moderates stream volumes by reducing peak flows during flooding periods and by storing and slowly releasing water into streams during low flows.[162]

In accordance with the DFW's recommendations, the Washington legislature requires all local governments to address critical

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> habitat has an abundance of snags that are critical to cavity-nesting birds and mammals and to many insectivorous birds. Downed logs are common and provide cover and resting habitat for amphibians, reptiles, and small mammals. Intact riparian habitat has well-developed vegetation, usually with multiple canopy layers. Each layer consists of unique habitat niches that together support a diversity of bird and mammal species. The relatively mild microclimate of riparian areas offers relief from hot, dry summers and cold, snowy winters which is especially important to deer, elk, and moose. Riparian habitat forms natural corridors that are important travel routes between foraging areas, breeding areas, and seasonal ranges, and provides protected dispersal routes for young. Protected access to water is also an essential attribute of intact riparian habitat.

Id. at xi.

162. *Id.*

areas[163] through the planning process,[164] and local government decisions on critical habitat are held to the standard of best available science.[165] Resulting riparian habitat protections are based on comprehensive planning for fish and wildlife ecosystem needs, often (but not always) guided by the presence of a sensitive species or a locally important habitat area.

Many local governments have addressed the problems of fish and wildlife habitat destruction and fragmentation[166] through land use regulation and planning. In general, these regulations are intended to control land development in order to maintain adequate space for functional habitats, ensure water quality, maintain biological diversity and populations, and connect habitats through habitat corridors.[167] Although many local governments have adopted discrete habitat protection regulations, some implement habitat protections by integration into other regulatory schemes. For instance, the Town of

163. The term "critical areas" has been defined to include "the following areas and ecosystems: (a) Wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas." WASH. REV. CODE § 36.70A.030(5) (1990).

164. *Id.* § 36.70A.060.

165. *Id.* § 36.70A.172.

166. Habitat fragmentation is:

> [T]he process whereby contiguous natural areas are reduced in size and separated into discrete parcels. Fragmentation results from a reduction in the area of the original habitat due to land conversion for other uses, such as residential and commercial development. It also occurs when habitat is divided by roads, railroads, drainage ditches, dams, power lines, fences or other barriers that may prohibit the free movement and migration of plant and animal species.

ENVIRONMENTAL LAW INSTITUTE (ELI), CONSERVATION THRESHOLDS FOR LAND USE PLANNERS 5 (2003).

167. The Habitat Conservation Ordinance adopted in Clark County, Washington focuses on preserving the functions and values of riparian habitat areas. Under the Clark County habitat program, ecosystem changes are allowed only where the applicant can demonstrate that the proposal "[s]ubstantially maintains the level of habitat functions and values as characterized and documented using best available science," and "[m]inimizes habitat disruption or alteration beyond the extent required to undertake the proposal." CLARK CNTY., WASH., CODE § 40.440.020.A.2 (2005). Clark County's ordinance also provides a list of possible mitigation measures, all subject to the rule that "disrupted functions and values shall be mitigated on-site as a first priority, and off-site thereafter." *Id.* § 40.440.020.A.3.b.

Ossining, New York, incorporates the goals of habitat protection into the goals and standards of its tree protection ordinance.[168] The City of Durham, North Carolina, addresses wildlife habitat throughout its land use regulations.[169] In addition, some local governments expressly include provisions for wildlife protection in their habitat regulations.[170]

A common element among local habitat ordinances is the use of buffers to protect riparian habitats (aquatic and terrestrial) from permanent disruption. Buffers, particularly when they are vegetated, can perform multiple ecosystem functions in the local landscape. Riparian buffers protect the functionality and biological integrity of the adjacent watercourse.[171] They have the ability to enhance water quality by protecting water resources from polluted residential, commercial and agricultural runoff.[172] Buffers include vegetation that slows the runoff from development, allowing for the pollution to settle out from the water before entering the water resource.[173] Riparian buffers capture 70% of some pollutants and prevent erosion.[174] The

168. OSSINING, N.Y., CODE §§ 183-2(5), 183-9(B)(2)(e) (2005).

169. *See, e.g.*, DURHAM, N.C., UNIFIED DEV. ORDINANCE § 8.8.1 (2006), *available at* http://www.ci.durham.nc.us/departments/planning/udo/ (steep slope regulations for the purpose of preserving wildlife habitat); *id.* § 8.9.1 (wetlands regulations for the purpose of maintaining wildlife habitat).

170. Boulder, Colorado directly regulates the taking of certain wildlife under its Wildlife Protection Ordinance. BOULDER, COLO., ORDINANCES art. 7321, § 6 (2005). The ordinance seeks to protect biodiversity, foster preservation of native wildlife, and minimize irreconcilable conflicts between human needs for surroundings and ecosystem needs of wildlife. *Id.* § 6-1-1(d)-(e). The ordinance prohibits mistreatment and intentional infliction of suffering of all animals, but also provides specific attention to the use of lethal chemicals to control prairies dogs and wild birds or destruction of their habitats. *Id.* § 6-1-11.

171. C. Mark Hersh, *The Clean Water Act's Antidegradation Policy and its Role in Watershed Protection in Washington State*, 15 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 217, 251 (2009).

