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Clean-Water Land Use: Connecting Scale and Function

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I. OVERVIEW

A critical issue facing most communities is the impact of land use and land development on water quality and watershed health.

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For example, urban runoff is the leading known cause of beach closures nationwide, resulting in both environmental harms and economic costs.[1] Often the failure of land use regulation to protect water quality is thought of as a problem of mismatched scales.[2] Watershed boundaries do not match political and land ownership boundaries.[3] Moreover, local governments, which have primary responsibility in the United States for land use regulation and planning, arguably have incentives to promote development, especially when the impacts are downstream, or at least outside, the political jurisdiction of the local unit of government.[4] Some argue that even when local governments want to protect aquatic ecosystems, they lack information, tools, resources, and authority.[5]

A frequently suggested solution—and growing trend—is to develop watershed-based institutions or processes to protect water quality and control land use patterns that affect water quality.[6]

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1. Craig Anthony (Tony) Arnold, *Is Wet Growth Smarter Than Smart Growth?: The Fragmentation and Integration of Land Use and Water*, 35 Envtl. L. Rep. (Envtl. Law Inst.) 10,152, 10,162 (2005) [hereinafter *Land Use and Water*].

2. *Land Use and Water*, *supra* note 1, at 10,165-66, 10,168; J.B. Ruhl et al., *Proposal for a Model State Watershed Management Act*, 33 ENVTL. L. 929, 930 (2003).

3. *Land Use and Water*, *supra* note 1, at 10165-66, 10168; William Goldfarb, *Watershed Management: Slogan or Solution?*, 21 B.C. ENVTL. AFF. L. REV. 483, 484 (1994); Charles P. Lord et al., *Natural Cities: Urban Ecology and the Restoration of Urban Ecosystems*, 21 VA. ENVTL. L.J. 317 (2003); Ruhl et al., *supra* note 2, at 930-31; A. Dan Tarlock, *The Potential Role of Local Governments in Watershed Management*, 20 PACE ENVTL. L. REV. 149, 149 (2002) [hereinafter *Local Governments*]. For a general discussion of ecosystems crossing administrative boundaries of political jurisdiction and land ownership, see STEWARDSHIP ACROSS BOUNDARIES (Richard L. Knight & Peter B. Landres eds., 1998).

4. *See, e.g.*, *Local Governments*, *supra* note 3, at 157-58, 166-68; James C. Buresh, *State and Federal Land Use Regulation: An Application to Groundwater and Nonpoint Source Pollution Control*, 95 YALE L.J. 1433, 1439-41 (1986); Daniel R. Mandelker, *Controlling Nonpoint Source Water Pollution: Can It Be Done?*, 65 CHI.-KENT L. REV. 479, 484 (1989).

5. *See, e.g.*, NAT'L RESEARCH COUNCIL, NEW STRATEGIES FOR AMERICA'S WATERSHEDS 30 (1999); *Local Governments*, *supra* note 3, at 157-58, 166-68; Buresh, *supra* note 4, at 1440-41.

6. *See infra* Part III. The seminal law review article on watershed protection is Robert W. Adler, *Addressing Barriers to Watershed Protection*, 25 ENVTL. L. 973 (1995). *See also* NAT'L RESEARCH COUNCIL, *supra* note 5, at 1-34 (urging watershed management and planning); Reed D. Benson, *A Watershed Issue: The Role of Streamflow Protection in Northwest River Basin Management*, 26 ENVTL. L. 175, 178-99 (1996) (discussing the popularity of watershed management at all levels of environmental and land use decision-making); Larry C. Frarey, *Toward the Development of Performance Criteria Beyond Best Management Practices*, 48 OKLA. L. REV. 353, 354 (1995) ("The next generation of water quality programs will likely rely on the watershed concept . . . ."); Ruhl et al., *supra* note 2, at 930-32; A. Dan Tarlock, *Putting Rivers Back in the Landscape: The Revival of Watershed Management in the United States*, 6 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 167 (2000) [hereinafter *Rivers*].

However, it is dangerously tempting to think that moving land use regulatory authority to the "watershed-level" or imposing new watershed-based regulatory structures on the current land use system will easily achieve better water quality and land use planning. Both watersheds and land use controls are complex. Ecological and hydrological processes that occur within watersheds do not necessarily happen at the watershed level.[7] Some transcend the watershed, while others are more localized. Likewise, land use impacts on water quality occur at scales larger and smaller than the watershed level.[8] Moreover, controlling land use is not a unitary function. Governmental entities (as well as specific users and developers of land) use different processes and tools to perform different land management functions.[9] For example, systematic analyses of land use patterns and comprehensive planning processes may differ substantially from decisions about discretionary permits for specific small- and medium-scale projects. Although particularized land use decisions should be consistent with comprehensive, well-developed plans, the types of processes, information, expertise, tools, and judgment needed for different types of land use decisions vary significantly.

Thus, the task of controlling land use to protect water quality and watershed health necessitates finding the right matches between various ecological and hydrological scales and functions, on one hand, and various land use planning and regulatory scales and functions, on the other hand. This article will analyze the lessons we can learn from the study of watersheds and our experiences with land use planning and regulation in the United States. It makes several suggestions about how a concept of aquatically sustainable development can be incorporated into each category of the land use decision-making process, appropriate to the ecological scale that the particular set of decisions can affect. Although in some circumstances land use decisions and institutions need to be more oriented towards watersheds than they are now, in other circumstances they will need to be more oriented to basins (larger than watersheds), catchments (smaller than watersheds), or other organizing units of nature, such as landscapes or habitats.

Part II describes the impacts of land use on water quality and watersheds. Part III analyzes five categories of proposals for watershed institutions to address the impacts of land use on water-

7. *See infra* Part IV.
8. *See infra* Part V.
9. *See infra* Part V.

shed integrity and health. It contends that each of the prototypical proposals is flawed for its failure to contemplate linkages among watershed scales, watershed functions, land use scales, and land use functions. Part IV discusses four lessons that we can learn from watershed scale and function, relating to 1) geographic scale, 2) functional scale, 3) problem scale, and 4) temporal scale. Part V discusses four lessons that we can learn from land use scale and function, relating to 1) functional scale, 2) political scale, 3) resource scale, and 4) temporal scale. Part VI proposes a new model of clean-water land use that connects watershed scale and function to land use scale and function. This new model would create regional watershed agencies with planning, educational, advocacy, and coordination functions, while retaining basic land use planning and regulatory powers at the local level, but legally subject to regional watershed plans and policies. This mixed regional-local model is based not only on lessons about watersheds and land use, but also an additional lesson about legal scale and function.

II. IMPACTS OF LAND USE ON WATER QUALITY AND WATERSHEDS

Land use patterns and practices have adverse impacts on water quality and watershed integrity in several different ways. One feature of land use having particularly significant aquatic impacts is impervious cover. Impervious cover is land cover that water cannot penetrate.[10] Impervious cover may be rocky or hard-packed natural surfaces; and even pervious urban soils may have low permeability because the soils are compacted, highly disturbed, and of poor quality.[11] However, most impervious cover in an urban watershed is human-made, such as buildings and similar structures with roofs; paved or hard-cover recreational facilities like decks and patios, plazas, swimming pools, tennis and basketball courts, skate parks, and playgrounds; and transport systems like roads and streets, highways, freeways, driveways, parking lots, and sidewalks.[12] Waterways that are lined with con-

10. EPA, NATIONAL MANAGEMENT MEASURES TO CONTROL NONPOINT SOURCE POLLUTION FROM URBAN AREAS, EPA-841-B-05-004 (2005), at 0-16 [hereinafter NATIONAL MANAGEMENT MEASURES].

11. *Id.* at 0-16, -18.

12. *Id.* at 0-16 to -17.

crete, clay, or impervious rock, such as many urban drainage channels, are also mostly impervious.[13]

Impervious cover prevents the natural filtration of precipitation and water flows that would occur if the water were to fall on or flow over permeable soils.[14] It also decreases natural evaporation and transpiration processes.[15] Impervious cover increases the quantity and velocity of water that runs off of developed lands during rainfalls and snowmelts, as well as the variety and quantity of pollutants being carried from developed lands into bodies of water.[16] The quantity and velocity of stormwater runoff cause flooding, drainage problems, streambed sedimentation, the destruction of vegetation and habitat, reduction in large woody debris (an important structural component of many streams), increase in stream temperatures, and downstream channel or streambed erosion.[17] Runoff's transportation of sediment and pollutants into rivers, creeks, streams, lakes, and oceans and into the stormwater drainage systems that empty into these bodies of water has emerged as one of the most significant causes of water quality degradation in the United States, now ranking well ahead of point source discharges from industry and sewer treatment facilities.[18]

Moreover, impervious cover affects the entire integrity and health of the watershed. Urban land development not only increases peak flows from a given storm event but also decreases the ecologically important baseflow between storms and widens floodplains.[19] An area with more than 10 percent impervious cover can

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13. JOHN RANDOLPH, ENVIRONMENTAL LAND USE PLANNING AND MANAGEMENT 469-70 (2004).

14. AM. RIVERS ET AL., PAVING OUR WAY TO WATER SHORTAGES: HOW SPRAWL AGGRAVATES THE EFFECTS OF DROUGHT (2002); RANDOLPH, *supra* note 13, at 363, 373, 486-87.

15. NATIONAL MANAGEMENT MEASURES, *supra* note 10, at 0-22.

16. *Id.*

17. *Id.* at 0-25 to -27; RANDOLPH, *supra* note 13, at 363. *See generally* Douglas A. Miltenberger, *Development on the Banks of the Letort Spring Run: What Can Be Done to Save Pennsylvania's Waterways from Post Construction Stormwater Runoff?*, 11 PENN ST. ENVTL. L. REV. 127 (2002).

18. RANDOLPH, *supra* note 13, at 363, 392-93; SANJAY JEER ET AL., NONPOINT SOURCE POLLUTION: A HANDBOOK FOR LOCAL GOVERNMENTS, AM. PLANNING ASSN. REPORT NO. 476, 29-53 (1997). *See generally* THOMAS E. DAVENPORT, THE WATERSHED PROJECT MANAGEMENT GUIDE 32 (2003). Nonetheless, dry weather flows can also carry pollutants, although generally at lower levels than wet weather flows. *See generally* Timothy N. McPherson et al., *Dry and Wet Weather Flow Nutrient Loads from a Los Angeles Watershed*, 4 J. AM. WATER RESOURCES ASS'N 959 (2005).

19. RANDOLPH, *supra* note 13, at 373.

suffer adverse impacts to stream health, and at 25 percent or more of a subwatershed devoted to impervious cover, the streams in the subwatershed are deemed "nonsupporting" for their likely irreversible harms to aquatic life.[20] Likewise, excess water running off of impervious cover into surface waters is not recharging groundwater and is thus contributing to decreased groundwater levels.[21] A study by American Rivers, the Natural Resources Defense Council, and Smart Growth America showed that impervious cover from land development contributes to groundwater infiltration losses of between 6.2 billion and 132.8 billion gallons of water per day per major metropolitan area where land development is outpacing population growth.[22]

Nonetheless, the impact of any particular impervious cover on runoff depends on the location, the structure of impervious cover, the availability of adjacent pervious areas to absorb and filter runoff, and the extent to which the cover is connected to the storm-drain network.[23] The amount of impervious cover having adverse runoff impacts tends to vary with different types of land use, with the least impacts resulting from low-density residential development and the greatest impacts resulting from commercial and industrial development.[24]

A second type of land use impact on water quality is the generation of pollutants that contaminate surface waters and groundwater. There is no question that land development and land use activities cause decreased water quality.[25] Land use decisions encompass not only choices among categories of uses (e.g., residential, commercial, industrial, agricultural), and types of design (e.g., height, density, setbacks, structure design and placement, materials, landscaping, parking), but also ongoing operational ac-

20. NATIONAL MANAGEMENT MEASURES, *supra* note 10, at 0-20; RANDOLPH, *supra* note 13, at 405.

21. Miltenberger, *supra* note 17, at 127.

22. *See generally* AM. RIVERS ET AL., *supra* note 14.

23. NATIONAL MANAGEMENT MEASURES, *supra* note 10, at 0-17.

24. *Id.*; RANDOLPH, *supra* note 13, at 375 tbl.13.1 (illustrating that the amount of runoff from undeveloped land with natural cover is 10 percent, from residential uses is between 23 percent and 30 percent depending on density, and from developed urban centers is 55 percent).

25. NAT'L RESEARCH COUNCIL, *supra* note 5, at 20; Adler, *supra* note 6, at 990; David F. Boutt et al., *Identifying Potential Land Use-Derived Solute Sources to Stream Baseflow Using Ground Water Models and GIS*, 39 GROUND WATER 24, 24-34 (2001). *See generally* C. Leitch & J. Harbor, *Impacts of Land Use Change into the Near-Coast Zone*, 54 J. SOIL & WATER CONSERV. 584, 592 (1999); TOM DANIELS & KATHERINE DANIELS, THE ENVIRONMENTAL PLANNING HANDBOOK FOR SUSTAINABLE COMMUNITIES AND REGIONS (2003).

tivities related to the use of the land, including the use of pollutants. I have previously summarized the kind of impacts that land use has on water quality:[26]

> Degraded water quality from urban development is related in part to the amount of impervious cover that increases runoff into stormwater systems and into bodies of water, as discussed previously. However, water quality impacts from land development also result from the nature and concentration of pollutants used on urban, suburban, and exurban lands. Fertilizers, pesticides, herbicides, and pet waste come from lawns, golf courses, parks, and other humanly landscaped areas especially prevalent in sprawling communities. Freeways, streets, parking lots, car wash locations, automotive repair and storage facilities, and driveways are sources of automobile oil, coolants, other fluids, and contaminated car-washing runoff. Other pollution sources include commercial and household cleaning fluids; sediment and soil from construction, grading, landscaping, or other land alteration; decomposing litter; industrial and commercial chemicals and wastes; gas stations and their underground storage tanks; and landfills. These pollutants may run off ultimately into surface and coastal waters, facilitated by impervious cover. But they may also contaminate groundwater, degrade species' habitat, or overtax the natural filtration functions of soils, wetlands, and estuaries.
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> Pollution from urban development harms more and more biological communities as this development sprawls across our landscapes. Organic wastes, such as pet wastes, deplete receiving waters' dissolved oxygen, which can cause or contribute to fish kills. Nutrients in fertilizers that enter urban runoff enhance algae growth in surface and coastal waters, affecting not only the types of plants and animals living in the waters but also dissolved oxygen levels and the survival of aquatic species. Pesticides, chemicals used in or with vehicles, and some household products contain toxics that can biomagnify in concentration in the food chain (including in fish consumed by humans), and kill aquatic life. Soil erosion from construction and land development activity causes sedimentation of streams, lakes, or

26. *Land Use and Water*, *supra* note 1, at 10,162-63. *See also* DANIELS & DANIELS, *supra* note 25, at 99-107; DAVENPORT, *supra* note 18, at 33; NATIONAL MANAGEMENT MEASURES, *supra* note 10, at 0-28 to -35 (sediment, nutrients, oxygen-demanding substances, pathogens, road salts, hydrocarbons, heavy metals, and toxic pollutants from urban runoff impair surface waters and cause violations of water quality standards). *See generally* Monica G. Turner et al., *Land Use*, *in* STATUS AND TRENDS OF THE NATION'S BIOLOGICAL RESOURCES 37 (U.S. Geological Survey ed., 1998).

estuaries, which can smother bottom feeding or benthic organisms.[27]

We are continuing to discover ways that our land use activities harm water quality. For example, a recent study demonstrates that parking lot sealcoat is a significant source of polycyclic aromatic hydrocarbons, which are carcinogenic contaminants appearing in high concentrations in urban waters where there has been rapid development.[28] Particles of parking lot sealcoat become scraped from freshly coated parking lots by the abrasion of tires and then enter urban runoff.[29] In general, local land use regulatory requirements for parking result in overbuilt parking lots and structures, which in turn have adverse environmental impacts.[30]

Land use development also alters lands that are critical to watershed functioning, such as wetlands, hillsides and slopes, and riparian lands. In fact, "lands that serve important water system functions in their natural state, such as riverfront lands, coastal lands, wetlands, aquifer recharge areas, and hillside and mountain slopes, are targeted for development due to their landscape amenities that consumers of development want."[31] Development in floodplains is a major problem, contributing to flooding and related loss of life and property.[32] The loss of aquatic habitat to urban development also affects overall watershed health and functioning.[33]

The filling and development of wetlands, in particular, has substantially altered watershed hydrology. Wetlands serve critical flood control and pollution filtration functions, both absorbing floodwaters like a sponge and settling out and breaking down pollutants.[34] Wetlands have been lost to land development at alarm-

27. RANDOLPH, *supra* note 13, at 400.

28. *See generally* Barbara J. Mahler et al., *Parking Lot Sealcoat: An Unrecognized Source of Urban Polycyclic Aromatic Hydrocarbons*, 39 ENVTL. SCI. & TECH. 5560 (2005).