172. Barton H. Thompson Jr., *Market For Nature*, 25 WM. & MARY ENVTL. L. & POL'Y 261, 295 (2000).

173. James Salzman, *Creating Markets for Ecosystem Services: Notes From the Field*, 80 N.Y.U. L. REV. 870, 876-77 (2005).

174. U.S. EPA, NATIONAL MANAGEMENT MEASURES TO PROTECT AND RESTORE WETLANDS AND RIPARIAN AREAS FOR THE ABATEMENT OF NONPOINT SOURCE POLLUTION 11-16 (2005) (explaining the importance of maintaining and restoring wetlands and riparian areas for their services in decreasing the need for stormwater and flood protection facilities), *available at*

buffers decrease the chance of extreme flood events by slowing the runoff entering the watercourse, and allowing for the natural saturation process to occur within the buffer, and storing any excess water.[175] The buffer creates a "natural reservoir" for water runoff, releasing it periodically, and maintaining constant and safe water flow.[176] In addition, the riparian buffer areas provide habitat, beauty, and recreational opportunities for the community.[177]

In addition to the ecological impacts, the use of buffers as a multi-purpose and flexible tool is known to yield substantial benefits to local communities.[178] Vegetated buffers can be designed to mitigate habitat fragmentation by providing linkages,[179] decrease energy use in the natural and built environment by providing shade[180] and windbreaks,[181] filter

http://water.epa.gov/polwaste/nps/wetmeasures/index.cfm#10; Sue B. Smith, *Stream Buffers: Amend Code Section 12-7-6 of the Official Code of Georgia Annotated Relating to Best Management Practices for Control of Soil Erosion and Sedimentation and Minimum Requirements for Rules, Regulations, Ordinances, or Resolutions to Change Certain Provisions Relating to Twenty-Five Foot Buffers Along State Waters; Repeal Conflicting Laws; And other Purposes,* 21 GA. ST. U. L. REV. 8, 8 (2004).

175. Thompson, *supra* note 172, at 297.

176. Clair E. Wischusen, *Who's Regulating the Regulators? A Proposal for State Oversight of Natural Resources Zoning Regulations in Pennsylvania,* 27 TEMP. J. SCI. TECH. & ENVTL. L. 315, 328 (2008).

177. Thompson, *supra* note 172, at 297.

178. Of course, many of the functions exhibited in riparian buffers can be accomplished through technological solutions. However, artificial solutions may result in the loss of ecosystem services, such habitat and aesthetics, at a high cost. *Id.* at 296-97. To maximize the effectiveness of buffers, the Forest Service recommends that local regulatory bodies observe a few basic parameters: consider the relevant landscape scale, including the likelihood that habitats and buffers will be bombarded by cumulative impacts; design buffers to provide multiple services (by themselves or in conjunction with the buffered ecological system), including the production of goods for harvesting or hunting and the provision of services, such as water capture or filtering; maintain flexible design, in accordance with local ecosystem needs and potential benefits; higher plant diversity may lead to greater ecosystem benefits; and "bigger is generally better." U.S. FOREST SERV., GEN. TECH. REP. SRS-109, CONSERVATION BUFFERS: DESIGN GUIDELINES FOR BUFFERS, CORRIDORS, AND GREENWAYS 69 (2008).

179. *Id.* at 46, 58.

180. *Id.* at 59.

181. *Id.* at 91.

urban runoff,[182] control erosion,[183] provide habitat and biomass components,[184] improve property values,[185] and assist in crop pollination,[186] treatment of contaminated soil and water,[187] and carbon sequestration.[188] In addition, the calculation of buffer width varies according to the needs of the resource and the community.[189] Alternative approaches include fixing minimum width buffers,[190] stratifying buffers into multiple zones and identifying permitted uses for each,[191] varying buffer widths

182. *Id.* at 36.

183. *Id.* at 39.

184. U.S. FOREST SERV., *supra* note 178, at 29.

185. *Id.* at 67.

186. *Id*. at 75.

187. *Id.* at 66.

188. *Id.* at 69.

189. *See* Casey Schach, *Stream Buffer Ordinances: Are Municipalities on the Brink of Protecting the Health of Streams or Opening the Floodgates of Takings Litigation?*, 40 URB. L. 73, 75-87 (2008) (identifying independent ordinances, stratified ordinances, dependent ordinances, and matrix ordinances).

190. *Id.* at 76. Plumstead Township, Pennsylvania, protects a fixed buffer as follows:

> Riparian Buffer Zone. A riparian buffer shall be preserved along all intermittent and perennial streams of water, rivers, creeks, brooks, or swales identified on the USGS (U.S. Geodetic Survey) maps; Natural Resources Conservation Service maps; delineated as Waters of the Commonwealth, and/or identified on the official map prepared by the Township. The riparian buffer shall be the transitional area extending 75 feet outward from the top of bank of the watercourse. Riparian buffers shall remain undisturbed and permanently protected. Riparian buffer areas shall not be altered, graded, filled, piped, diverted, or built upon except for roads, pedestrian paths and utility crossings where approved by the Township, the design represents the least possible disturbance, and no other alternative access is available.

PLUMSTEAD TWP., PA., ZONING ORDINANCE § 27-2401(10) (2006); *see also* Wischusen, *supra* note 176, at 328.

191. Schach, *supra* note 189, at 77; KENNETT TWP., PA., ORDINANCE NO. 158, § 1802 (2005), *available at* http://www.kennett.pa.us/ordinances/Ordinance158.htm. The Kennett Township buffer ordinances apply to property that is being subdivided or any land that is subject to development along with any building permit application. *See also* Alan W. Flenner, *Municpal Riparian Buffer Regulation in* Pennsylvania—*Confronting the Regulatory Takings Doctrine*, 7 DICK. J. ENVTL. L. & POL'Y 207, 219-20 (1998).

according to stream type and watershed size,[192] and more complex matrix approaches that include criteria for local needs.[193]

Riparian areas are complex, productive ecosystems, the values of which can be captured by informed local governments. Riparian buffers are flexible tools that can be used to protect, enhance, or even manipulate ecosystems and the services they provide. Because buffers serve multiple purposes (whether intended or not), and because buffers can add substantial value in the form of ecosystem services, local governments that are attentive to buffer design and function can add substantial value to a community's green infrastructure.

4. Public Management of Watersheds

Within the watershed, a functioning ecosystem provides drinking water, habitat, biodiversity, and biomass, captures and treats storm water, sequesters carbon, filters a variety of airborne and water pollutants, and regulates flood events, among other things.[194] A compelling case for an ecosystem services analysis at

192. Schach, *supra* note 189, at 78. In Overland Park, Kansas, the buffer width varies as the watershed land area increases. OVERLAND PARK, KA., CODE § 18.365.040(B) (2002), *available at* http://www.opkansas.org/Doc/18365-Stream-Corridor-Requirements.pdf; *see also* Schach, *supra* note 181, at 79-80. The buffer width varies from fifteen feet for a watershed area of twenty-five acres, to one hundred and twenty feet for a watershed drainage area of five thousand acres or more. In the State of Washington, riparian buffers are calculated based on water typing. If a watercourse is "fish bearing" then a wider buffer is required for protection. If the watercourse is deemed "nonfish-bearing" a less wide buffer is required for protection. *See* Hersh, *supra* note 171, at 251.

193. Schach, *supra* note 189, at 78. The City of Lexena combines the Matrix and stratified categories of calculating buffers. LEXENA, KA., CODE § 4-1-O (2003), *available at* http://www.ci.lenexa.ks.us/LenexaCode/CityCodes.html.

194. One recent statement captured the role of watershed functionality to human well-being:

> When children turn six, they learn about their place in the world--their street address, city, and zip code. But there is another important dimension to our lives that is also important to our sense of place--our watershed or ecological address. The future of the planet and the protection of the nation's water resources depend on a universal understanding and appreciation of watersheds.

the watershed scale is based on the coordination of ecosystem benefits that are often attributable to the boundaries of a watershed: "ecosystem services provided in a watershed tend to conform to natural boundaries, . . . at least more consistently than by ecologically arbitrary jurisdictions."[195] Although these benefits can be understood, monitored, and protected by separate agencies and entities (both public and private), watershed-level analysis recognizes the importance of "functional boundaries that have an impact on the migration or dispersal of the organisms being studied."[196] Moreover, addressing ecosystem functionality at a watershed level offers an efficient way of maximizing ecosystem benefits and minimizing conflicts in the management of the various services. Effective watershed management recognizes that natural and built capital should be managed in a coordinated fashion, reflecting on the idea that, at least for utilitarian benefits of ecosystem processes, they can be productively designed and managed as complements.[197]

Of course, as with all stories about ecosystem value, the mere act of identifying watershed ecosystem services may not be enough to direct productive attention toward protecting the ecosystem services of the watershed. Ballston Lake in New York illustrates such a challenge. In 2001, the Capital District Regional Planning Commission investigated the status of regional watershed management surrounding this 278-acre Class A lake, located just north of Albany.[198] Ballston Lake is fed by a system of underground springs and seven primary tributaries, four of which flow through wetlands prior to entering the lake.[199]

Benjamin H. Grumbles, Assistant Administrator for Water, EPA, Building Livable Communities Starts With a Watershed Address (2007), *available at* http://www.epa.gov/owow/watershed/oped2007.pdf.

195. BATKER, *supra* note 65, at 29.

196. Lord et al., *supra* note 54, at 326 (explaining the importance of overcoming "the obstacle of arbitrary political boundaries.").

197. "A water utility embodies the fact that built and natural capitals are complements – both are required to pour drinking water from the spigot." BATKER, *supra* note 65, at 14.

198. CAPITAL DIST. REG'L PLANNING COMM'N, WATERSHED PROTECTION AND MANAGEMENT PLAN FOR THE BALLSTON LAKE WATERSHED 13 (2001), *available at* http://www.cdrpc.org/Reports/Ballston_Lake_Watershed_Study.pdf.

199. *Id.* at 13.

Due to past difficulties experienced in drilling for groundwater and the costs associated with constructing public water infrastructure to serve lake residents, approximately 70% of the lakeside residents draw lake water for their domestic water needs.[200] Accordingly, Ballston Lake is relied upon for water quality and quantity.