29. *See id.* at 5560.

30. EPA, PARKING SPACES / COMMUNITY PLACES: FINDING THE BALANCE THROUGH SMART GROWTH SOLUTIONS, EPA 231-K-06-001, 1 (2006).

31. *Land Use and Water*, *supra* note 1, at 10,161.

32. Patrick Gallagher, *The Environmental, Social, and Cultural Impacts of Sprawl*, 15 NAT. RESOURCES & ENV'T 219, 221 (2001).

33. *See, e.g.*, Timothy J. Iannuzi & Daniel F. Ludwig, *Historical and Current Ecology of the Lower Passaic River*, 2 URB. HABITATS 147 (2004). *See also* Adler, *supra* note 6, at 989.

34. RANDOLPH, *supra* note 13, at 540-41. *See generally* JON A. KUSLER & TERESA OPHEIM, OUR NATIONAL WETLAND HERITAGE: A PROTECTION GUIDE (2d ed. 1996); S.

ing rates: More than half of the wetlands in the coterminous United States have been lost since 1700, and the loss continues to exceed 50,000 acres per year, but is down from nearly 300,000 acres per year in the 1980s.[35] Experts believe that the flooding of New Orleans from Hurricane Katrina—including the accompanying loss of life and property—would have been considerably less, if it were not for the combination of wetland-eliminating land development and control of water flows carrying wetland-creating sediment to Louisiana's coastal wetlands.[36]

The re-engineering of watershed hydrology also has resulted in degraded water quality and watershed functioning. Land use practices and land development patterns have directly or indirectly contributed to the demand for watershed re-engineering. The types of re-engineering activities that have altered the natural functioning of watersheds include channelizing and lining streambeds, building dams on rivers, creating artificial lakes, altering the natural course of waterways (including often making meandering streams straight), building ports and docks, discharging treated waters into water bodies, stabilizing streambeds with structures and riprap, extracting sand and gravel, removing woody debris, and clearing riparian vegetation.[37] The reasons for these projects have varied from energy generation to flood control to support of navigation to creation of new lands for development, but they have promoted economic development and human land use goals at the expense of watershed health and integrity. We are now learning that many of these re-engineering projects have had undesired consequences.[38] As a result, many communities

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Scott Burkhalter, *Oversimplification: Value and Function: Wetland Mitigation Banking*, 2 CHAP. L. REV. 261 (1999).

35. EPA, PROTECTING AND RESTORING AMERICA'S WATERSHEDS: STATUS, TRENDS, AND INITIATIVES IN WATERSHED MANAGEMENT, EPA-840-R-00-001, 15 (2001) [hereinafter PROTECTING AND RESTORING AMERICA'S WATERSHEDS]; Jack E. Williams et al., *Understanding Watershed-Scale Restoration*, *in* WATERSHED RESTORATION: PRINCIPLES AND PRACTICES 1, 8 (Jack E. Williams et al. eds., 1997).

36. *See, e.g.*, Craig Pittman, *On the Gulf: Too Little, Too Late: A Wetlands Buffer Could Have Made a Difference to New Orleans*, 71 PLAN. 10 (Nov. 2005).

37. GARY J. BRIERLEY & KIRSTIE A. FRYIRS, GEOMORPHOLOGY AND RIVER MANAGEMENT: APPLICATIONS OF THE RIVER STYLES FRAMEWORK 208-20 (2005); BOB DOPPELT ET AL., ENTERING THE WATERSHED: A NEW APPROACH TO SAVE AMERICA'S RIVER ECOSYSTEMS 16-18 (1993); ERIC T. FREYFOGLE, BOUNDED PEOPLE, BOUNDLESS LANDS: ENVISIONING A NEW LAND ETHIC 60-63 (1998). *See generally* Turner, *supra* note 26.

38. BRIERLEY & FRYIRS, *supra* note 37, at 208-09; DOPPELT ET AL., *supra* note 37, at 16-18; FREYFOGLE, *supra* note 37, at 60-63; Turner, *supra* note 26; Adler, *supra* note 6, at 989-90.

are now engaged in restoration projects for water bodies, attempting to undo the harm of human alterations.[39]

Growth-generated consumption of water, with resulting reductions in in-stream flows of surface waters and overdrafts of groundwater, contribute to poor water quality.[40] From 1950 to 1990, the population ot the United States grew 92 percent, while water use grew by 106 percent, with even higher increases in domestic use.[41] Land development has been characterized by especially "water-intensive land use practices, including large grassy lawns even in dry and hot climates, swimming pools, golf courses, water recreational parks, fountains, non-native landscaping, vehicle washing activities, and even lush lawns for commercial and industrial centers."[42]

Finally, sprawl exacerbates many types of land use impacts on watersheds. In comparison to more compact growth, sprawl increases the amount of impervious cover per person; requires more roads, highways, parking lots, and other vehicle-related development; and consumes more environmentally sensitive lands like wetlands, riparian lands, and hillside slopes.[43]

Land use degradation of water quality and watershed health causes tremendous ecological, ethical, social, and economic harms. Consider the following:

- "Between 1990 and 1998, floods killed more than 850 people in the United States and caused $89 billion in property

39. *See, e.g.*, WATERSHED RESTORATION, *supra* note 35; Daniel P. Loucks & A.B. Avakyan, *Restoration of Degraded Water Resource Systems: Issues, Opportunities, Challenges and Experiences, in* RESTORATION OF DEGRADED RIVERS: CHALLENGES, ISSUES AND EXPERIENCES 3, 31-43 (1998).

40. *See generally* DAVID H. GETCHES ET AL., CONTROLLING WATER USE: THE UNFINISHED BUSINESS OF WATER QUALITY PROTECTION (1991); WET GROWTH: SHOULD WATER LAW CONTROL LAND USE? (Craig Anthony (Tony) Arnold ed., 2005); Adler, *supra* note 6, at 990.

41. Trisha Riggs, *ULI Examines Connection Between Land Use and Water Use*, URB. LAND, Jan. 2003, at 110.

42. *Land Use and Water*, *supra* note 1, at 10,161.

43. *See, e.g.*, Gallagher, *supra* note 32; AM. RIVERS ET AL., *supra* note 14. This article addresses primarily urban and suburban land uses, which have been historically subject to regulation. It does not address the more difficult issue of agricultural land use, which can be a significant contributor to watershed degradation but has evaded land use controls. *See Land Use and Water*, *supra* note 1, at 10,163-64; Larry C. Frarey et al., *Conservation Districts as the Foundation for Watershed-Based Programs to Prevent and Abate Polluted Agricultural Runoff*, 18 HAMLINE L. REV. 151 (1994).

damage. Much of this flooding occurred in places where weak zoning laws allowed development in floodplains."[44]

- Using land in fragmented, self-serving ways that have adverse environmental impacts harms the interconnected ecological community of nature, the social community of neighbors, and the ethical community of humans who are connected to nature.[45]
- "Stormwater runoff costs the commercial fish industry $17-31 million per year in environmental damage to adjoining communities."[46]
- In 1996, there were over 2500 beach closings and advisories, and over 2000 fish-consumption advisories, almost all of which were due to water contamination.[47]
- "An estimated 70-90% of natural riparian vegetation, vital to maintaining the integrity of riverine-riparian ecosystems and biodiversity, has already been lost or is degraded due to human activities nationwide."[48]
- "The cumulative impacts of . . . many human impacts has been . . . *ecosystem simplification*: huge reductions in the life-supporting complexity and diversity of watershed ecosystems. As the complexity and diversity are reduced, the system's ability to self-repair is eroded, leaving the system with reduced ability to perform ecological functions and with biodiversity depleted."[49]

III. PROPOSALS FOR WATERSHED INSTITUTIONS

The fundamental problem of land use impacts on water quality and watershed integrity is the failure to control or manage land uses for watershed health. This failure of land use regulatory regimes in the United States is one of both scale and function.

Perhaps foremost, the failure to control impacts of land use and land development on waters and aquatic ecosystems is often

44. Gallagher, *supra* note 32, at 221.

45. *See generally* FREYFOGLE, *supra* note 37.

46. Daniel J. Hutch, *The Rationale for Including Disadvantaged Communities in the Smart Growth Metropolitan Development Framework*, 20 YALE L. & POL'Y REV. 353, 361 (2002).

47. EPA & USDA, CLEAN WATER ACTION PLAN: RESTORING AND PROTECTING AMERICA'S WATERS 10 (1998).

48. DOPPELT ET AL., *supra* note 37, at xxii.

49. *Id.* at xxiii.

characterized as a problem of mismatched scales. Watersheds cross administrative boundaries—the political and legal boundaries of nations, states, counties, cities, and other municipal governments, and property ownership.[50] Ecosystems generally, and watersheds specifically, are composed of interconnected biological, chemical, and physical parts and processes that do not correspond to the fragmented patchwork of land-management jurisdictions and decision-makers.[51]

In the United States, control over land corresponds to diffused and fragmented property interests, resulting from the nation's long history of parcelization of land, widespread ownership opportunities, strong private property rights, and recognition of numerous property and contract interests in the control and use of land.[52] Countless persons and entities hold some type of interest in some portion of land within any given watershed. Many different property owners and local units of government make decisions about land use that have major impacts on water quality and watershed health, both within and beyond the boundaries of the decision-makers' jurisdiction.

Moreover, fragmentation also characterizes the American system of coordinating land use decisions and preventing property users from harming the community or the environment. The United States relies primarily on local governments, mostly cities and counties, to regulate land use through planning, zoning, subdivision controls, and various types of land use permits.[53] Indeed, land use regulation is arguably the primary function of municipalities.[54] The jurisdictional boundaries—and therefore power boundaries—of local units of government do not correspond to wa-

50. *See* sources cited *supra* note 3.

51. STEWARDSHIP ACROSS BOUNDARIES, *supra* note 3; ERIC T. FREYFOGLE, JUSTICE AND THE EARTH: IMAGES FOR OUR PLANETARY SURVIVAL (1993); FREYFOGLE, *supra* note 37; ERIC T. FREYFOGLE, THE LAND WE SHARE: PRIVATE PROPERTY AND THE COMMON GOOD (2003); Eric T. Freyfogle, *The Tragedy of Fragmentation*, 36 VAL. U. L. REV. 307 (2002). *See also* Goldfarb, *supra* note 3, at 485-86 (lamenting the disconnect between water resources management and land-use management).

52. *See* LAWRENCE M. FRIEDMAN, A HISTORY OF AMERICAN LAW, 230-34 (2d ed. 1985); *Land Use and Water*, *supra* note 1, at 10,168. *See also Home Ownership Reaches Record*, DAYTON DAILY NEWS, Jan. 22, 1998, at 7B (reporting that 65.7 percent of all American families owned their own homes in 1997); *Most U.S. Real Estate Still American-Owned*, HOUSTON CHRON., June 30, 1991, at 8 (summarizing a study showing that individuals owned about 60 percent of the nation's real estate).

53. Hess v. Port Authority Trans-Hudson Corp., 513 U.S. 30, 44 (1994) (land use regulation is primarily a local function); Mandelker, *supra* note 4, at 489.

54. Buresh, *supra* note 4, at 1436. The public safety functions of police and fire protection are also core local functions, but in many jurisdictions, special local units of

tershed boundaries, often covering much smaller areas of land than the land and waters affected by local land use decisions.[55] The sheer number of cities and counties in the United States (the nation has 38,971 counties, cities, and townships)[56] indicates that any given watershed will be affected by land use decisions made by many distinct governmental entities. Thus, the scale at which decisions about land use are made is significantly smaller than the scale of the impacts of those decisions. Many scholars and environmental policy experts argue that the fragmentation of land use authority across many local units of government under-protects watersheds.[57]

Experts also argue that the function of land use regulation is misplaced in local government, especially in light of a growing understanding of the regional and environmental impacts of land use. In their view, cities and other local governmental units lack the resources and expertise, incentives, tools, authority, and political will to regulate land in an environmentally sustainable manner.[58] One set of authors has written:

> [E]ffective watershed management regimes cannot rely exclusively on the initiative of local governance, particularly if channeled through conventional local political entities. Even putting aside the lack of match between local political boundaries and watersheds, local governments face several constraints to effective watershed management. First, while most state political systems allow considerable local authority—certainly enough to establish watershed ordinances—management of transboundary effects often lies outside their authority or is able to be undertaken only through burdensome interlocal coordination procedures. Second, many watershed management issues will present difficult political choices with potentially significant economic consequences, and local governments, particularly those

government have authority over other local functions like public education, public utilities, and public infrastructure ranging from roads to parks to waste management.

55. *See* sources cited *supra* note 3. Localities can also cross watershed boundaries, having impacts on at least two different aquatic ecosystems.

56. U.S. CENSUS BUREAU, 2002 CENSUS OF GOVERNMENTS, PRELIMINARY REPORT No. 1, GC02-1(P) 1 (2002), *available at* http://ftp2.census.gov/govs/cog/2002COGprelim_report.pdf.

57. *See Local Governments*, *supra* note 3, at 157-58, 166-68; Buresh, *supra* note 4, at 1439-41; Ruhl et al., *supra* note 2, at 937.

58. *See Local Governments*, *supra* note 3, at 157-58, 166-68; Buresh, *supra* note 4, at 1439-41; Mandelker, *supra* note 4, at 489; Barry T. Woods, *Environmental Land Use, Indirect Source Controls and California's South Coast Plan: Is the Day of Attainment Coming?*, 23 ENVTL. L. 1273, 1277-82 (1993).

> constituted by popular election, may be reluctant to make economic sacrifices not being made by others. Finally, even with most local governments committed to watershed management, it is doubtful that all could afford the intensive scientific, social, and economic data gathering and analysis necessary to carry it out effectively.[59]

Indeed, the number and size of local governments in the United States have arguably created competition among localities for economic development and fiscal resources, while simultaneously constraining local government revenues, information, staff, and expertise.[60]

Many experts have responded to this perceived inability of local governments to protect water quality by calling for watershed-based institutions, not only to manage hydrological and biological features of watersheds but also to control or influence land use decisions. These proposals fall into five general categories.

The first three categories of watershed management proposals would displace local government authority over land use, at least in substantial part. The first proposal, the most radical of all, would reorganize local and regional political jurisdictions to correspond to watershed boundaries.[61] In other words, the proposal calls for abolishing existing cities and counties and forming new sub-state or sub-national governmental institutions around watersheds.

The second proposal would give federal or state agencies primary watershed management responsibilities and a preemptive role over local land use decisions. There are two versions of this proposal. One version would centralize land use regulatory powers in federal or state environmental agencies that have specific

59. Ruhl et al., *supra* note 2, at 937 (citing *Local Governments*, *supra* note 3).

60. *See, e.g.*, Vicki Been, *"Exit" as a Constraint on Land Use Exactions: Rethinking the Unconstitutional Conditions Doctrine*, 91 COLUM. L. REV. 473 (1991).

61. John T. Woolley et al., *The California Watershed Movement: Science and the Politics of Place*, 42 NAT. RESOURCES J. 133, 141 (2002) (reporting that the Western Water Policy Review Advisory Commission recommends restructuring government around watersheds). Janet Neuman, building on John Wesley Powell's vision for the West as a "dryland democracy" organized politically and jurisdictionally around watersheds, encourages the creation of new watershed institutions with greater governance over both land use and water management. However, Professor Neuman acknowledges that achieving Powell's vision may be politically difficult after decades of local control over land use. Janet Neuman, *Dusting Off the Blueprint for a Dryland Democracy: Incorporating Watershed Integrity and Water Availability Into Land Use Decisions*, *in* WET GROWTH, *supra* note 40, at 119-69.

watershed protections missions.[62] The other version would add federal or state watershed-impact permit requirements to existing land use controls.[63] These "overlays" of federal or state permit requirements[64] might look much like the U.S. Fish and Wildlife Service's processes for approving habitat conservation plans and issuing incidental take permits for land development that modifies endangered or threatened species' habitat under the Endangered Species Act,[65] or the U.S. Army Corps of Engineer's § 404 permit processes for the filling of wetlands under the Clean Water Act.[66]

The third proposal would create formal regional watershed agencies with a preemptive role over local land use decisions. One of the most thoughtful versions of this idea is a proposal by J.B. Ruhl, Christopher Lant, and others for a model state watershed management act.[67] The model act would establish regional watershed agencies and invest them with the authority to review and

62. *See* Buresh, *supra* note 4, at 1442-45. *See also* Mandelker, *supra* note 4, at 491 (calling for federal and state land use planning and regulatory programs to control nonpoint source pollution).

63. *See* Buresh, *supra* note 4, at 1442-45; Robin Kundis Craig, *Local or National? The Increasing Federalization of Nonpoint Source Pollution Regulation*, 15 J. ENVTL. L. & LITIG. 179 (2000) (acknowledging an important role for local government in controlling nonpoint source pollution but arguing for federal and citizen-suit enforcement of national standards). *See also* Patricia E. Salkin, *Land Use*, *in* STUMBLING TOWARD SUSTAINABILITY 369, 377-84 (John C. Dernbach ed., 2002) (calling for greater national and state government roles in requiring smart growth and sustainable development policies). Arguably, the Clean Water Act requirements that states set water quality standards and total maximum daily loads (TMDLs) for waters that do not meet those standards constitute a "federal overlay" that will constrain land uses that degrade water quality. *Local Governments*, *supra* note 3, at 155-56.

64. *See, e.g.*, Lindell L. Marsh & Peter L. Lallas, *Focused, Special-Area Conservation Planning: An Approach to Reconciling Development and Environmental Protection*, *in* COLLABORATIVE PLANNING FOR WETLANDS AND WILDLIFE: ISSUES AND EXAMPLES 7, 9 (Douglas R. Porter & David A. Salvesen eds., 1995) (layers of regulation of species' habitat and land use). *See also* Peter A. Buchsbaum, *Permit Coordination Study by the Lincoln Institute of Land Policy*, 36 URB. LAW. 191 (2004) (same); JON KUSLER & TERESA OPHEIM, OUR NATIONAL WETLAND HERITAGE: A PROTECTION GUIDE (2d ed. 1996) (a guide to multiple levels of regulation and policy to protect wetlands).

65. Endangered Species Act, 16 U.S.C. §§ 1531-1544 (2000). *See also* Craig Anthony (Tony) Arnold, *Conserving Habitats and Building Habitats: The Emerging Impact of the Endangered Species Act on Land-Use Development*, 10 STAN. ENVTL. L.J. 1 (1991) [hereinafter *Conserving Habitats*].

66. Federal Water Pollution Control Act § 404, 33 U.S.C. § 1344 (1994). *See also* Peter A. Buchsbaum, *Federal Regulation of Land Use: Uncle Sam the Permit Man*, 25 URB. LAW. 589 (1993).

67. Ruhl et al., *supra* note 2, at 935-46.

make decisions on all local land use decisions, including zoning and individual permits.[68]

The last two categories of proposals for watershed institutions do not include land use powers for these institutions, but instead rely on "soft" methods of persuasion, information, and cooperation to effect changes in local land use patterns.[69] The fourth proposal is to create formal regional watershed management institutions with coordinating study, educational, and advocacy functions. These agencies might have powerful tools in the form of federal or state grant funding, information and analytical tools, methods of public education and advocacy, and the mission and credibility to achieve cooperation among stakeholders within watersheds. However, these agencies would not have any formal land use planning or regulatory authority.

The fifth proposal is to create informal watershed-based institutions to achieve cooperation, planning, and problem-solving among stakeholders within watersheds. Instead of creating new formal governmental entities, this proposal relies on coalitions, groups, collaborative efforts, and multi-stakeholder negotiations to get the relevant parties to change land use activities and practices that adversely affect the watershed.

All five categories of proposals, at least as national models of watershed-protecting management of land use, contain fundamental flaws. The first three proposals are naïvely idealistic about their prospects politically.[70] A major displacement of local authority over land use is highly unlikely to occur, because local governments will fight it and voters tend to value local control of land use. Many experts, even when calling for greater federal or

68. *Id.* at 943-46.

69. For examples of the fourth and fifth categories of proposals, often discussed together, see SWIMMING UPSTREAM: COLLABORATIVE APPROACHES TO WATERSHED MANAGEMENT (Paul A. Sabatier ed., 2005); Woolley et al., *supra* note 61; Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189 (2002); *Rivers, supra* note 6; Elizabeth Ann Rieke, *The Bay-Delta Accord: A Stride Toward Sustainability*, 67 U. COLO. L. REV. 341 (1996); Patrick Wright, *Fixing the Delta: The CALFED Bay-Delta Program and Water Policy Under the Davis Administration*, 31 GOLDEN GATE U. L. REV. 331 (2001); Jon Cannon, *Choices and Institutions in Watershed Management*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 379 (2000).

70. Adler, *supra* note 6, at 991 (noting that the organization of water management by watersheds is politically difficult due to jealously guarded fragmentation of authority); Buresh, *supra* note 4, at 1436 (observing federal and state government reluctance to regulate land use); Goldfarb, *supra* note 3, at 484 ("In the American political system, regional political institutions are difficult to create and, when established, tend to lack political viability.").

state control over land use, acknowledge that there are strong political and cultural forces favoring local government control of land use.[71]

In addition, proponents should be realistic about the availability of funding and other resources for new watershed institutions to engage in comprehensive and effective management of watersheds. The tasks of managing hydrologic processes (e.g., in-stream flows, flooding, runoff patterns, aquifer recharge), watershed-related biological resources, and all land use decisions in an entire watershed are likely to be expensive and labor-intensive.[72] Congress and state legislatures will likely under-fund any new watershed institutions, if past practice is any predictor.[73] This is all the more likely to the extent that new watershed institutions are land use regulatory entities overlaid on local government authority over land use, thus duplicating some costs. The probable result of limited government resources will either be a narrowing of the mission of watershed institutions from the proposed reforms, or a failure of watershed institutions to meet their mandates and responsibilities. In either case, new watershed institutions will have limited effect in controlling land use to protect water quality.

Another limitation to effective watershed-based land use controls is the likelihood of "regulatory traffic jams."[74] One scenario

71. *See, e.g.*, Mandelker, *supra* note 4, at 489, 501-02; Adler, *supra* note 6, at 991-93, 1095; Jerold S. Kayden, *National Land-Use Planning: Something Whose Time Has Never Come*, 3 WASH. U. J.L. & POL'Y 445 (2000).

72. *See, e.g.*, DAVENPORT, *supra* note 18, at 11 (stating that planning an entire watershed is "an overwhelming task"); Adler, *supra* note 6, at 1088-1104 (exploring the complexity of watershed protection).

73. For a discussion of the challenges of funding for watershed programs, see, e.g., NAT'L RESEARCH COUNCIL, *supra* note 5, at 4, 32; Adler, *supra* note 6, at 995 ("Given the current and foreseeable fiscal climate in the United States, resources for water system protection and restoration are inadequate and increasingly scarce.").

74. *See* James Salzman et al., *Regulatory Traffic Jams*, 2 WYO. L. REV. 253 (2002); J.B. Ruhl & James Salzman, *Mozart and the Red Queen: The Problem of Regulatory Accretion in the Administrative State*, 91 GEO. L.J. 757 (2003). For the potential for land use and environmental controls to create costly delays and backlog generally, see KENNETH CULP DAVIS & RICHARD J. PIERCE, JR., ADMINISTRATIVE LAW TREATISE § 12.1 (1994) ("All individuals and institutions involved in the administrative law system agree on two propositions: (1) Agency decisionmaking often takes a long time and (2) decisionmaking delay imposes enormous costs on individuals, society, and the legal system."); Albert C. Lin, *Participants' Experiences with Habitat Conservation Plans and Suggestions for Streamlining the Process*, 23 ECOLOGY L.Q. 369 (1996); Shirley Leung, *Streamlining City Charter May Help Business in L.A.*, WALL ST. J., Feb. 3, 1999, at CA1 (comparing length of time to obtain conditional use permit or zoning change in Los Angeles with time in nearby cities of Anaheim and

is that watershed institutions would review and make decisions about proposals for land use and land development, in addition to existing local entities and possibly state and federal entities, depending on whether the proposed use would affect protected lands like endangered species habitat, wetlands, coastal zones, Superfund sites, and the like. Adding another layer of regulatory control to the existing layers[75] would likely increase the time, complexity, paperwork, and costs involved in pursuing land use projects. It would also likely create a backlog in the review and decision-making processes. Even if watershed institutions entirely replaced some government authorities' land use regulatory powers, these institutions would have to be well-staffed and well-funded in order to prevent a backlog. The resources and funding would have to accommodate all the land use proposals and permits, both large and small, that arise throughout an entire watershed. The staff would have to be thoroughly familiar with the range of considerations that go into land use decisions in each type of area within the watershed, whether a major urban downtown area, a suburban residential community, a small town, agricultural lands, industrial areas (often problematically intermixed with low-income and minority neighborhoods),[76] and so forth.

Burbank); IRA S. LOWRY & BRUCE W. FERGUSON, DEVELOPMENT REGULATION AND HOUSING AFFORDABILITY 143-52 (1992) (documenting typical processing time for rezoning, subdivision approvals, and building permits for eight counties near Sacramento, Cal., ten counties near Nashville, Tenn., and eight counties near Orlando, Fla.); Chris Kenning, *Hospital Deal Falls Through*, PORTLAND OREGONIAN, Nov. 3, 1998, at C01 (time required to obtain zoning and historic preservation approvals has contributed to non-use of hospital building for sixteen years); Thomas M. Reynolds, *Government Can Make Housing Affordable*, BUFFALO NEWS, Aug. 14, 1992, at C-2 (describing report of New York Assembly Republican Task Force on Affordable Housing, which contends that development permitting delays contribute to higher housing costs); Bette Sheldon, *Unheralded New Law Should Ease Developers' Delays and Frustrations*, SEATTLE TIMES, May 28, 1995, at B7 ("Projects have been subjected to multiple reviews, resulting in costly and time-consuming delays."); Deborah Schoh, *Bird Grounds Some Landowners Development*, L.A. TIMES, Sept. 3, 1998, at B1 (landowners' development of gnatcatcher habitat delayed pending creation of wildlife preserves and U.S. Fish & Wildlife Service approval of incidental take permits); Nancy Woodbury, *Environmental Rules Frustrate Business Owners*, BUSINESS J. JACKSONVILLE, Nov. 6, 1992, at 9 (reporting complaints about and examples of lengthy delays in obtaining development and environmental permits); Julie Tamaki, *Turf Battle Waiting in the Wings*, L.A. TIMES, Mar. 21, 1999, at K1 (stating that developers are frustrated over uncertainty and delay in surveying Quino checkerspot butterfly habitat, possibly as long as two years before development can proceed).

75. *See* Ruhl et al., *supra* note 2, at 947.

76. *See, e.g.*, Craig Anthony (Tony) Arnold, *Planning Milagros: Environmental Justice and Land Use Regulation*, 76 DENV. U. L. REV. 1, 76-139 (1998) [hereinafter *Planning Milagros*] (documenting high percentage of industrial land uses in low-in-

Again, the scope of responsibility that a regional watershed-defined land use agency would have for all land uses within the watershed poses the likelihood of regulatory traffic jams.

On the opposite end of the spectrum, watershed institutions with merely persuasive—as opposed to regulatory—roles will not likely affect enough change in land use patterns to meet the need.[77] Improvement in the quality of water bodies and prevention of additional degradation of watersheds will require substantial and widespread changes in land use practices. Formal or informal watershed institutions that must rely solely on stakeholder cooperation and the facilitation of voluntary measures through funding and information lack the necessary "hammer" (or "lever," if you prefer), to force change among recalcitrant localities, developers, property owners, and other entities with land use authority.

The literature on watersheds can overstate local resistance to ecologically sustainable land use policies and practices, especially in light of evidence that local governments can and will adopt such policies and practices.[78] Nonetheless, a variety of political, economic, and institutional forces creates substantial obstacles to watershed-regarding land use reforms, in varying ways and to varying degrees.[79] Just as these obstacles should not be overestimated, they should not be underestimated. Proposals for weak

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come, minority neighborhoods and analyzing use of land use planning and regulatory tools to address this pattern).

77. Ruhl et al., *supra* note 2, at 935; Adler, *supra* note 6, at 1101-04.

78. *Land Use and Water*, *supra* note 1, at 10,156-58; John R. Nolon, *In Praise of Parochialism: The Advent of Local Environmental Law*, 26 HARV. ENVTL. L. REV. 365 (2002) [hereinafter *Parochialism*]; John R. Nolon, *Champions of Change: Reinventing Democracy*, 30 HARV. ENVTL. L. REV. 1 (2006) [hereinafter *Champions of Change*]; Daniel B. Rodriguez, *The Role of Legal Innovation in Ecosystem Management: Perspectives from American Local Government Law*, 24 ECOLOGY L.Q. 745 (1997); NAT. RESOURCES DEF. COUNCIL, STORMWATER STRATEGIES: COMMUNITY RESPONSES TO RUNOFF POLLUTION (2005); EPA, PROTECTING AND RESTORING AMERICA'S WATERSHEDS: STATUS, TRENDS, AND INITIATIVES IN WATERSHED MANAGEMENT, EPA-840-R-00-001 (2001); The Stormwater Manager's Resource Center, Model Ordinances for Aquatic Resource Protection [hereinafter Aquatic Resource Protection], http://www.stormwatercenter.net/intro_ordinances.htm (last visited Apr. 5, 2006); EPA, Model Ordinances to Protect Local Resources [hereinafter Protect Local Resources], http://www.epa.gov/owow/nps/ordinance (last visited Apr. 5, 2006); Pace Law School Land Use Law Center, Gaining Ground Information Database [hereinafter Gaining Ground Database], http://www.landuse.law.pace.edu (last visited Apr. 5, 2006); EPA, Local Source Water Protection Programs: Summary of All Case Studies [hereinafter Case Studies], http://www.epa.gov/safewater/protect/casesty/casestudysum.html (last visited Apr. 14, 2006).

79. Goldfarb, *supra* note 3; Adler, *supra* note 6.

watershed institutions with purely voluntary policies do not do enough to address the potential for continued degradation of watersheds from local land use practices.

From a more theoretical perspective, the prototypical proposals to address land use impacts on watersheds tend to be caught in two false dichotomies. The first is a choice between centralism or regionalism on one hand and localism on the other hand. This choice characterizes solutions as top-down or bottom-up. The second is a choice between hard law and soft process. This choice characterizes solutions as involving mandatory controls or voluntary cooperation. These two dichotomies can be combined to form four possible directions for water-quality policy: a) top-down command-and-control regulation by a centralized (or at least regional) authority; b) top-down voluntary cooperation initiated or managed by a centralized (or at least regional) authority; c) command-and-control regulation enacted by local authorities; and d) bottom-up voluntary cooperation initiated by local authorities and stakeholders. Figure 1 illustrates the matrix of options using this dichotomized perspective.

Nature of response → Level of authority ↓	Mandatory Controls (hard law)	Voluntary Cooperation (soft process)
Centralized (or regionalized) (top-down)	Central or regional authority regulates land use and water quality with command-and-control measures.	Central or regional authority initiates and facilitates voluntary cooperation to manage land use so as to protect water quality.
Localized (bottom-up)	Local authority regulates land use and water quality with command-and-control measures.	Local entities initiate and facilitate voluntary cooperation to manage land use so as to protect water quality.