The obstacle identified by the planning commission in the Watershed Protection and Management Plan for the Ballston Lake Watershed was land use. Older subdivisions are characterized by malfunctioning septic systems and high nutrient runoff. Industrial uses are identified as unmaintained. New development threatens to exchange the remaining riparian zones and wetlands for impervious surfaces and additional contaminants. Notwithstanding these concerns, the planning commission noted how "fortunate" it was that runoff from a nearby junkyard flows into a wetland before entering the lake,[201] and that contamination from some of the presently failing septic systems is likewise mitigated as contaminated flows are filtered by wetlands.[202]

The dilemma in Ballston Lake is one of implementation: some of the lake's more persistent challenges (particular land uses and outdated sewage facilities) do not present simple solutions. Unfortunately, declining ecological conditions and ecosystem services opportunities are often missed due to private ownership of watershed areas. The planning commission recommended the application and enforcement of typical ecosystem-based land use tools such as riparian buffers, vegetation retention, stormwater control facilities and enforcement of best practices in stormwater control.[203] However, given the extent of private ownership and the political challenges of regulating private property use, the planning commission also recommended property acquisition, including the purchase of development rights and investigation of a New York-based program authorizing a sewer district to acquire problematic

200. *Id.* at 22.
201. *Id.* at 31.
202. *Id.* at 30.
203. *Id.* at 33.

septic systems and charge the owners as sewer customers.[204] In this case, the community has identified the value of ecosystem services from the Ballston Lake watershed,[205] but the community has been unable to find the resolve to secure that value, despite a potentially devastating loss of water quality in the lake.

In some cases, as seen throughout this article, the benefit of ecosystem services drives regulatory programs that prevent private interference with ecosystem processes. In other cases, however, local governments are willing to occupy the terrain and secure ecosystem services by ownership. The watershed planning successes of the City of Seattle and Seattle Public Utilities ("SPU") illustrate that local governments can take a more proactive approach to preserving ecosystem services value. Seattle's urban watersheds include Thornton Creek,[206] Piper's Creek,[207] Taylor Creek in the southeast corner of Seattle, Longfellow Creek in southwest Seattle,[208] and Fauntleroy Creek located on the western slope of the West Seattle peninsula.[209] More importantly, the 91,339-acre, Seattle-owned Cedar River Municipal Watershed provides about 70% of the drinking water for the greater Seattle area residents.[210] Since 1964, the smaller

204. CAPITAL DIST. REG'L PLANNING COMM'N, *supra* note 198, at 32.

205. *See* RALPH W. TINER, WETLANDS OF SARATOGA COUNTY: VITAL RESOURCES FOR PEOPLE AND WILDLIFE 9-12 (2000), *available at* http://www.fws.gov/wetlands/_documents/gOther/WetlandsSaratogaCounty.pdf (identifying the various wetlands services provided to Saratoga County).

206. The Thorton Creek watershed is highly urbanized, draining approximately eleven square miles and running northeast through Seattle. Seattle Public Utilities, *Our Watersheds*, SEATTLE.GOV (last visited Mar. 28, 2011), http://www.seattle.gov/util/Services/Drainage_&_Sewer/Keep_Water_Safe_&_Clean/RestoreOurWaters/OurWatersheds/index.htm.

207. Piper's Creek drains almost three square miles in northwest Seattle. *Id.*

208. Longfellow Creek drains a 2,685 acre watershed into the Duwamish River. *Id.*

209. *See id.*

210.

> In 1962, landowners signed the Cedar River Watershed Cooperative Agreement, which set up a process of land transfers that resulted in Seattle's complete ownership of its watershed lands. This led to further procedures for fire protection and public access control. In 1996, the USDA Forest Service ceded its watershed land to the City, which gave Seattle final and sole ownership of the entire watershed.

Tolt River Watershed has served as the second supply watershed in SPU's freshwater supply system and provides about 30% of the drinking water for the greater Seattle area residents.[211] Seattle currently owns approximately 70% of the Tolt River watershed.[212] The investment has been significant:

> As it turned out, this was a magnificent investment by any measure. Today, SPU would have to pay an upfront cost of $200 million to build a filtration plant to filter the city's water supply with annual operating and maintenance costs of $3.6 million per year if the forest did not do this job. In addition, by 2010 it would likely have been the third or fourth filtration plant to be built as filtration plants, like all built capital, depreciate and eventually fall apart. Like most natural capital, the forest did not depreciate or fall apart. Relative to the size of the asset, a forest requires light maintenance. The watershed now provides far more water and value than ever was imagined by the original SPU directors. An additional benefit reaped from this wise investment is that lives were saved as cholera, once a significant problem in Seattle, was eliminated through the development of a clean, reliable water supply.[213]

Seattle's foresight has resulted in water security: Seattle largely controls the ecosystem processes that provide the vast majority of

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Seattle Public Utilities, *History of the Watershed*, SEATTLE.GOV, http://www.cityofseattle.net/util/About_SPU/Water_System/Water_Sources_&_Treatment/Cedar_River_Watershed/HistoryoftheWatershed/index.htm (last visited Mar. 24, 2011).

211. SEATTLE PUBLIC UTILS., SOUTH FORK TOLT WATERSHED MANAGEMENT PLAN 2-2 to 2-4 (2008), *available at* http://www.cityofseattle.net/util/groups/public/@spu/@ssw/documents/webcontent/spu01_004082.pdf.

212. *Id.* The city first purchased water rights in the Tolt River drainage basin in 1936, but at that time the city did not have the rights or infrastructure for diversion, transmission or distribution of the water. *Id.* at 2-3. When the city acquired property interests in 1959 to construct a reservoir, it concurrently acquired rights to enforce environmentally-protective logging practices in the watershed to maintain water quality. *Id.* at 2-3. The city's acquisitions continued through 1997, when it acquired the remainder of Weyerhauser's property holdings in the Tolt River watershed. *Id.* at 2-4.