Figure 1: Matrix of Dichotomous Perspectives on Clean-Water Land Use

Despite the tempting allure of this matrix, neither watershed management nor land use management lend themselves to such simple models. These simple, broad, and rather rigid models do not reflect the nuances and complexities of both watersheds and land use planning and regulatory functions. Nor do they convey the potential for solutions to have various mixes of centralized, localized, mandatory, and voluntary elements. There is, of course, the rather standard critique that "real world" solutions do not fall neatly into clean, well-defined categorical boxes, but instead lie on

points along a continuum or spectrum, or perhaps at the intersection of two or more continua or spectra.[80] More importantly, though, solutions are formed from different mixes or combinations of multiple types of actions (or functions), arising from or occurring at multiple scales. For example, a legal rule or regulation might not form the content of a solution to a given environmental problem, but it might move the relevant stakeholders to cooperate in developing a solution.[81] This phenomenon is sometimes called "bargaining in the shadow of the law,"[82] but might more accurately be called "problem-solving in the shadow of the law." In this situation, a combination of mandatory and voluntary tools is used. Likewise, the combined participation of central, regional, and local entities might be needed to address land use and environmental problems. For example, experts on collaborative watershed conservation processes contend that successful processes require considerable leadership and participation by local stakeholders at the grassroots level, but also require a meaningful federal government involvement.[83]

Therefore, solutions to control and manage land use for watershed health likely require a mix of actions, functions, and tools occurring at various levels of scale.[84] There is merit to the idea of creating formal watershed institutions with legal and political au-

80. For theories about the complexity and dynamic nature of legal systems, see J.B. Ruhl, *Complexity Theory as a Paradigm for the Dynamical Law-and-Society System: A Wake-Up Call for Legal Reductionism and the Modern Administrative State*, 45 DUKE L.J. 849 (1996); J.B. Ruhl, *The Fitness of Law: Using Complexity Theory to Describe the Evolution of Law and Society and Its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407 (1996); J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean up the Environment by Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933 (1997). For examples of the complexity of environmental and land use systems, see Adler, *supra* note 6 (describing the inherent complexity of watershed protection efforts); John R. Nolon, *Katrina's Lament: Reconstructing Federalism*, 23 PACE ENVTL. L. REV. (forthcoming *Intersection of Land Use and Environmental Law* Issue 2006) (arguing for an "integrated federalism" for controlling stormwater runoff, which involves linking federal, state, and local authority).

81. *See* Craig Anthony (Tony) Arnold, *Working Out an Environmental Ethic: Anniversary Lessons from Mono Lake*, 4 WYO. L. REV. 1, 32-39 (2004) [hereinafter *Environmental Ethic*] (developing a concept of law's "bounded effectiveness").

82. *See* Robert Cooter et al., *Bargaining in the Shadow of the Law: A Testable Model of Strategic Behavior*, 11 J. LEGAL STUD. 225 (1982); Robert H. Mnookin & Lewis Kornhauser, *Bargaining in the Shadow of the Law: The Case of Divorce*, 88 YALE L.J. 950 (1978-1979).

83. *See, e.g.*, David H. Getches, *Some Irreverent Questions About Watershed-Based Efforts*, *in* ACROSS THE GREAT DIVIDE: EXPLORATIONS IN COLLABORATIVE CONSERVATION AND THE AMERICAN WEST 180, 180-87 (Philip Brick et al. eds., 2001).

84. *See, e.g.*, *Local Governments*, *supra* note 3, at 149-53 (arguing that local governments can play an important role in watershed management despite constraints,

thority, while also encouraging and facilitating informal watershed processes. Likewise, there is merit to the idea of planning land use patterns on regional levels that take into account impacts on aquatic ecosystems, while also retaining most land use planning and regulatory functions at the local level.

The critical tasks are to evaluate the complex scales and functions of watersheds and their processes, and to evaluate the complex scales and functions of land use decisions and actions. Experts on watershed encourage the selection of planning, management, regulatory, and coordination structures that match the scale of the problems that they are trying to address.[85] In particular, watershed management should be sufficiently flexible to accommodate both the nested ecological scales of watersheds and the various functional boundaries of social, political, and legal institutions.[86] Effective solutions to land use impacts on watersheds require matching the appropriate scales and functions of watersheds to the appropriate scales and functions of land use, as illustrated by Figure 2.

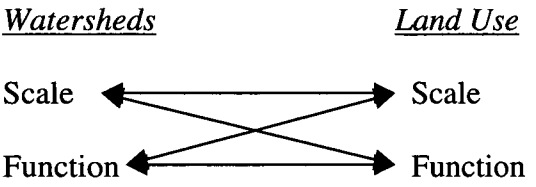

Figure 2: Connecting Scale and Function in Watersheds and Land Use

In the following sections, I discuss four aspects of watershed scale and function and four aspects of land use scale and function. These eight insights, in conjunction with an additional insight about legal scale and function, support legal reform that combines regional watershed planning, expertise, and resources with local land use control and participatory processes.

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but should do so in cooperation with federal, state, and private sector efforts); Adler, *supra* note 6, at 1088-92, 1094-99.

85. NAT'L RESEARCH COUNCIL, *supra* note 5, at 3; Adler, *supra* note 6, at 1088-1104.

86. NAT'L RESEARCH COUNCIL, *supra* note 5, at 16 (describing the National Resource Conservation Service approach to watershed management).

IV. WATERSHED SCALE AND FUNCTION

When we consider four features of watersheds, we quickly see that simply organizing land use decisions around a particular hydrologic unit will not, by itself, achieve clean water.

A. The Geographic Scale: Watersheds Are Nested, Having Varying Scales

Despite common reference to the need to manage land use at the watershed level,[87] the precise geographic level to which these proposals refer often is either unclear or an artificial selection more for administrative convenience than for ecological significance. In fact, hydrologic units of land exist in the natural world in "nested" form and have varying scales of significance.[88]

The problem may be one of semantics, resulting from the use of the shorthand term "watershed" to refer to a complex, multifaceted concept.[89] The literature and policy discussions about watershed management and watershed protection use the term "watershed" in two different ways. The general meaning of "watershed" is a geographic area that drains to a common point.[90] In other words, people may be using the term "watershed" to refer to any hydrologic unit of land or to define land in terms of its relationship to water flow, drainage, and surface waters.

The use of "watershed" in this generic sense distinguishes the classification of land from other characteristics, such as landscapes, habitats and biological communities, or political and legal jurisdictions. Unfortunately, using the term "watershed" so broadly does not tell us very much about an appropriate geo-

87. G.E. Griffith et al., *Ecoregions, Watersheds, Basins, and HUCs: How State and Federal Agencies Frame Water Quality*, 54 J. SOIL & WATER CONSERVATION 666, 667 (1999) ("Watersheds have been widely claimed to provide the necessary spatial mechanism for ecosystem research, assessment, and management.").

88. PROTECTING AND RESTORING AMERICA'S WATERSHEDS, *supra* note 35, at 9 (describing basic concepts of watershed planning); RANDOLPH, *supra* note 13, at 256-57; Ruhl et al., *supra* note 2, at 933.

89. For an analysis of the commingling of terms in discussions of watersheds, see NAT'L RESEARCH COUNCIL, *supra* note 5, at 37-39. *See also Local Governments*, *supra* note 3, at 161-62 (discussing the vagueness of the term "watershed").

90. NAT'L RESEARCH COUNCIL, *supra* note 5, at 14 ("a watershed is 'a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water'") (citation omitted); Goldfarb, *supra* note 3, at 484 (discussing the EPA's definition of watershed, "the drainage basin of the receiving water body"). The term "watershed" originally referred to a topographic peak or line of high points separating two different basins, but it now refers to the drainage basin itself. NAT'L RESEARCH COUNCIL, *supra* note 5, at 39.

graphic scale for land and water management, because hydrologic units of land are nested. Smaller drainage areas drain to larger drainage areas, which drain to even larger drainage areas, and so on.

The two most commonly used classification systems for hydrologic units of land are the United States Geological Survey's (USGS) hydrologic unit codes (HUCs) and the Center for Watershed Protection's watershed management units.[91] The USGS has divided the entire United States into twenty-one hydrologic regions and given each region a two-digit code. Each region is divided into subregions, each with a four-digit code starting with the two digits of the region. Each subregion is divided into basins, each with a six-digit code starting with the digits of the region and the subregion. The basin level is referred to as the "accounting unit." Each basin is divided into watersheds, which are referred to as the "cataloging unit." Each watershed has an eight-digit code. Within each watershed are subwatersheds, each with an eleven-digit code. Within each subwatershed are microwatersheds, each with a fourteen-digit code. The classification scheme is represented in Figure 3.

Unit	Number of Digits	Quantity in the U.S.
Region	2	21
Subregion	4	222
Basin	6	352
Watershed	8	2150
Subwatershed	11	Over 7000
Microwatershed	14	Unknown

Figure 3: U.S. Geological Survey Hydrologic Unit Codes Classification System

Tom Schueler and the Center for Watershed Protection developed a similar but somewhat different method of classification,

91. Descriptions of the two systems can be found in RANDOLPH, *supra* note 13, at 255-58 (citing, *inter alia*, Tom Schueler, *Basic Concepts of Watershed Planning*, *in* THE PRACTICE OF WATERSHED PROTECTION 145-67 (T. Schueler & H. Holland eds., 2000), and EPA, WATERSHED ANALYSIS AND MANAGEMENT: A GUIDE FOR TRIBES (2000)). For additional information on these systems, see DAVENPORT, *supra* note 18, at 23-24; NAT'L RESEARCH COUNCIL, *supra* note 5, at 37-54; Griffith et al., *supra* note 87, at 667-68; Adler, *supra* note 6, at 1091 & n.742.

which many environmental planning experts use. The broadest layer is the basin, in which subbasins are nested, in which watersheds are nested, in which subwatersheds are nested, in which catchments are nested. The typical basin may be as large as 10,000 square miles or as small as 1000 square miles. In contrast, a catchment is typically only 0.05 to 0.50 square miles. Figure 4 summarizes this classification system.

Unit	Typical Area Covered
Basin	1,000-10,000 square miles
Subbasin	100-1,000 square miles
Watershed	10-100 square miles
Subwatershed	1-10 square miles
Catchment	0.05-0.50 square miles

Figure 4: Center for Watershed Protection Watershed Management Units

In contrast to the more general meaning of the term "watershed," many discussions of watershed management, governance, planning, and institutions refer to the drainage-area level identified by the eight-digit HUC, the fourth level of hydrologic unit in the USGS classification system. This level is commonly accepted or recommended as the appropriate level for ecologically sustainable management of land and water.[92]

The selection of the eight-digit watershed unit as the appropriate level for controlling land use and protecting watershed functions poses three problems, though. The first is that the nesting feature of watersheds is important to the development of policy, law, institutions, and actions. The appropriate scale for analysis and action varies across the multiple units that are nested one within the other. Some hydrologic processes and functions and some relevant relationships between land use and aquatic integrity occur at larger scales, such as river basins or even larger hydrologic regions, while others occur at smaller

92. Griffith et al., *supra* note 87, at 668 (reporting that the EPA and the USDA recommend the eight-digit watershed HUC as a proper focus for watershed management under the Clean Water Action Plan); Ruhl et al., *supra* note 2, at 944 (recommending establishment of boundaries for watershed management councils according to the USGS eight-digit cataloging units).

scales, such as subwatersheds and small catchments.[93] For example, sediment storage tends to occur on the scale of a larger watershed, but not on a smaller watershed, which means that cumulative impacts of sediment are not merely a sum of small area processes.[94] According to the National Research Council, the smallest drainage basins are source areas for water, sediment, and chemicals, and soil conditions heavily influence hydrologic activity in these small basins.[95] These areas are most susceptible to impacts from storm events and to impacts from human disturbance and land development.[96] Intermediate basins have more space for temporary storage of water, sediment, and pollutants than do smaller basins, and have a complex mix of slopes, channels, and floodplains for the temporary storage and ultimate drainage of overflow waters.[97] Larger natural or human disturbances, such as tropical storms, large dams and channel engineering projects, and extensive changes to hillsides and channels can have significant effects.[98] Finally, large basins (meaning those typically greater than 3860 square miles), host a great variety of ecosystems and land uses, provide the scale for alluvial and deltaic processes, and often experience change in one part at a time, instead of system-wide.[99] Environmental planning experts recommend planning at the higher levels like basins and subbasins, zoning at the watershed level, and site-specific or project-specific regulation, design, and management at the smallest scales of subwatersheds and catchments.[100]

Second, research on the USGS watershed classifications indicates that some of the watershed delineations are somewhat artificial. They do not correspond to ecologically or hydrologically relevant scales or functions, but instead are arguably for adminis-

93. NAT'L RESEARCH COUNCIL, *supra* note 5, at 42-43.
94. *Id.* at 43.
95. *Id.* at 42.
96. *Id.*
97. *Id.*
98. *Id.* at 43.
99. *Id.*
100. RANDOLPH, *supra* note 13, at 258 ("Most effective watershed planning is guided by larger issues of the basin but focuses on smaller scale subwatersheds and catchments for action. Guidance, policies, and financial and technical assistance may be basinwide, but specific plans and implementation occur in subwatersheds.") A subwatershed is an effective scale for management not only because it may be small enough to fall within one local jurisdiction or just a few local jurisdictions, but also because the influence of land use on watershed health is the greatest at the subwatershed scale, as well as the easiest to control. *Id. See also* Frarey, *supra* note 6, at 358-59; Adler, *supra* note 6, at 1091-92.

trative convenience.[101] In particular, a group of environmental geographers analyzing eight-digit HUCs found that most of these HUCs are not true topographic watersheds and do not correspond to hydrologically meaningful units.[102] The authors state that "[i]t is impossible to divide the country into a finite number of true watersheds at any hierarchical level."[103]

In addition, watershed unit classifications are not the only way of classifying hydrologic functions. An alternative is to use a stream ordering system to describe the topology of stream channels:

> In the Strahler ordering system, a first-order channel is the smallest fingertip tributary that begins in a hillslope area and terminates at the confluence with another channel. A second-order stream forms where two first-order channels join; a third-order stream forms where two second-order streams join; and so on. A channel changes order only when joined by another of equal order.[104]

Although the Strahler system is the most commonly applied method of stream ordering, the Shreve method is an alternative stream ordering method that "shows increases in stream order more closely associated with hydrologic reality."[105]

Third, watershed delineations do not always reflect ecologically significant connections between groundwater hydrology and surface-water hydrology. Relevant groundwater boundaries may transcend watershed boundaries.[106] For example, groundwater that is hydrologically connected to surface water in watershed A may actually be located under lands that are within watershed B.

Thus, hydrologic processes and aquatic ecological values and services are interconnected across different geographic scales. Admittedly, the selection of a particular hydrologic unit of land, such as the USGS eight-digit hydrologic unit called "watershed," gener-

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101. *See* Neuman, *supra* note 61, at 143 (noting but disagreeing with the assertion that river basins "do not necessarily have 'truth' but only 'utility.'").

102. Griffith et al., *supra* note 87, at 667-68.

103. *Id.* at 667.

104. NAT'L RESEARCH COUNCIL, *supra* note 5, at 44.

105. *Id.* at 45 fig.2.3 (citation omitted).

106. *Id.* at 41 ("Groundwater . . . migrates along groundwater gradients that do not always respect the surface configuration, so that an aquifer may transcend watershed boundaries."); MARTIN P. WANIELISTA, STORMWATER MANAGEMENT: QUANTITY AND QUALITY 30 (1978) ("There is disparity between topographic and groundwater basins."); Goldfarb, *supra* note 3, at 484.

ally has more meaning and utility in the natural world (and thus the dimension in which land use affects water quality) than a unit of purely political geography, such as a municipality or county. Nonetheless, the classification and selection of any particular hydrologic unit of land are artificial human constructs imposed on a complex natural world. The preferred—and more sophisticated—approach is to develop institutions, policies, and practices that contemplate the multiple geographic scales at which land and water, and their processes, interrelate.[107]

B. The Functional Scale: Watersheds Serve Various Ecological Functions

Just as the geographic scale of watersheds is complex, their ecological functions are likewise complex. Watersheds serve critical ecosystem services. These services include filtration of pollutants, flood control, habitat for aquatic species, support of biodiversity, maintenance of biological and chemical content of surface waters (freshwater bodies, estuaries, and coastal waters) and groundwater, soil enrichment and deposition, shaping of landscapes, and provision of water necessary to maintain and support life.[108] Healthy watersheds are critical to a healthy natural environment.[109] They are also critical to supporting human life and economic activity like fishing, recreational water sports, commercial shipping, and provision of public water supplies.[110] Given the functions that watersheds provide, we need to find new approaches to land use that promote the healthy functioning of watersheds.

By the same token, though, basing land use policy on a particular geographic scale of surface water drainage (e.g., the USGS eight-digit hydrologic unit) would fail to match land use decision-making to the rich array of ecological functions that occur in the land-water interface. Environmental geographers observe that neither HUCs nor watersheds in the broader meaning of the word necessarily correspond to spatial patterns of landscape conditions

107. R. Edward Grumbine, *What Is Ecosystem Management?*, 8 CONSERVATION BIOLOGY 27 (1994) (calling for a "systems" approach to ecosystem management by which managers working at one level "seek connections between all the levels"); Adler, *supra* note 6, at 1088-92.

108. *See generally* Sandra Postel & Stephen Carter, *Freshwater Ecosystem Services*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 195 (Gretchen C. Daily ed., 1997).

109. *See generally* DOPPELT ET AL., *supra* note 37.