213. EARTH ECONOMICS, ACCOUNTING FOR NATURAL CAPITAL 1 (2010), *available at* http://www.eartheconomics.org/FileLibrary/file/Reports/Puget%20Sound%20and%20Watersheds/Puget%20Sound%20Russell/Case%20Studies/Accounting%20for%20Natural%20Capital_v2.pdf.

its water supply.[214] For the price of land, the City of Seattle has acquired the living technology that supplies clean water to the city's residents.

5. Identifying Special Places

Communities, through their local governments, often recognize the benefit of particular ecosystem services and identify themselves with such features and attributes of the local environment.[215] In some cases, local ecologies determine local and regional economic advantages through the production of ecosystem goods such as fisheries and timber. Some communities find historical, scientific, or spiritual significance in their interactions with their natural surroundings.[216] In others, ecosystems draw attention through recreation and tourism.[217] In these instances, local governments have internalized the value of the services provided by ecosystems and recognize their local ecosystems as special places. These communities have realized that "human culture is embedded within natural systems."[218]

Obviously, there is a sense in which a "special places" analysis states too much, as it might be more credibly argued

214. The City of Seattle began to acquire interests in the Cedar River Watershed in 1899. *See* Seattle Public Utilities, *History of the Watershed*, *supra* note 210. At that time, the watershed was actively logged, but not actively managed to protect ecosystem resources. In 1924, Seattle retained a staff forester and began to reprioritize the value placed on the watershed. *Id.* However, it was not until 1962 that the city successfully negotiated the Cedar River Watershed Cooperative Agreement with private parties for the eventual transfer of watershed lands to the city. *Id.*

215. Rudolf S. deGroot et al., *A Typology for the Classification, Description, and Valuation of Ecosystem Functions, Goods, and Services*, 41 ECOLOGICAL ECON. 393, 402 (2002) ("Natural ecosystems and natural elements (such as ancient waterfalls or old trees) provide a sense of continuity and understanding of our place in the universe which is expressed through ethical and heritage-values.").

216. *Id.* ("Nature is an important basis for folklore and culture as humans have developed different means of coping and interacting with nature.").

217. *See, e.g.*, Robin Kundis Craig, *Valuing Coastal and Ocean Ecosystem Services: The Paradox of Scarcity for Marine Resources Commodities and the Potential Role of Lifestyle Value Competition*, 22 J. LAND USE & ENVTL. L. 355, 398-406 (2007) (discussing examples where state and local governments acted to protect local values in marine recreational and aesthetic resources).

218. deGroot, *supra* note 215, at 402.

that all local places bear the quality of "special" to their local governments. Yet local governments also connect with special places in ways that are not generally felt throughout a given jurisdiction. Accounting for ecosystem services is typically case- and place-sensitive, if only due to the variability in ecosystem dynamics and local institutions, character of the ecosystem services provided, and the nature of the competition between uses of the ecosystem.[219] In this accounting, particular ecosystem goods and services may receive special attention, indicating the local choice in prioritizing among competing land uses.

Examples of such a connection vary with geography and time, but also with foresight, size, and sophistication. Yet, it is significant that communities do identify closely with the services that are provided by ecosystems. For instance, the residents of North Greenbush, New York, consider Snyder Lake a "special place."[220] The Town notes that, as one of its primary resources, "the Lake has been a favorite destination of residents for many years and in the 1920s through the 1940s there were hotels, restaurants and entertainment venues located there."[221] At present, the Town has funded the preparation of a lake management plan to address the past and ongoing water quality challenges in the Lake from erosion and stormwater runoff, invasive species, and algae blooms.[222] The Town has adopted a zoning designation that is intended to protect the Lake from sedimentation and turbidity impacts from ground disturbance near the Lake.[223]

As a second example, the fifty-three-foot Minnehaha Falls is a special place and has proven a persistent component of the local identity. [224] The Falls has been acknowledged as a sacred place

219. Karl-Goran Maler et al., *Accounting for Ecosystem Services as a Way to Understand the Requirements for Sustainable Development*, 105 PNAS 9501, 9505 (2008).

220. NORTH GREENBUSH, N.Y., COMPREHENSIVE PLAN 31 (2008), *available at* http://www.townofng.com/boards/cpicrc/?page=compplan200912.

221. *Id.* at 31-32.

222. *Id.* at 32.

223. *See generally* NORTH GREENBUSH, N.Y., CODE § 197-96 (2011) (Snyders Lake Watershed Overlay District).