110. *Id.*

that affect water quality, such as physiography, soils, vegetation, geology, climate, and land use.[111] Consistent with the lessons of geographic scale, the lessons of functional scale tell us that some ecological functions of water ecosystems occur on a large geographic scale, whereas others may occur on a very localized scale.[112] For example, support for vegetation patches and defined areas of habitat for wildlife may occur solely within small drainage areas, whereas mass and energy exchanges related to hydrologic functions may occur well outside of large basins.[113] The level of management or problem-solving may depend on the type and scope of the ecological function at issue. For example, Reed Benson argues that watershed management efforts are not well suited to protecting in-stream flows in entire river basins and that large-scale efforts are required to maintain in-stream flows.[114]

Moreover, hydrologic processes are interconnected with many other environmental features and processes.[115] Watershed planning and management cannot serve as a cure-all for regional environmental problems or land use impacts on the environment, many of which do not have particularly water-related qualities. Reforms to our land use practices must protect not only water quality and watershed health but also air quality, the viability and diversity of habitat patches and corridors, the dynamic functioning of energy and nutrient cycles, the integrity of landscapes, the health of soils, and biodiversity generally, among others.[116] For example, the Committee on Watershed Management of the National Academy of Science's National Research Council admits that "[t]he use of watershed boundaries is less effective for wildlife and vegetation applications. Many types of ecosystems do not have boundaries determined by drainage divides."[117] In addition, some experts recommend the use of ecoregions, instead of watersheds, due to the watersheds' failure to match with topographical accuracy not only actual hydrological processes, but also geo-

111. Griffith et al., *supra* note 87, at 668-69; Adler, *supra* note 6, at 984-86.

112. WANIELISTA, *supra* note 106, at 193; James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L.Q. 887 (1997) (contending that the value of any particular ecosystem varies with its location, among other factors).

113. NAT'L RESEARCH COUNCIL, *supra* note 5, at 41.

114. Benson, *supra* note 6.

115. *See generally* DOPPELT ET AL., *supra* note 37; Adler, *supra* note 6, at 1093-94.

116. John M. Blair et al., *Ecosystems as Functional Units in Nature*, 14 NAT. RESOURCES & ENV'T 150 (2000); Grumbine, *supra* note 107; Lord et al., *supra* note 3, at 325.

117. NAT'L RESEARCH COUNCIL, *supra* note 5, at 41.

graphical conditions that affect the environment.[118] Tying land use primarily to watersheds may take attention away from the impacts of land use on many different types of ecological functions and the need to develop a variety of ecologically sustainable land use practices.[119]

C. The Problem Scale: Water Quality Problems Can Be Widespread or Localized, and Their Sources Can Be Widespread or Localized

Experts often call the watershed the "problem shed," which means that water quality problems occur on a watershed scale and that the watershed scale is the appropriate level for addressing water quality problems.[120] However, this statement is true only if we use the term "watershed" in its very general sense, meaning any of the nested geographic levels of hydrology and drainage, from macro-basins to micro-catchments.[121] It is not the case that water quality problems always correspond to the USGS eight-digit hydrologic unit that has been labeled "watershed."

Water quality problems occur on many different levels, ranging on a spectrum from macro- to meso- to micro-scales.[122] Likewise, the sources of water quality problems can arise far beyond the boundaries of a particular watershed[123] or can arise solely

118. Griffith et al., *supra* note 87; *See also* Adler, *supra* note 6, at 984-86.

119. For arguments that ecosystem management should treat the city as an ecosystem, see Lord et al., *supra* note 3; Nancy Perkins Spyke, *Charm in the City: Thoughts on Urban Ecosystem Management*, 16 J. LAND USE & ENVTL. L. 153 (2001). *But see* J. B. Ruhl, *The (Political) Science of Watershed Management in the Ecosystem Age*, 35 J. AM. WATER RESOURCES ASSN. 519 (1999) (preferring the use of watersheds as the primary units of ecosystems for ecosystem management). *See also* NAT'L RESEARCH COUNCIL, *supra* note 5, at 40 (contending that selection of an ecosystem for management is administratively and cognitively difficult in a political environment, but that watersheds serve as useful and easily understandable areas for organizing ecosystem management).

120. NAT'L RESEARCH COUNCIL, *supra* note 5, at 2-3; Lord et al., *supra* note 3, at 325-27; Goldfarb, *supra* note 3, at 484; *Rivers*, *supra* note 6, at 168.

121. *See supra* note 90 and accompanying text.

122. WANIELISTA, *supra* note 106, at 208-09 (comparing concentrations of pollutants in smaller hydrologic units and larger hydrologic units); Frarey, *supra* note 6, at 358-59 (reporting that management of phosphorus runoff into a lake basin varies with the size and use of parcels of land and with the degree to which different sub-basins contribute to the lakes' phosphorus load).

123. *See, e.g.*, Paul G. Risser, *Impacts on Ecosystems of Global Environmental Changes in Pacific Northwest Watersheds*, in WATERSHED MANAGEMENT: BALANCING SUSTAINABILITY AND ENVIRONMENTAL CHANGE 12 (Robert J. Naiman ed., 1992) (analyzing the impact of global conditions on watersheds); Holly Doremus, *Crossing Boundaries: Commentary on "The Law at the Water's Edge,"* in WET GROWTH, *supra* note 40, at 271, 284-86 (stating that aquatic degradation can result from trans-basin

from a single catchment or subwatershed. For example, a particular contaminant running into a creek from a highly localized source could cause acute harm to a particular portion of the creek but have minimal impact beyond that localized area due to dilution from larger downstream flows or filtration as slow-moving water passes over a sandy, porous bed of the creek, or even absorption by vegetation in or adjoining the creek.[124] Notably, the influence of impervious cover on water quality and watershed health has been determined to be strongest at small scales, such as first- to third-order streams or subwatersheds.[125]

On the other end of the spectrum, a particular contaminant might have minimal impact in a particular watershed but might have substantial cumulative impacts throughout a basin, or even region, from other sources of the contaminant across a wide geographic area, or from downstream synergistic impacts when mixed with other substances from sources outside a single watershed.[126] For example, a river basin's sediment storage processes occur in greater degrees at larger scales than merely the sum of small-scale processes.[127] These points illustrate the lesson that there is no single "problem shed" for which there is a single solution or simple model of institutional reform. In fact, even for actions like watershed restoration efforts, which generally are appropriate for large scales, experts recommend planning and implementation at several different levels, including region, river basin, watershed, and specific site.[128]

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water transfers, the spread of invasive species, and the deposition of atmospheric pollutants into waters); DAVENPORT, *supra* note 18, at 34 (describing atmospheric deposition as a major source of water pollution).

124. For a description of the factors affecting the ability of aquatic ecosystems to assimilate pollutants, see DANIELS & DANIELS, *supra* note 25, at 99-100.

125. NATIONAL MANAGEMENT MEASURES, *supra* note 10, at 0-18.

126. BRIERLEY & FRYIRS, *supra* note 37, at 231-32; Adler, *supra* note 6, at 984-85. For examples of complex environmental problems involving aquatic ecosystems beyond a single watershed, see Robert W. Adler, *The Law at the Water's Edge: Limits to "Ownership" of Aquatic Ecosystems*, *in* WET GROWTH, *supra* note 40, at 201, 212-23 (Colorado River and aquatic species); Alfred Light, *Ecosystem Management in the Everglades*, 14 NAT. RESOURCES & ENV'T 166 (2000) (Everglades); Joseph W. Dellapenna, *Interstate Struggles Over Rivers: The Southeastern States and the Struggle over the 'Hooch*, 12 N.Y.U. ENVTL. L.J. 828 (2005) (Appalachicola-Chattahoochee-Flint River Basin).

127. NAT'L RESEARCH COUNCIL, *supra* note 5, at 43.

128. Robert R. Ziemer, *Temporal and Spatial Scales*, *in* WATERSHED RESTORATION, *supra* note 35, at 80, 87-88.

D. The Temporal Scale: Watersheds Change over Time, Requiring Adaptive Management, Responses to Past Degradation, and Planning for Future Healthy Practices

Continuing on the point that watershed scale and function defy simple solutions to water quality problems, we turn to the temporal scale of watersheds. The scientific community widely agrees that ecosystems are stochastically dynamic, ever changing over time in adaptive and humanly unpredictable ways.[129] The study of changes in watersheds over time tells us much about their nature, scale, and function, as well as the impacts that various land uses have had on watersheds over time.[130]

The non-equilibrium nature of watersheds means two things for designing watershed institutions and modifying land use institutions. First, adaptive management is the preferred policy approach for any watershed management.[131] Adaptive management anticipates uncertainty and limited information in ecosystem management, and therefore involves a series of incremental decisions based on monitoring, evaluation, and modification of actions in light of experience.[132] We must build flexibility, discretion, and experimentation into our regulatory reforms.

Second, when we seek to improve or protect watershed health, we are addressing three related, yet distinctly different categories of land use activities: 1) past land use decisions that have altered the watershed physically, chemically, and/or biologically; 2) current practices and activities that are still changing the watershed; and 3) future decisions, activities, and land uses that will affect the watershed. Thus, land use decision-makers are addressing water quality issues arising across different scales of time when they adopt restoration projects that seek to correct past mistakes,

129. BRIERLEY & FRYIRS, *supra* note 37, at 4-5; James H. Brown et al., *Complex Species Interactions and the Dynamics of Ecological Systems: Long-Term Experiments*, 293 SCI. 643 (2001); A. Dan Tarlock, *The Nonequilibrium Paradigm in Ecology and the Partial Unraveling of Environmental Law*, 27 LOY. L.A. L. REV. 1121 (1994); Colloquium, *Beyond the Balance of Nature: Environmental Law Faces the New Ecology*, 7 DUKE ENVTL. L. & POL'Y F. 1 (1996).

130. BRIERLEY & FRYIRS, *supra* note 37, at 208-39; WANIELISTA, *supra* note 106, at 30 (stating that development changes physical form of watershed peaks, drainage points, and watershed boundaries).

131. C.S. HOLLING, ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT (1978); Ronald D. Brunner & Tim W. Clark, *A Practice-Based Approach to Ecosystem Management*, 11 CONSERVATION BIOLOGY 48 (1997); Grumbine, *supra* note 107.

132. Jeffrey L. Kershner, *Monitoring and Adaptive Management*, *in* WATERSHED RESTORATION, *supra* note 35, at 116, 125.

regulations that seek to control current practices, and planning processes that seek to promote future sustainable patterns of land use. By the same token, many watershed problems span periods of time, and even watershed problems that arise at different times are interconnected across the seamless continuum of time. For example, disturbances to watersheds may be "pulse" disturbances that are infrequent, temporary, or isolated, or they may be "sustained" disturbances that produce long-term or even permanent impacts.[133] Watershed protection measures should be coordinated with one another. Even if multiple land use policies are addressing problems arising at different points in time, they should be consistent with one another in the overall goals they serve and should be coordinated to achieve maximum effectiveness.

V. LAND USE SCALE AND FUNCTION

When we consider four features of land use, we quickly see that some land use decisions should be made at the level of regional jurisdictions defined by hydrological characteristics and a watershed conservation mission, while others should be made at the local level, albeit with watershed-regarding criteria and information.

A. The Functional Scale: Land Use Management Consists of Several Different, Related Functions

One of the primary weaknesses in discussions of legal and institutional reforms to protect watersheds is the tendency to treat "land use management" or "land use control" as a unitary function that can and should be shifted to the watershed level. Land use management or control consists of several different functions, though. Even though these functions are related and should be coordinated, it is critically important to recognize the differences among them when redesigning the land use system.[134]

133. Christopher A. Frissell, *Ecological Principles*, *in* WATERSHED RESTORATION, *supra* note 35, at 96, 102-03.

134. The discussion of land use functions is a synthesis from a variety of sources. Therefore this sub-section lacks footnotes for each separate point made. The sources regarding land use functions are ROBERT C. ELLICKSON & VICKI L. BEEN, LAND USE CONTROLS: CASES AND MATERIALS (3d ed. 2005); CHARLES M. HAAR & MICHAEL ALLAN WOLF, LAND-USE PLANNING: A CASEBOOK ON THE USE, MISUSE, AND RE-USE OF URBAN LAND (4th ed. 1989); EDWARD J. KAISER ET AL., URBAN LAND USE PLANNING (4th ed. 1995); ERIC DAMIAN KELLY & BARBARA BECKER, COMMUNITY PLANNING: AN INTRODUCTION TO THE COMPREHENSIVE PLAN (2000); DANIEL R. MANDELKER, LAND USE LAW (5th ed. 2003); JOHN R. NOLON, WELL GROUNDED: USING LOCAL AND LAND USE AUTHORITY

Land use management includes at least five different functions that are directed at land use decisions of differing types and scope: 1) general planning, 2) specific-area planning, 3) regulation of land uses, 4) development and maintenance of public infrastructure and projects, and 5) decisions about project-specific permits.

The General Planning Function. When engaged in general planning, decision-makers develop integrated, comprehensive policies and plans to guide the development of an entire jurisdiction (e.g., city, county, region). These plans designate the general types, locations, intensities, and characteristics of desired land uses to shape the physical, economic, and socio-political future of the locality. In particular, general plans lay out the desired patterns and directions of growth. All other types of land use decisions should be consistent with the general or comprehensive plan.

The Specific Planning Function. When engaged in specific-area planning, decision-makers develop a vision for the future of a specific area of the jurisdiction, such as a neighborhood, business district, transit corridor, or sub-area of the city. This vision, the goals behind it, and the policies to achieve it are included in the plan. Although the geographic scope of a specific-area plan is obviously less than that of a general plan, all specific-area plans should be consistent with the general plan for the greater geographic area. In addition, a given specific-area plan may have a narrower scope substantively than the general plan, due to the particular context and types of land use decisions for the specific area in question.

The Regulatory Function. Land use regulations translate general policies into specific policies and then into specific legally applicable regulations of land uses, heights, bulk, design, and activities impacting the environment and surrounding communities. This translation typically occurs in the form of zoning (both tradi-

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TO ACHIEVE SMART GROWTH (2001); RANDOLPH, *supra* note 13; DANIEL P. SELMI & JAMES A. KUSHNER, LAND USE REGULATION: CASES AND MATERIALS (2d ed. 2004); FRANK S. SO & JUDITH GETZELS, THE PRACTICE OF LOCAL GOVERNMENT PLANNING (2d ed. 1988); *Planning Milagros*, *supra* note 76, at 89-138. For discussions about how land use controls can be used to protect water quality and watersheds, see DANIELS & DANIELS, *supra* note 25, at 119-24; JEER ET AL., *supra* note 18; Ctr. for Watershed Prot., Site Planning for Urban Stream Protection, http://www.cwp.org/SPSP/TOC.htm (last visited Mar. 22, 2006); *Land Use and Water*, *supra* note 1, at 10,172-75; Aquatic Resource Protection, *supra* note 78; Protect Local Resources, *supra* note 78; Gaining Ground Database, *supra* note 78; Case Studies, *supra* note 78; Barbara J.B. Green & Jon B. Alby, *Watershed Planning*, 1 U. DENV. WATER L. REV. 75 (1997); Lord et al., *supra* note 3; Mandelker, *supra* note 4, at 486-89.

tional Euclidean zoning and flexible zoning techniques), subdivision map regulations, and requirements that land developers and property owners obtain permits to engage in certain land development, land uses, or land-related activities.

The Public Infrastructure Function. A locality's plans cannot be fully realized by relying solely on private land uses. Local government and other local governmental entities also have to provide public infrastructure, like roads, sidewalks, parks, schools, stormwater systems, water treatment and distribution, sewer collection and treatment, civic centers, open space, transportation facilities and networks, and other such public amenities. Local governments also engage in public projects to solve specific problems, like redeveloping blighted and underproductive areas, subsidizing or building affordable housing, stimulating the locality's economic competitiveness, cleaning up contaminated lands, and restoring natural areas that have suffered degradation.

The Permitting Function. A substantial component of land use control in practice, or in effect, involves local government decisions about specific projects and proposals, typically through discretionary permit decisions made by local government officials. The projects may be relatively large, such as an entire subdivision or a major industrial park, or may be small, involving the in-fill development of a single residence on a small vacant parcel of land or the mere addition of new signage and modification of parking spaces in a major industrial park. The technique of controlling land use by discretionary permitting is site-specific, case-by-case, highly contextualized, relatively focused on details and specifics, and often essentially "negotiated" between local officials and the developer(s) (and sometimes also groups of local residents or environmentalists). Permit approval requirements offer the local government opportunities to require or negotiate project alterations, redesign, features, operating practices, and other such conditions of approval that minimize and/or mitigate impacts on the environment, surrounding land uses, and the community generally.