224. Minnehaha Creek is a twenty-two-mile waterway that flows between Lake Minnetonka and the Mississippi River in and around Minneapolis,

to the Dakotas.[225] In the mid-1800s, the Falls was visited by tourists, depicted by artists, and celebrated in Henry Wadsworth Longfellow's poem, "The Song of Hiawatha."[226] In 1885, the state began to acquire lands around the creek for presentation of the first state park. The state later conveyed the lands to Minneapolis for a city park in 1889.[227] Reverence for the Falls and its surrounding park continues to reflect the importance of this place, which currently attracts more than eight hundred and fifty thousand visitors each year.[228]

Over time, regional development trends and geologic circumstances wore at the creek, compelling the Minnehaha Creek Watershed District to consider the benefits of creek restoration. The Watershed District found that years of increasing flooding had caused substantial erosion, stream bank instability, and deterioration of tourist facilities including walkways, bridges, and stairs. To preserve this historic symbol of the region, in 2008, the Watershed District awarded contracts for the restoration and revegetation of the creek corridor, as well as for the implementation of Best Management Practices ("BMPs")

Minnesota. The creek drains a watershed of approximately 178 square miles and has long served as a recreational amenity for area residents and visitors. Importantly, near the confluence of the creek with the Mississippi River, the Minnehaha Creek cascades fifty-three feet over the Minnehaha Falls (once called Little Falls or Brown's Falls). *See* MINNEHAHA CREEK WATERSHED DIST., COMPREHENSIVE WATER RESOURCES MANAGEMENT PLAN 2 (2010), *available at* http://www.minnehahacreek.org/documents/MCWDComprehensivePlan-Amended10-14-10.pdf.

225. RICH & SUSAN CAIRN, HISTORY OF MINNEHAHA CREEK WATERSHED 20 (2003), http://www.minnehahacreek.org/pdf/MinnehahaHistory.pdf.

226. *Minnehaha Historic District,* CITY OF MINNEAPOLIS, http://www.ci.minneapolis.mn.us/hpc/landmarks/Minnehaha_District.asp (last visited Mar. 24, 2011).

227. DAVID C. SMITH, PARKS, LAKES, TRAILS, AND SO MUCH MORE: AN OVERVIEW OF THE HISTORIES OF MPRB PROPERTIES 167-71 (2008), *available at* http://www.minneapolisparks.org/documents/parks/Parks_Lakes_Trails_Much_More.pdf.

228. Minnehaha Creek Watershed Dist., *Restoring a Historic Landmark: Minnehaha Falls and Glen Restoration*, http://www.minnehahacreek.org/MinnehahaFallsandGlenRestoration.php (last visited Mar. 24, 2011).

in storm water control on a historic site that drains into the creek.[229]

An example of a broader approach is found in Bucks County, Pennsylvania. In 1999, the Bucks County Commissioners funded a Bucks County Natural Areas Program to incentivize the protection of the area's unique natural areas.[230] The primary mission of the Natural Areas Program is to protect significant geological features, natural ecological functions, biological diversity, while providing the public with an opportunity to experience and learn about the county's unique natural features.[231] The Natural Areas Program was emboldened by the completion of the Natural Areas Inventory of Bucks County ("NAI") by the Morris Arboretum of the University of Pennsylvania. The NAI, which noted the exceptional plant diversity in Bucks County, succeeded in identifying and ranking the local and ecological importance of 115 exceptional natural areas, many of which included the identification of rare plants and animals.[232] Through the Natural Areas Program, the County

229. The contract includes installation of innovative infiltration control features such as porous concrete and rain gardens. *See id.*; Richard Parrish, *Green Construction Transforms Minnehaha Creek*, CONSTRUCTION BULL., Apr. 6, 2009, http://mnwatershed.govoffice.com/index.asp?Type=B_PR&SEC=%7B6DAACCA2-FB68-4399-8D48-FC4952AE11D2%7D&DE=%7B83308543-7740-430C-9144-8B53B510FFB6%7D. During the renovation process, the Watershed District and the Army Corps battled a variety of issues, but have since resolved these disputes in a productive partnership. *See* Laurie Blake, *Feud Freezes Minnehaha Creek Work*, STAR TRIBUNE, Feb. 3, 2010, http://www.startribune.com/local/83166627.html; *see* Laurie Blake, *Minnehaha Falls Project to Start Flowing Again*, STAR TRIBUNE, Sept. 3, 2010, http://www.startribune.com/local/102196484.html.

230. *See* Bucks County Planning Commission, *Natural Areas*, http://www.buckscounty.org/government/departments/communityservices/planningcommission/OpenSpace/NaturalAreas.aspx (last visited Mar. 24, 2011).

231. *See* BUCKS COUNTY, NATURAL AREAS PROGRAM APPLICATION GUIDELINES 1 (2008), *available at* http://www.buckscounty.org/government/departments/communityservices/planningcommission/NaturalAreasProgramGuidelinesFall2008.pdf.

232. MORRIS ARBORETUM OF THE UNIV. OF PA., BUCKS COUNTY NATURAL AREAS INVENTORY (1999), *available at* http://www.buckscounty.org/government/departments/communityservices/planningcommission/OpenSpace/BucksCountyNAIsites.pdf.

provides a 50% matching grant (up to $500,000) for the acquisition and preservation of significant natural areas.[233]

Of course, local governments in Bucks County do not solely rely on the Natural Areas Program in identifying and protecting their special places. Jericho Mountain, located in the Upper Makefield Township, is one such unique place.[234] Because the mountain has been identified as a place of unique aesthetic, ecological, and historic significance, the Township has created a special zoning district designed to protect the mountain's fragile ecology.[235] Land use restrictions applicable in the Jericho Mountain district prohibit development on slopes of more than 15%, limit impervious surface coverage to 5% of the site, and require open space set-asides for single-family cluster subdivisions.[236] Additional restrictions arise from the limited groundwater availability in the area.[237]

Although aesthetics is not a universal trait of locally special places, aesthetics clearly serves as another common indicator of local value, as evidenced by the legal protection offered by local governments. The aesthetic services provided by natural places have been proven to contribute to property values, identity and a sense of place, community organization:[238] "[A]esthetic

233. The program allows applicants to acquire fee simple interests or conservation easements that would ensure protection of the property's significant natural area. *See* BUCKS COUNTY, *supra* note 231, at 2.

234. NEWTOWN, PA., AREA JOINT MUNICIPAL COMPREHENSIVE PLAN ch. 7 (2007), *available at* www.twp.newtown.pa.us/comprehensive_plan/7_Natural_Resources_Protection.pdf.

235. Interestingly, the several area Townships participate in a joint planning and zoning venture. *See* NEWTON, PA., JOINT MUNICIPAL ZONING ORDINANCE §400 (2006), *available at* http://www.keystatepub.com/keystate-pdf/PA/Bucks/Newtown%20Area%20Joint%20Municipal%20Zoning%20Ordinance/Article%20IV%20Residential%20Districts.pdf.

236. *Id*. § 400.

237. *See* NEWTON, PA., AREA JOINT MUNICIPAL COMPREHENSIVE PLAN ch. 14, *available at* www.twp.newtown.pa.us/comprehensive_plan/14_Future_Land_Use.pdf.

238. deGroot, *supra* note 215, at 397 (identifying aesthetics – the provision of attractive viewsheds and objects – as an ecosystem service); *see, e.g.*, Echevarrieta v. City of Rancho Palos Verdes, 103 Cal. Rptr. 2d 165, 167-70 (Cal. Ct. App. 2001) (Local ordinance regulated tree height to protect viewshed as a unique asset of community. The Court held that the process for removal posed no financial burden and did not reduce privacy right of property owner.)

information can have considerable economic importance . . . through the influence on real estate prices: houses near national parks or with a nice ocean view are usually much more expensive than similar houses in less favored areas."[239]

Local governments have regulated visual impacts through the use of building codes, zoning laws[240] and environmental

239. deGroot, *supra* note 215, at 402.

240. The City of San Antonio has adopted viewshed protection overlay districts, which prohibit construction that encroaches upon the viewshed of specific cultural, historic, and natural views. *See*, *Office of Historic Preservation: Viewsheds*, CITY OF ANTONIO, http://www.sanantonio.gov/historic/viewsheds.aspx (last visited Mar. 24, 2011); *see also* New Hampshire Office of Energy and Planning, *Preservation of Scenic Areas and Viewsheds*, TECHNICAL BULL., no. 10, Spring 1993 at 1, *available at* http://www.nh.gov/oep/resourcelibrary/technical_bulletins/documents/scenic_preservation.pdf. VPOD should be established by an appropriate commission, using an inventory and adhering to standards tied into comprehensive/master planning. NAPA CNTY., CAL., CODE OF ORDINANCES tit. 18 , ch. 18.106 (2010), *available at* http://library.municode.com/index.aspx?clientID=16513&stateid=9&statename=California. This constitutes a "Viewshed Protection Program" that uses the police power to: regulate and protect existing landforms, geology, ridgelines and views as seen from public roadways through planning and approval of new construction that is consistent with existing landforms and minimally impacts on the viewshed. Exceptions are made if the proposed action serves to provide an improved visual impact, measures are taken to use lighting and earthtone color choices that will improve the view from public roadways, and the project in general conforms with the surrounding landscape. Before a permit is issued, the applicant must execute and record a restriction on the property, enforceable against herself and subsequent owners to maintain improvements in concert with the provisions of the ordinance. Hawaii has an early explicit viewshed statute regulating "major view planes, view corridors, and other environmental elements such as natural light and prevailing winds, shall be preserved through necessary regulation and design review." HAW. REV. STAT. ANN. § 206E-33(4) (LexisNexis 1990). Maine planning and land use regulations for subdivisions provides that:

> The proposed subdivision will not have an undue adverse effect on the scenic or natural beauty of the area, aesthetics, historic sites, significant wildlife habitat identified by the Department of Inland Fisheries and Wildlife or the municipality, or rare and irreplaceable natural areas or any public rights for physical or visual access to the shoreline.

ME. REV. STAT. tit. 30-A, §4404 (1989).

Minnesota Rules address vegetative screening, visual impacts on public views, signage, and lighting, among others. MINN. R. 6120.3300 (2008). Vermont zoning law provides a category of Design Control Districts that protect "striking vistas, views across open fields . . . ." VT. STAT. ANN. tit. 24, § 4407(3)(E)(6) (2004).

protection regulations.[241] For instance, the City of Monterey, California, adopted a "Visual Sensitivity District" as an overlay district for the purpose of providing "district regulations for the review of development in those areas of the County of Monterey in which such development could potentially create adverse visual impacts when viewed from a common public viewing area."[242] The ordinance is limited "to those areas . . . which contain the most unique and highly sensitive visual resources of regional or county-wide significance."[243] Applicants under the ordinance are required to stake and flag the building site to allow for a visual impact analysis.[244] The ordinance contains specific standards intended to minimize substantial visual impacts, including siting of structures "to minimize tree removal, grading, and visibility from common public viewing areas," limitations of building new access roads, and underground placement of utilities.[245]

IV. CONCLUSION

This article has looked at examples of local commitments to contain local environmental despoliation and the unrecoverable loss of natural resources. Emerging from this analysis are the recent trends in recognizing and regulating ecosystem services at the local level. Local governments are adopting regulations aimed at capturing the benefits of functioning ecosystems by transcending aesthetic values of local nature and focusing on ecological processes and the services they provide. The idea that

241. *See, e.g.*, Uliano v. Bd. of Envtl. Prot., 977 A.2d 400, 405 (Me. 2009). (Landowners were denied permit to build a pier on their property in Bar Harbor, because the permitting board found that the pier would unreasonably interfere with existing scenic and aesthetic uses of coastal wetland. The court held that the Board did not act arbitrarily when it denied the permit because the pier would be a significant visual intrusion, no other private property owner had a private pier without providing a public benefit, and there were viable alternatives to construction of the pier that would provide the required water access.)