Moreover, five other functions run throughout all the functions of planning, regulation, infrastructure development, and permitting. These five cross-level functions are: 1) study and assessment; 2) public participation, empowerment, and education; 3) coordination and collaboration; 4) enforcement; and 5) monitoring and feedback.

The Informational Function. Land use decisions, whether they involve planning, zoning, or permitting, should be based on

careful study and assessment of current conditions and the likely impacts of the various decisions that could be made. This function involves both data collection and data analysis with respect to current conditions and needs, projected trends, and sources of problems. It also involves gathering and analyzing data about the likely impacts of plans, policies, regulations, and specific proposed projects. Furthermore, it involves the consideration of alternatives, modifications, and mitigation measures.

The Democratic Function. Land use decisions should result from the participation of an informed and empowered public. Local residents' visions for their community, whether citywide or neighborhood-specific, often play an important role in shaping land use policies and decisions. Moreover, the public shares some responsibility with land use planners and land use interest groups for identifying specific land use problems or needs for particular projects. The land use planning and regulatory system plays an important role in building civic capacity, social capital, and strong participatory political institutions in the United States, because people often care quite deeply about the land uses in their neighborhoods and localities and perceive local government as being close and accessible for expressing their policy preferences. Furthermore, land use plans and regulations are more effectively implemented and enforced if local residents, property owners, and developers are educated about land use impacts, policies, and recommended or required practices.

The Cooperative Function. Land use management also involves tasks of coordinating and collaborating with multiple government agencies across jurisdictional boundaries and multiple stakeholders. Some land use issues cross jurisdictional boundaries, vertically (federal-state-local), horizontally (inter-local), or both. In these situations, cooperation among the affected governmental entities (and sometimes stakeholders within or crossing jurisdictional boundaries) is necessary to achieve solutions. Intergovernmental cooperation on land use issues is paradoxically difficult to achieve, yet common. Some land use issues fall within jurisdictional boundaries, though. Within the jurisdiction of a land use regulatory or management entity, the entity may seek input concerning either a specific issue or general plans and policies from various stakeholders, such as neighborhood groups (either in a particular neighborhood or across a range of neighborhoods), environmentalists, developers, resource users, and existing businesses. In addition, the entity may establish

and/or coordinate processes designed to achieve cooperative outcomes, ranging from collaborative problem-solving processes to negotiation or mediation of specific conflicts. Finally, the entity may engage in educational and outreach programs to encourage voluntary compliance with land use policies and regulations.

The Enforcement Function. A land use regulatory system requires mechanisms for enforcing applicable regulations, if it is to be effective. As mentioned in the previous paragraph, one key component of enforcement involves education and outreach to encourage voluntary compliance. Regulatory agencies also need staff, resources, and methods for detecting violations, as well as legal authority, processes, and sanctions for punishing violators. Moreover, given the degree of private control over land and the range of possible ways that land use activities might or might not comply with governmental policies and regulations, land use regulatory systems must rely on permitting requirements to ensure interactions between regulators and landowners or land users. These interactions serve not only to establish rights to use particular parcels of land in certain ways and specific conditions of use, but also serve to inform or educate the owner/user of the land and to monitor his/her/its uses of the particular parcel(s) of land.

The Feedback Function. A land use regulatory system also requires a monitoring and feedback loop to evaluate policies, regulations, and land use activities. As mentioned in the previous paragraph, permitting requirements and enforcement mechanisms provide means of monitoring and feedback. Other important mechanisms for monitoring and feedback include evaluation of existing conditions, updating and revisions of general or specific plans, built-in implementation and effectiveness monitoring mechanisms for specific programs or policies, performance audits or evaluations, lessons learned from prior decisions or inaction, identification of problems, judicial review, public participation, and elections.

Proposals for watershed institutions to assume land use functions do not address in detail how these watershed institutions will accomplish all of the functions that current land use institutions, primarily local units of government, perform. Moreover, we lack systematic analysis about whether the same institution needs to perform all ten functions. For example, while it may be true that reforming land use to protect watersheds requires regional coordination, planning, and study, it does not necessarily follow that a regional institution should be making site-specific

permit decisions on every land use project or controlling the development of area-based specific plans to revitalize inner-city neighborhoods. Of course, if a local unit of government ignores watershed-based plans and regulations when making site-specific permit decisions or developing neighborhood-based specific plans, the plans may have little practical effect and water quality will continue to be degraded. However, a consistency requirement, mandating that all local land use decisions be consistent with regional watershed plans or even specific regulatory requirements to protect water quality, might be relatively effective at preventing local governments from ignoring watershed-protecting policies.

At the same time, reliance on a legal requirement of consistency without dumping all land use functions into a regional agency might be an efficient way to keep the regional institution focused primarily on watershed issues, instead of the broad range of land use functions and issues from the macro to the micro. This approach might also keep the multi-faceted land use process working smoothly, without being stymied by a centralized bureaucracy with expertise and a mission oriented primarily towards water quality and hydrology. Different functions focus on different levels of geographic scope and impact and require different kinds of expertise and analysis.

B. The Political Scale: Local Control of Land Use Serves Political, Social, and Economic Functions

The placement of land use planning and regulatory functions primarily at the local level is no accident. Local control over land use serves important roles in a society that values democratic processes and widespread public participation in policy decisions that most directly affect people in their everyday lives.[135]

Local control of land use promotes participatory democracy.[136] The local level of government is typically perceived as the most accessible to popular participation and grassroots involvement.[137] Local governments, despite a few counter-examples, are controlled by political forces that make them relatively accounta-

135. *See* Bradley C. Karkkainen, *Zoning: A Reply to the Critics*, 10 J. LAND USE & ENVTL. L. 45 (1994).

136. *Id.* at 83-85.

137. *See, e.g.*, Richard Briffault, *Localism and Regionalism*, 48 BUFF. L. REV. 1, 16-17 (2000); Joseph Seliga, *Democratic Solutions to Urban Problems*, 25 HAMLINE L. REV. 1 (2001).

ble to local residents. Local residents have many more opportunities to participate directly in local policymaking than they do at the state or federal level, merely because of the proximity and scale of local governance.[138] In addition, local issues are often perceived as more comprehensible and relevant to the populace than are regional, state, and federal issues.[139]

Local control of land use also serves to protect one of the largest and most identity-defining investments that many people make—the investment in a home. Brad Karkkainen has argued that the persistence and justification of zoning, despite criticisms from the right and the left, can be attributed to zoning's maintenance of neighborhoods' value and character.[140] Karkkainen describes this phenomenon as maintenance of individuals' and families' investment in the "neighborhood commons."[141] Similarly, economist William Fischel's "homevoter hypothesis" is that land use policies and local land use controls are explained and justified by local homeowners' attempts to protect and maximize the value of the investments in their homes through the local political process.[142] From a psychological and philosophical perspective, Margaret Jane Radin's renowned personhood theory of property emphasizes the role law should play in protecting the "human flourishing" functions of property, particularly the sense of personal and social identity formed from one's relationship with one's home.[143]

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138. Charles C. Mulcahy & Marion E. Mulcahy, *Innovation as the Key to a Redesigned and Cost Effective Local Government*, 78 MARQ. L. REV. 549, 551 (1995).

139. *See* Daniel P. Selmi, *Reconsidering the Use of Direct Democracy in Making Land Use Decisions*, 19 UCLA J. ENVTL. L. & POL'Y 293, 325-26 (2001-2002) (many land use issues are readily comprehensible to local voters).

140. Karkkainen, *supra* note 135, at 64-80.

141. *Id.*

142. WILLIAM A. FISCHEL, THE HOMEVOTER HYPOTHESIS: HOW HOME VALUES INFLUENCE LOCAL GOVERNMENT TAXATION, SCHOOL FINANCE, AND LAND-USE POLICIES 4-6 (2001).

143. MARGARET JANE RADIN, REINTERPRETING PROPERTY (1993); MARGARET JANE RADIN, CONTESTED COMMODITIES (1996); Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982); Margaret Jane Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849 (1987); Margaret Jane Radin, *The Liberal Conception of Property: Cross Currents in the Jurisprudence of Takings*, 88 COLUM. L. REV. 1667 (1988); Margaret Jane Radin, *The Pragmatist and the Feminist*, 63 S. CAL. L. REV. 1699 (1990). For discussions of Radin's works, see William W. Fisher III, *The Trouble with Lucas*, 45 STAN. L. REV. 1393, 1398-99 (1993); Stephen J. Schnably, *Property and Pragmatism: A Critique of Radin's Theory of Property and Personhood*, 45 STAN. L. REV. 347 (1993); Jeanne Lorraine Schroeder, *Virgin Territory: Margaret Radin's Imagery of Personal Property as the Inviolate Feminine Body*, 79 MINN. L. REV. 55 (1994); Silverman v. Barry, 845 F.2d 1072, 1081 (D.C. Cir. 1988).

Local control of land use also serves the social and psychological functions of developing a "sense of place" among local residents.[144] One's particular connections to special places contribute to self-identity, community identity, beneficial human relationships with nature and society. These places might be part of the built environment, such as a plaza, a human-created park, or a downtown district; or they might be part of the natural environment, such as a creek, an urban forest, or an ocean viewscape. Often, the interrelationship between the built environment and the natural environment is the focal point of human and social connectedness, as suggested by Nancy Perkins Spyke in her tribute to "charm in the city."[145] Local land use and regional ecosystem conservation efforts must reflect the special, socially valuable, and often highly localized connections that people make to their surrounding environment.[146]

Local government decisions about land use result from consideration of a wide range of non-environmental factors and impacts, as well as consideration of environmental factors and impacts. Many land use decisions result from local government policies and local officials' judgments about factors like public health and safety, economic development, neighborhood character and property values, aesthetics, social capital and community building, preservation of historic and cultural assets, promotion of the free exercise of religion and free speech, and the like.[147] Al-

144. For discussions of social and psychological connections to place, see *Environmental Ethic*, *supra* note 81, at 26-32. *See generally* TIMOTHY BEATLEY & KRISTY MANNING, THE ECOLOGY OF PLACE: PLANNING FOR ENVIRONMENT, ECONOMY, AND COMMUNITY (1997). *But see* Adler, *supra* note 6, at 1000-02 (arguing for place-based commitments to bioregions that correspond to ecologically defined, not politically defined, places).

145. *See generally* Spyke, *supra* note 119.

146. *Id.*

147. *See* sources cited *supra* note 134. *See also Land Use and Water*, *supra* note 1, at 10,176:

> [L]ocal governments regulate many aspects of land use that have only tangential connections, at most, to watershed health, such as: the signage, hours of operation, and security of a liquor store; a church's request for a variance from building height limits, setback requirements, and prohibition of icons above the parapet; the supply of affordable housing for moderate-, low-, and very low-income households; a new shopping center's number of parking spaces, traffic signals, and flow of traffic in and out of the site; the appropriate land use classification for cyber cafes; review of architectural plans and drawings for changes to an historic house subject to historic preservation regulations; and so forth. Experts in conservation ecology, aquatic biodiversity, water chemistry, and watershed management would not likely have the interest or expertise to take

though local land use decision-makers have failed to give adequate attention to the environmental impacts of proposed land use actions, especially regional or cross-jurisdictional impacts, it would be a reactionary mistake to treat land use decisions as if they have only environmental impacts, or more narrowly, only water quality impacts.

The non-environmental aspects of land use decisions merit particular attention when evaluating proposals for regional watershed agencies to handle all land use decisions. Will these agencies give adequate consideration to local residents' non-environmental goals and values? The point of moving land use authority to regional watershed agencies may be to ensure that decision-makers prefer environmental protection goals over non-environmental goals when the two conflict. However, it is not clear that watershed experts at a regional agency would have the inclination or expertise to give adequate attention to non-environmental land use goals and considerations, even when there is no conflict between environmental protection and other land use issues. Moreover, even when land use decisions present tensions between environmental and non-environmental values, placement of those decisions with a regional agency having a narrow, resource-specific mission (i.e., to protect watersheds) raises questions about whether such a system is anti-democratic. Such a system is also likely to invite political backlash from local residents who perceive that their community is being defined by distant, specialized bureaucrats.

The move of land use authority from local governments to higher levels of government and to narrower areas of specialization and focus also raises questions about the impact on the least advantaged in society.[148] Historically, racial and ethnic minorities and the poor have suffered disproportionately high numbers of burdens and disproportionately low numbers of benefits from zoning, urban planning, and land use practices.[149] However, environmental justice activists, part of a movement that emerged in the 1980s to address the disproportionately harmful impacts of environmental law on minority and low-income communities,

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on these kind of decisions in a watershed-based system of land use regulation.

148. For an environmental justice perspective on regional watershed institutions, see Eileen Gauna, *Environmental Justice in a Dryland Democracy: A Comment on Water Basin Institutions*, *in* WET GROWTH, *supra* note 40, at 171-99.

149. *Planning Milagros*, *supra* note 76, at 76-105.

have increasingly focused attention and efforts on using planning, zoning, and other land use regulatory tools to address past harms and achieve future land use goals for their communities.[150] Indeed, a proactive planning model of environmental justice offers many advantages over a reactive oppositional model in trying to achieve a just society and environment for all people.[151] Moving land use decision-making to agencies at higher levels of government staffed primarily by environmental experts with a specific mission to protect watersheds may disempower minorities and low- and moderate-income people who have just begun to exercise greater voice at the local level. One of the environmental justice movement's primary critiques of environmental law is that decisions are made at national, not grassroots, levels by scientific and legal experts who do not consider adequately (or at all) the social and distributive justice impacts of their decisions.[152] Local governments do not have an admirable track record with respect to environmental justice, but a growing number of case studies indicates that minority low-income and working-class neighborhoods can influence local land use policy.[153]

Finally and most importantly, most of the reasons localities do not adequately protect watersheds in their land use decisions involve political, social, and economic forces that regional agencies will not escape. We should take care not to use broad brush strokes to paint local governments as relatively powerless servants of parochial, economically self-serving interests, inevitably spawning urban sprawl, pollution, and adverse impacts on areas outside their own respective jurisdictions. In addition to abundant evidence that local governments can and do enact local measures to protect the environment,[154] we cannot assume that federal, state, and regional governments will be more effective at protecting the environment (or watersheds) simply because their jurisdictions encompass a larger geographic area.

Political forces, limited resources, and gaps in environmental knowledge, understanding, and values constrain federal, state, and regional regulators, not merely local regulators.[155] Although

150. *Id.* at 4-8, 98-105.
151. *Id.* at 89-96.
152. *Id.* at 27-30.
153. *Id.* at 98-105.
154. *See* sources cited *supra* note 78.
155. *See, e.g.*, NAT'L RESEARCH COUNCIL, *supra* note 5, at 190 (reporting that Florida's regional water management districts "still face many of the same financial and political pressures" that localities face in protecting watersheds); *Local Governments*,

federal environmental standards and regulatory programs are presumably necessary because local governments allegedly engage in a "race to the bottom" in environmental protection,[156] federal efforts fail to achieve effective environmental protection for a variety of reasons, including congressional enactment of symbolic legislation without meaningful substance; congressional enactment of legislative schemes that contain inherent conflicts or weaknesses that will produce implementation failure; legislation or regulation with the purported purpose of protecting the environment but with the real purpose of protecting certain sectors of the regulated community; regulatory agency capture by special interests; delay by agencies in implementing statutes or adopting regulations; inadequate resources to implement and enforce environmental laws and regulations; strong regulations undermined by weak enforcement; inconsistent priorities and framing of environmental policy problems from administration to administration; lack of necessary information or understanding about complex human impacts on complex environmental processes and systems; incrementalism; political backlash by the regulated community against environmental controls; lack of incentives to ensure compliance; poor communication and strained relationships between federal regulators and the regulated community or among various agencies and levels of government with regulatory responsibility; disconnects between national policy aspirations and local realities; economic or social changes that undermine existing regula-

supra note 3, at 153-60 (asserting that the federal government has not regulated and is not likely to regulate land use to protect watersheds). *See generally* Adler, *supra* note 6.