242. MONTEREY, CAL., MUNICIPAL CODE § 21.46.010 (2010), *available at* http://library.municode.com/index.aspx?clientId=16111&stateId=5&stateName=California&customBanner=16111.jpg&imageclass=L&cl=16111.txt.

243. *Id.* § 21.46.020B.

244. *Id.* § 21.46.060B.

245. *Id.* § 21.46.060C.

community identity benefits from a close examination of ecosystem services at a local scale illustrates that the relationship between local governance and ecosystem services can be understood within the frameworks of economy, ecology, and identity. At the local level, the notion that "ecosystems are assets, a form of wealth,"[246] is meaningful because ecosystems have tangible local value.

The study of how local governments value ecosystem services, including the services prioritized in particular regions and the consequences (including adverse consequences) of local regulatory choices, shows the interdependency between local values and local ecology. When local governments adopt an ecosystem services approach, they confront the environment in unique ways—not because environmental protection and ecosystem services protection are necessarily at odds, but because ecosystem services allows communities to value local ecologies in ways the federal scheme may overlook. Importantly, the ecosystem services approach encourages local governments to prioritize those ecosystem services that converge with local needs, a process that is, in essence, the process of local governance.

This is not to imply that the prioritization of ecosystem advantages is *easier* at the local level.[247] However, it is at the

246. EARTH ECONOMICS, *supra* note 68, at 54.

247. Of course, some environmental challenges are more complex and difficult to calculate in economic terms. Subjects such as the adaptive challenges of climate change and the role of biodiversity have not been consistently championed at the local level, perhaps because of the scale of the challenges, the complexity of the science, uncertainty of the economics, or even the difficulty in identifying the incremental benefits accruing locally. *But see* U.S. CONFERENCE OF MAYORS, THE U.S. MAYORS CLIMATE PROTECTION AGREEMENT 1 (2005), *available at* http://www.usmayors.org/climateprotection/documents/mcpAgreement.pdf. This was signed by 1,044 mayors. *See also* WARWICK, N.Y., CODE §164-47.9 (2010), *available at* http://www.ecode360.com/?custId=WA1027 (a local ordinance creating a biodiversity overlay district). The EPA has made a substantial contribution by identifying a range of difficulties that might obstruct an effective local process of ecosystem prioritization that includes misperception, misunderstanding, and miscommunication among various stakeholders. U.S. EPA, OFFICE OF WATER, *supra* note 56, at 2. In some cases, communities did not grasp the threats imposed by existing levels of environmental deterioration and continued practices, while in other cases, disagreement may have been grounded in differing understandings of key terms and concepts such as "sustainable" and forest health. *Id.* at 208-11, 216-17. Misunderstanding may also begin at the

local level that governments, whether predominantly urban or rural, face a constant competition among valuable land uses and valuable ecosystem services. In some cases, the competition appears to resolve in favor of an exclusive use – ecosystem or development.[248] Even where land uses do not present unresolvable conflicts of space or use, controversy may arise from the perception of the interaction between the natural and built environments. As reported by the City of Seattle, "some [business owners] are strong advocates for trees and others are not, or are even opposed to having trees near their businesses. Some business owners raise concerns about trees blocking signs, creating debris, or producing too much shade. For other business owners, the benefits trees provide are very important to their business environment."[249] In local governments, however, this type of prioritization is very meaningful, and as such, informational agendas and the democratic process are essential.[250]

federal level, where federal agencies may fail to grasp the local importance, use, and understanding of ecosystem conditions. *Id.* at 232-33 ("In this case, EPA did not initially understand the relationship of the community members' sense of place to their local identity, and their perception of the natural landscape as a protective boundary from outside influence."). The complexities identified by the EPA call for an adaptive process of ecosystem services assessment and prioritization – one that should largely be led by information processes and stakeholder involvement, particularly where the process of participation involves a low cost relative to delay and litigation that often follows misunderstanding and lack of consensus. *See, e.g.*, *id.* at 226.

248. *See* EARTH ECONOMICS, A NEW VIEW OF OUR ECONOMY: NATURE'S VALUE IN THE SNOQUALMIE WATERSHED 39 (2010) ("Agricultural and urban development often results in lost forest cover or riparian vegetation. This shift in land cover is among the most important causes of a smaller freshwater flow to coastal wetlands and bays.").

249. CITY OF SEATTLE URB. FOREST COAL., *supra* note 83, at 74.

250. Seattle proposes education and information to build public consensus. *Id.* (identifying the "opportunity to provide more and better information to Seattle's downtown businesses on the value that trees can bring to commerce.").