156. *See Local Governments*, *supra* note 3, at 159 (discussing the debate over a race to the bottom). For the idea that inter-state and inter-local competition fosters a "race to the bottom," i.e., the lowest possible environmental protections needed to attract economic investment and tax revenues, see Been, *supra* note 60, at 509; Kirsten H. Engel, *State Environmental Standard-Setting: Is There a "Race" and Is It "to the Bottom"?*, 48 HASTINGS L.J. 271 (1997); Richard B. Stewart, *Pyramids of Sacrifice?: Problems of Federalism in Mandating State Implementation of National Environmental Policy*, 86 YALE L.J. 1196, 1212 (1977). For the rejection of the idea that local and state governments will inevitably adopt weaker environmental laws than neighboring local and state governments or even the federal government, see Jonathan H. Adler, *Let 50 Flowers Bloom: Transforming the States into Laboratories of Environmental Policy*, 31 Envtl. L. Rep. (Envtl. Law Inst.) 11,284 (2001); Richard L. Revesz, *Federalism and Environmental Regulation: A Public Choice Analysis*, 115 HARV. L. REV. 555 (2001); *Parochialism*, *supra* note 78.

tory systems; and simplistic responses to problems of enormous scope and complexity.[157]

Regional watershed agencies, in particular, may be more effective than local governments at controlling land use impacts on watershed simply because their political and legal jurisdictions will correspond to watershed boundaries. However, each watershed agency will face the same temptations that local governments do on a smaller scale to under-regulate activities that have impacts on other watersheds or to shift pollution-generating activities to the edges of the jurisdiction because most of the impacts will be external to the watershed.[158] Moreover, the mere creation of regional watershed agencies does not automatically insulate them from political pressures, lobbying by proponents of development and sprawl, the problems of all-too-limited resources especially in an environment of state budget constraints in many states, and the challenges of actually implementing and enforcing watershed protections.

Consider the example of the California Coastal Commission, a special California agency created by statewide voter initiative in 1972 to protect the California coastal zone by, among other things, regulating land use and development.[159] The California Coastal Commission, despite its statewide coastal protection authority and mandate, has a mixed record of sometimes under-protecting the environment, while at other times over-restricting private property rights.[160] Moreover, some experts view the Coastal Com-

157. *See, e.g.*, BRUCE A. ACKERMAN & WILLIAM T. HASSLER, CLEAN COAL/DIRTY AIR 21-25 (1981); *Environmental Ethic*, *supra* note 81, at 41-42; Lynda L. Butler, *State Environmental Programs: A Study in Political Influence and Regulatory Failure*, 31 WM. & MARY L. REV. 823 (1990); John P. Dwyer, *The Pathology of Symbolic Legislation*, 17 ECOLOGY L.Q. 233 (1990); Richard J. Lazarus, *The Tragedy of Distrust in the Implementation of Federal Environmental Law*, 54 LAW & CONTEMP. PROBS. 311 (1991); Kenneth M. Murchison, *Learning from More than Five-and-a-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*, 32 B.C. ENVTL. AFF. L. REV. 527, 577-78 (2005); Zygmunt J.B. Plater, *Environmental Law in the Political Ecosystem—Coping with the Reality of Politics*, 19 PACE ENVTL. L. REV. 423 (2002); Christopher H. Schroeder, *Cool Analysis Versus Moral Outrage in the Development of Federal Environmental Criminal Law*, 35 WM. & MARY L. REV. 251, 258-63 (1993); Michael Allan Wolf, *Overtaking the Fifth Amendment: The Legislative Backlash Against Environmentalism*, 6 FORDHAM ENVTL. L.J. 637 (1995).

158. Goldfarb, *supra* note 3, at 484.

159. *See* Briggs v. State, 159 Cal. Rptr. 390, 396 n.6 (Cal. Ct. App. 1979). The voter initiative, known as the California Zone Conservation Act of 1972, was eventually replaced, pursuant to its own terms, by the California Coastal Act of 1976, CAL. PUB. RES. CODE §§ 30000-30900 (West 2001). *Id.*

160. David R. Carpenter, *On the Separation of Powers Challenge to the California Coastal Commission*, 79 N.Y.U. L. REV. 281, 283-84 (2004) (describing criticisms of

mission as having become derailed by political controversies and micromanagement of small land use decisions, at the expense of greater needs, such as long-term planning for coastal zone protection.[161] The Coastal Commission is mired in politics, faces limited resources, and lacks the authority to address impacts on coastal resources arising from land uses outside the coastal zone.[162]

Even when federal legislation imposes nationwide regulatory standards and programs to overcome local disincentives, incapacity, and even opposition to protecting the environment, political and economic forces undermine the federal programs. The Endangered Species Act,[163] a presumably strong national mandate to protect species from extinction, regularly undergoes weakening from political backlash from the regulated community (and congressional reaction to political backlash);[164] inadequate resources to implement the Act;[165] uncertainty and lack of information;[166]

Commission from both sides); *Compare* SIERRA CLUB COASTAL PROGRAM ET AL., CALIFORNIA COASTAL COMMISSION ½ YEAR CONSERVATION VOTING CHART 2005 (July 2005), *available at* http://www.sierraclub.org/ca/coasts/2005_votingchart1.pdf (reporting on the votes of Coastal Commission members and characterizing the majority of votes as harmful to environmental protection), *and* Bolsa Chica Land Trust v. Superior Court, 83 Cal. Rptr. 2d 850 (Cal. Ct. App. 1999) (holding that the Commission wrongly approved development that would destroy an environmentally sensitive habitat area even though destruction would be mitigated off-site), *with* J. David Breemer, *What Property Rights: The California Coastal Commission's History of Abusing Land Rights and Some Thoughts on the Underlying Causes*, 22 UCLA J. ENVTL. L. & POL'Y 247 (2004) (criticizing the Coastal Commission for failing to respect private property rights), and Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987) (holding that the Commission unconstitutionally took private property without just compensation when it imposed a permit condition that did not bear any essential nexus to the purpose of the regulation).

161. *See, e.g.*, Terry Rodgers, *Bucking the Tide: Coastal Commission's Executive Director Not Afraid to Take on Friend or Foe to Realize His Vision for Protecting California's 1,100 Miles of Precious Seashore*, SAN DIEGO UNION-TRIBUNE, June 5, 2005, at A1 ("Critics assert that under Douglas' guidance, the agency has remained bogged down in nitpicky building-permit issues to the detriment of long-range planning"; critics contend that failure to engage in long-range planning is inconsistent with ecosystem management, while Commission's executive director contends that attention to regulating individual projects is more important than long-range planning).

162. *See* Carpenter, *supra* note 160, at 284 (describing the Commission as unable to achieve long-range planning for the coast due to political influences); Rodgers, *supra* note 161 (discussing political pressures and lack of funding); Sierra Club v. Cal. Coastal Comm'n, 111 P.3d 294 (Cal. 2005) (holding that the Commission does not have authority to regulate land outside of the coastal zone even if noncoastal land use adversely affects the coastal zone).

163. Endangered Species Act, 16 U.S.C. §§ 1531-1544 (2000).

164. *Environmental Ethic*, *supra* note 81, at 41-42; Plater, *supra* note 157.

165. *See* Envtl. Def. Ctr. v. Babbitt, 73 F.3d 867 (9th Cir. 1995); Conservation Council for Haw. v. Babbitt, 24 F. Supp. 2d 1074 (D. Haw. 1998); Or. Nat. Resources Council v. Turner, 863 F. Supp. 1277, 1282-83 (D. Or. 1994); James Salzman, *Evolu-*

and agency officials' decisions that are inconsistent with the Act's mandates.[167] Moreover, critics of the Act point out that it has not had its intended effect of promoting the recovery of endangered and threatened species, at least on a broad scale.[168] Thus, some skepticism about local governments' potential role in protecting the environment may be equally applicable to all levels of government, at least given the U.S. system of government and political culture.

C. The Resource Scale: The Distribution of Land Use Management Functions Should Match the Nature and Extent of the Respective Institutions' Resources

Choice among institutions to manage land uses for watershed health should account for various institutions' respective resources. Despite the temptation to think of resources as involving budgets, finances, and tax base, we should think of resources as involving relative institutional competencies. We can more quickly and effectively design systems to shift financial resources from institutions with greater resources but lesser institutional competency to handle a particular task than we can design systems to build institutional competencies in institutions with financial resources but relatively weak task-specific or solution-relevant competencies. Indeed, one particularly insightful analysis of watershed institution design makes the case for watershed

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tion and Application of Critical Habitat Under the Endangered Species Act, 14 HARV. ENVTL. L. REV. 311 (1990).

166. *See* Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 680 (D.D.C. 1997); Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 WASH. U. L.Q. 1029, 1035-36 (1997); Holly Doremus, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOLOGY L.Q. 265, 313-14 (1991); Holly Doremus, *Biodiversity and the Challenge of Saving the Ordinary*, 38 IDAHO L. REV. 325, 344-45 (2002); Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 339-43 (2003); Kevin D. Hill, *What Do We Mean By Species?*, 20 B.C. ENVTL. AFF. L. REV. 239, 262 (1993).

167. *See Babbitt*, 958 F. Supp. 670, 679; N. Spotted Owl v. Hodel, 716 F. Supp. 479 (1988); Nat. Resources Def. Council v. U.S. Dept. of the Interior, 113 F.3d 1121, 1124-25 (9th Cir. 1997); Sierra Club v. Glickman, 156 F.3d 606, 616-17 (5th Cir. 1998); Nat. Resources Def. Council v. Houston, 146 F.3d 1118, 1127-28 (9th Cir. 1998).

168. *See* JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY 272-73 (2003); Oliver A. Houck, *The Endangered Species Act and Its Implementation by the U.S. Departments of Interior and Commerce*, 64 U. COLO. L. REV. 277, 278-79 (1993); Daniel J. Rohlf, *Jeopardy Under the Endangered Species Act: Playing a Game Protected Species Can't Win*, 41 WASHBURN L.J. 114 (2001).

management by small-scale flexible organizations.[169] Cognitive limits to human understanding of ecosystems and ecological processes indicate the need for adaptive learning, for which small-scale flexible organizations are best suited.[170]

As we think about the relative roles of regional watershed agencies and local general-purpose governments, we should think about their relative institutional competencies, including experience, training, knowledge, information, political and social capital (including trust of the public), processes, and missional focus. Local governments have institutional strengths in site-specific analysis and monitoring of land uses. Local government officials and staff have experience, training, knowledge, and information relevant to the physical, social, political, and economic context of particular projects, land use sites, and land use policies. They understand and appreciate the local community's goals, values, and vision for the locality's growth and choices among possible geographic and social spatial arrangements. They appreciate local historical, cultural, and community-building resources. They have existing data on land use patterns and practices in the locality. Local government officials have the capacity to process land use decisions relatively efficiently because the geographic scale is relatively small, at least in comparison to making all land use decisions on a regional level. In addition, different local governments may experiment with various innovations in addressing land use and environmental problems, creating a range of models which other localities and even state and federal agencies can use or adapt.[171]

In contrast, regional watershed agencies have or, if created, would have certain relative institutional strengths and resources. These special institutional competencies of regional watershed agencies would include scientific and technical expertise in ecological and hydrological processes and conditions, an understanding of how broad land use patterns across the region or watershed affect water quality and watershed health and integrity, access to data on the impacts of particular kinds of land use activities on

169. Robert G. Lee, *Ecologically Effective Social Organization as a Requirement for Sustaining Watershed Ecosystems*, *in* WATERSHED MANAGEMENT, *supra* note 123, at 73, 73-90.

170. *Id.*

171. Craig, *supra* note 63, at 230-31 (acknowledging the important role of governments in experimenting with different ways of addressing complex nonpoint runoff problems); *Champions of Change*, *supra* note 78 (arguing that local innovations in environmental protection create models of change for other localities).

watersheds specifically, and a particular focus on watershed functioning. Regional watershed officials and staff would have a mission to advance watershed health and integrity and could develop a vision for how an entire region's land use patterns and practices could be aquatically sustainable. They would have the capacity to work with various local governments and stakeholders within the watershed unit and various other regional agencies at broader hydrological and political scales. They would have the information and capacity to educate local officials, property owners, and other stakeholders about aquatically sustainable land use practices, as well as the impacts of land uses on watershed conditions.

These relative institutional competencies of local governments and regional watershed agencies might overlap at times. Nonetheless, it is important to note that each type of governmental entity has strengths, resources, and functional competencies that are particular to its respective scale, mission, and composition. This observation suggests that reform of land use patterns and practices to protect watersheds must involve a substantial, but different, role for each of these two types of governmental institutions.

D. The Temporal Scale: Land Use Decision-Makers Adapt to Changing Conditions, Needs, and Norms

Finally, land use planning and regulatory functions have a temporal scale, changing and adapting over time.[172] When assessing the capacity of local governments to conform land use policies and decisions to watershed protection goals, the past failure of many, perhaps even all, local governments to do so may be of limited utility. Local land use planning and regulation have changed considerably over the history of the United States, or even since the widespread adoption of zoning in the early twentieth century.[173] Local governments adapt to changing conditions, needs, and social norms.[174]

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172. For a general assertion that social institutions are complex and dynamic, and that information, values, and goals change over time, see JULIA M. WONDOLLECK & STEVEN L. YAFFEE, MAKING COLLABORATION WORK: LESSONS FROM INNOVATION IN NATURAL RESOURCE MANAGEMENT 15-16 (2000). *See also* sources cited *supra* note 80.

173. Lord et al., *supra* note 3, at 331-37; *See* Alejandro Esteban Camacho, *Mustering the Missing Voices: A Collaborative Model for Fostering Equality, Community Involvement and Adaptive Planning in Land Use Decisions, Installment One*, 24 STAN. ENVTL. L.J. 3 (2005).

174. *See Champions of Change*, *supra* note 78; Karkkainen, *supra* note 135, at 79-83; Mulcahy & Mulcahy, *supra* note 138, at 556-59. *See generally* Michael C. Dorf &

Several examples illustrate the point. Flexible zoning techniques, like performance zoning, buffer zones, overlay zones, and variances, arose in response to the rigidity of traditional Euclidean zoning.[175] Negotiated land use designations, like planned unit developments or planned development districts, transferable development rights, conditional zoning, conditional use permits, and development agreements, resulted from the need for local regulators and land developers to work out with certainty for both parties the details of projects that would meet local government approval and be feasible for developers.[176] Grassroots activism by low-income communities of color is starting to move local officials to integrate environmental justice concerns into land use planning and decision-making, despite decades of planning and zoning that intermixed low-income minority residences and industrial land uses.[177]

More specific to the issue of watershed protection, many recent studies demonstrate that local governments can and do use local land use authority and tools to protect the environment.[178] From riparian buffer zones to aquifer protection overlay zones to stormwater runoff ordinances to planning for open space to various growth control measures, we now observe example after example of local government protection of aquatic resources, particularly from land use and land development.[179] John Nolon calls these environment-protecting local regulations examples of "local environmental law"[180] and the localities that enact them "champions of change."[181] Skeptics of local governance need to assess what these empirical studies tell us about the local capacity and inclination to protect the environment in general and watersheds in particular.

Nonetheless, there is little question that the current status of local environmental law is mixed at best. Some local governments have done very little to control land use with adverse impacts on

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Charles F. Sabel, *A Constitution of Democratic Experimentalism*, 98 COLUM. L. REV. 267 (1998).

175. *See, e.g.*, Karkkainen, *supra* note 135, at 79-83; Lord et al., *supra* note 3, at 339-41.

176. *See, e.g.*, Karkkainen, *supra* note 135, at 79-83; Camacho, *supra* note 173, at 8-35.

177. *See, e.g.*, *Planning Milagros*, *supra* note 76, at 76-139.

178. *See* sources cited *supra* note 78.

179. *Id.*

180. *Parochialism*, *supra* note 78.

181. *Champions of Change*, *supra* note 78.

the natural environment, while others have taken only token measures, and still others have actually encouraged land development that harms the environment.[182] These localities have not adapted their land use policies and regulations in the same manner that other localities have.

Therefore, in understanding the temporal scale of local government, we must understand the circumstances under which local governments will create policy innovations or develop solutions to environmental or regional problems. In my years of study and experience,[183] I have come to believe that at least six conditions are necessary to policy innovation. The first is that local officials must have a good understanding of the problem. Local officials need good data and information about both watersheds themselves, including their ecological conditions and hydrological processes, and the impacts of various land uses on water quality. Local officials also need good analytical tools and the capacity to engage in analysis of the relationships between land use patterns and practices and watershed functioning and integrity. Just as important as local officials' capacity to understand the problem, though, is how they frame the problem. Framing is a psychological and social process of understanding, organizing, interpreting, and representing the world around us.[184] How local officials, primary land use stakeholders, and local residents frame land use

182. Mandelker, *supra* note 4; *Local Governments*, *supra* note 3; Ruhl et al., *supra* note 2; Adler, *supra* note 6, at 1102; Terry Rodgers, *Ruling May Force Builders to Control Storm Runoff*, SAN DIEGO UNION-TRIB., Sept. 1, 2000, at A1; Alexis Penn, The Role of Ecology in Developing the Last Open Spaces of Orange County: A Look at Crystal Cove's Newport Coast Planned Community and the Impacts of Development in an Already Impacted Landscape (2004) (unpublished manuscript, on file with author).

183. *See, e.g.*, WET GROWTH, *supra* note 40; *Land Use and Water*, *supra* note 1; *Conserving Habitats*, *supra* note 65; *Planning Milagros*, *supra* note 76; *Environmental Ethic*, *supra* note 81; Craig Anthony (Tony) Arnold, *Litigation as Dispute Non-Resolution: Lessons from Case Studies in Water Rights Disputes*, *in* BEYOND LITIGATION: CASE STUDIES IN WATER RIGHTS DISPUTES 1-14 (Craig Anthony (Tony) Arnold & Leigh A. Jewell eds., Envtl. L. Inst., 2002). In addition, my practical experience with local government includes service on the Anaheim Planning Commission from 1999 to 2002 (Chair from 2001 to 2002) and on the Anaheim General Plan Advisory Committee from 2001 to 2004; representation of local governmental entities in private practice in Texas from 1991 to 1995, including serving as a city attorney for two municipalities; a land use law and planning internship with the Boston Redevelopment Authority; and work on various local efforts to address land use, economic development, housing, and environmental problems.

184. *See* Barbara Gray, *Framing of Environmental Disputes*, *in* MAKING SENSE OF INTRACTABLE ENVIRONMENTAL CONFLICTS: FRAMES AND CASES 11, 11-34 (Roy J. Lewicki et al. eds., 2003).

and watershed issues determines 1) whether or not they perceive or identify that land use patterns and practices have adverse impacts on water quality and watershed health (problem identification); 2) how they perceive the nature and causes of the problem(s) (problem definition); 3) whether they perceive the problem(s) to be locally relevant, capable of local solutions, and the result (at least in part) of local choices (responsibility for the problem); 4) how important the problem(s) is/are (problem prioritization); and 5) what kinds of solutions they consider (solution identification).[185] For a locality to adopt meaningful measures to protect watersheds, they must perceive that local land use patterns and practices—for which local choices are responsible—cause serious degradation of water quality and watersheds to the detriment of the local community. They must believe that changes in local land use controls and policies will improve watershed health and are important to make. They must have a clear picture of the kind of land use decisions that they wish to address and the kind of solutions that will change these land use patterns and practices, at least with some moderate degree of effectiveness.

The second condition is a disturbance, a set of conditions and/or events that upsets the status quo and to which the locality must adapt.[186] Local political systems and entities, like ecosystems and biological organisms, evolve over time as they adapt to changing conditions and disturbance events or regimes.[187] For example, many examples of local innovation in environmental protection may arise when local power—especially local land use authority—faces threats from federal, state, or regional assertion of power over land use (or threatened assertion of such power). Grassroots political movements that seek greater environmental protections and growth controls may be the kinds of disturbances that prompt adaptive change in local policies and practices. Litigation or the threat of litigation may push stakeholders to negotiation, mediation, or other collaborative methods of finding solutions to complex environmental and land use problems.[188]

The third condition is the involvement of policy entrepreneurs. In general, policy innovations of many types at many different levels of government require political or community leaders

185. *See id.*

186. *See Champions of Change*, *supra* note 78.

187. *See supra* note 128 (adaptive nature of ecosystems) and note 80 (adaptive nature of legal and political institutions) and accompanying text.

188. *See Environmental Ethic*, *supra* note 81, at 32-39.

who take risks by advancing policy issues and ideas.[189] The fourth condition is the engagement of the public, both in the sense of political participation and in the sense of discussion about social values, norms, or ethics. This engagement involves not only education of the public about environmental problems, but also development of a psychology and ethic of place that generates public commitment to, and involvement in, environmental protection.[190] The fifth condition is the use of collaborative problem-solving processes.[191] The sixth condition is the availability or generation of tools, options, and resources for solving the problem. Not surprisingly, many experts on watershed management also recommend processes and institutions that use collaborative

189. WONDOLLECK & YAFFEE, *supra* note 172, at 10-11; JOHN W. KINGDON, AGENDAS, ALTERNATIVES, AND PUBLIC POLICIES (1984); Helen M. Ingram & R. Kenneth Godwin, *Conservation and the Forces of Change*, *in* PUBLIC POLICY AND THE NATURAL ENVIRONMENT 167, 179 (Helen M. Ingram & R. Kenneth Godwin eds., 1985).

190. *See generally*, *Environmental Ethic*, *supra* note 81. *See also* JOHN S. DRYZEK, DELIBERATIVE DEMOCRACY AND BEYOND: LIBERALS, CRITICS, CONTESTATIONS (2000); JOHN FORESTER, THE DELIBERATIVE PRACTITIONER: ENCOURAGING PARTICIPATORY PLANNING PROCESSES (1999); DEMOCRACY AND THE CLAIMS OF NATURE: CRITICAL PERSPECTIVES FOR A NEW CENTURY (Ben A. Minteer & Bob Pepperman Taylor eds., 2002); ROBERT J. BRULLE, AGENCY, DEMOCRACY, AND NATURE: THE U.S. ENVIRONMENTAL MOVEMENT FROM A CRITICAL THEORY PERSPECTIVE (2000); DEWITT JOHN, CIVIC ENVIRONMENTALISM: ALTERNATIVES TO REGULATION IN STATES AND COMMUNITIES (1994); ADOLF G. GUNDERSON, THE ENVIRONMENTAL PROMISE OF DEMOCRATIC DELIBERATION (1995); WILLIAM A. SHUTKIN, THE LAND THAT COULD BE: ENVIRONMENTALISM AND DEMOCRACY IN THE TWENTY-FIRST CENTURY (2000); BRUCE A. WILLIAMS & ALBERT R. MATHENY, DEMOCRACY, DIALOGUE, AND ENVIRONMENTAL DISPUTES: THE CONTESTED LANGUAGES OF SOCIAL REGULATION (1995); Walter F. Baber & Robert V. Bartlett, *Toward Environmental Democracy: Rationality, Reason, and Deliberation*, 11 KAN. J.L. & PUB. POL'Y 35 (2001); PETER H. KAHN, JR., THE HUMAN RELATIONSHIP WITH NATURE: DEVELOPMENT AND CULTURE (1999); BEATLEY & MANNING, *supra* note 144; PERSPECTIVES ON ENVIRONMENT AND BEHAVIOR: THEORY, RESEARCH, AND APPLICATIONS (Daniel Stokols ed., 1997); READINGS IN ENVIRONMENTAL PSYCHOLOGY: LANDSCAPE PERCEPTION (Amita Sinha ed., 1995); E.N. ANDERSON, ECOLOGIES OF THE HEART: EMOTION, BELIEF, AND THE ENVIRONMENT (1996); ERAZIM KOHÁK, THE EMBERS AND THE STARS: A PHILOSOPHICAL INQUIRY INTO THE MORAL SENSE OF NATURE (1984); CLAUDE LEVY-LEBOYER, PSYCHOLOGY AND ENVIRONMENT (David Canter & Ian Griffiths trans., 1982); EUGENE VICTOR WALTER, PLACEWAYS: A THEORY OF THE HUMAN ENVIRONMENT (1988); Fred R. Myers, *Ways of Placemaking*, *in* CULTURE, LANDSCAPE, AND THE ENVIRONMENT 72, 72-110 (Kate Flint & Howard Morphy eds., 2000).

191. Collaborative problem solving plays a critical role in a variety of environmental and land use contexts. *See* WONDOLLECK & YAFFEE, *supra* note 172; Alejandro Esteban Camacho, *Mustering the Missing Voices: A Collaborative Model for Fostering Equality, Community Involvement, and Adaptive Planning in Land Use Decisions, Installment Two*, 24 STAN. ENVTL. L.J. 269 (2005); ACROSS THE GREAT DIVIDE: EXPLORATIONS IN COLLABORATIVE CONSERVATION AND THE AMERICAN WEST (Philip Brick et al. eds., 2001); Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189 (2002).

approaches, public education and participation, political leadership, and the pooling of resources among various stakeholders.[192]

VI. CONNECTING WATERSHED SCALE AND FUNCTION TO LAND USE SCALE AND FUNCTION

According to the eight lessons about watershed scale and function and land use scale and function, neither a solely regional model of clean-water land use nor a solely local model of clean-water land use fits the complexity of both watersheds and land uses. Instead, we should connect watershed scale and function to land use scale and function by using both watershed-focused regional agencies and general-purpose local governments. We should create formal regional watershed agencies with planning authority, analytical functions, resources, and tools to help localities, and inter-local and inter-regional coordination functions. At the same time, we should retain land use regulatory authority, including planning in general, zoning, and specific permit decisions, at the local government level. However, we should mandate that local land use decisions be consistent with regional watershed plans and policies. This section first describes the specifics of this proposal and then discusses the ways that this proposal approximates the scales at which watershed functions and land use functions operate. In analyzing the benefits of this mixed regional-local model of clean-water land use, this section draws on a ninth lesson, about legal scale and function.

The mixed regional-local model of clean-water land use requires three components: 1) state creation and empowerment of regional watershed agencies; 2) a clear state legislative directive to retain primary authority for land use planning and regulation at the local government level; and 3) mechanisms for ensuring that local government decisions are consistent with watershed protection policies and plans and that local governments have incentives to take advantage of the tools and expertise that regional watershed agencies can provide.

To start, state legislation should divide the state into different "watershed regions" and create a regional watershed agency for each "watershed." The state legislature will have to select a

192. DAVENPORT, *supra* note 18; DOPPELT ET AL., *supra* note 37; NAT'L RESEARCH COUNCIL, *supra* note 5; Woolley et al., *supra* note 61; David Getches, *Grassroots Versus Waterlogging*, 4 GREAT PLAINS NAT. RESOURCES J. 1 (1999); *Rivers*, *supra* note 6.

hydrologic unit of area as a basis for dividing up the state. An obvious choice might be the commonly recommended eight-digit HUC under the USGS cataloging system.[193] However, the state legislature could use other methods of identifying drainage areas that roughly correspond to what are commonly understood to be "watersheds" or sub-watersheds." As discussed in Part IV.A., there is a certain artificiality to selecting any particular geographic classification system for "watershed management."[194] However, legally and politically a level must be selected and identified.[195] Moreover, the creation of multiple, nested agencies along the geographic boundaries of multiple, nested levels of hydrological function would be too complicated, politically unrealistic, and financially expensive. Regional "watershed" agencies could address patterns and conditions occurring at levels higher (or broader) than the particular agency's jurisdiction through inter-regional or inter-agency cooperation (e.g., at the basin or sub-basin level). Agencies with a specific watershed protection mission might be more inclined and equipped to coordinate with one another on large basin-wide projects and plans than would local units of government or state environmental agencies with many subject-matter areas of responsibility. To the extent that study, planning, and management activities should occur at a lower (or narrower) level than the particular agency's jurisdiction (e.g., at a sub-watershed level), the agency could organize its staff and functions into sub-units.

State legislation creating regional watershed agencies should vest certain functions and powers in these agencies. First, and foremost, regional watershed agencies should have responsibility for watershed-based planning. They should have the duty to develop general plans and policies for the protection of watershed features and functions, and the promotion of clean water. The state legislation should mandate that the watershed planning process involve local governments and stakeholders within the regional jurisdiction to the maximum extent possible. The regional watershed agency should coordinate a bottom-up, participatory

193. Griffith et al., *supra* note 87, at 668 (reporting that the EPA and the USDA recommend the eight-digit watershed HUC as a proper focus for watershed management under the Clean Water Action Plan); Ruhl et al., *supra* note 2, at 944 (recommending establishment of boundaries for watershed management councils according to the USGS eight-digit cataloging units).

194. *See supra* Part IV.A.

195. J. B. Ruhl, *The (Political) Science of Watershed Management in the Ecosystem Age*, 35 J. AM. WATER RESOURCES ASSN. 519 (1999).

planning process, but with established objectives for achievement and maintenance of watershed health and integrity and with data, analytical tools, technical support, planning tools, educational programs, and grants and other financial assistance.

The regional watershed plans should contain, at a minimum, the following components:

- Designation of critical areas where development should not occur or should be minimal, including lists of the types of uses appropriate for critical areas;
- Objective water quality performance standards or criteria that local governments must meet;
- Designation of riparian and wetland buffer zones to protect areas immediately adjacent to rivers, streams, creeks, lakes, and wetlands from development;
- Groundwater recharge overlay zones to limit the types, design, and operation of land uses on lands with significant contribution to groundwater recharge;
- Criteria for appropriate percentages of land with impervious cover (or the appropriate percentage of land that can be covered with impervious material) in different types of locations, depending on runoff patterns and current status of receiving water integrity and quality;
- Policies promoting retention of existing vegetation and minimal soil disturbance, pre-construction, during construction, and post-construction;
- Identification of preferred restoration projects and sites for water bodies, wetlands, riparian vegetation and habitat, and hydrological and geological physical features (e.g., stream morphology, hillside and slope integrity);
- Menus of structural and non-structural best management practices for both new construction and existing land uses (with identification of relative or comparable water quality protection functions for each type of practice), from which local governments, property owners, and developers could select, given the specific features of the site, the nature of the proposed activity or project, and the specific needs of the locality and the developer/property owner.

The regional watershed agency should also have the authority and responsibility to 1) encourage and coordinate inter-local coop-

eration and planning for scales smaller than the agency's jurisdiction but larger than any particular locality's jurisdiction; 2) engage in inter-watershed (inter-regional or inter-agency) coordination, planning, and joint restoration or management projects at scales larger than the hydrologic unit corresponding to the particular agency's jurisdiction; 3) gather and analyze data and information; 4) develop models of watershed features and functions, including hydrologic processes and patterns, ecologically significant features, water quality conditions and goals, and impacts of land uses across the watershed; 5) educate both local officials and the public about watershed conditions, the regional watershed plan, and methods of controlling land use activities to protect water quality; 6) initiate inter-local restoration projects; and 7) develop monitoring and feedback mechanisms, including monitoring local progress towards meeting performance standards and other policies in the regional watershed plan. Finally, the regional watershed agency should have the authority to bring suit against localities for local plans, zoning code provisions and zoning map designations, infrastructure projects, and specific permit decisions that are inconsistent with the regional watershed plan. Likewise, the agency should have the authority to issue "safe harbor" certificates of compliance for local plans, zoning code provisions and zoning map designations, infrastructure projects, and specific permit decisions, upon a finding that the local decision in question is not inconsistent with the regional watershed plan.

The statute creating regional watershed agencies should expressly and specifically state that general authority to plan and regulate land uses within a locality's jurisdiction (including its extraterritorial jurisdiction in some states, if already the case there) shall remain within the authority and responsibility of the municipal government (or county government in some states, if already the case there). Thus, local governments would retain primary authority over local planning, zoning, infrastructure projects, specific permit decisions, and other such normal features of land use regulation. However, the statute should also require that, notwithstanding local government responsibility for land use, all local government plans, ordinances, projects, policies, permits, and activities shall be consistent with any regional watershed plan duly adopted by a regional watershed agency having jurisdiction over land within the local government's jurisdiction. In addition, the statute should authorize suits by private citizen groups or regional watershed agencies against local governments to enforce

the consistency doctrine. It should provide a remedy of invalidation of any local government action that a private citizen group or regional watershed agency can prove by clear and convincing evidence is inconsistent with the applicable regional watershed plan. However, it should preclude the lawsuit if the regional watershed agency with jurisdiction has issued a "safe harbor" certificate of compliance upon a finding that the local government action (e.g., local comprehensive plan, zoning code or zoning ordinance, permit or project approval, local infrastructure project) is not inconsistent with the applicable regional watershed plan. An enforceable consistency doctrine is a critical component to ensure that plans are actually implemented through land use decisions. As Lora Lucero and Dan Tarlock have stated, "[t]he consistency doctrine is the linchpin for connecting land, water, and growth."[196]

Despite the necessity of regional agency planning to protect watersheds and a judicially enforceable consistency doctrine, the key to the success of the mixed regional-local model will be the extent to which regional watershed agencies facilitate watershed-regarding land use management at the local level. The state will have to fund, and regional watershed agencies will have to provide, financial incentives and ongoing technical assistance to local governments to participate in watershed planning, restoration, and conservation efforts.

The mixed regional-local model of clean-water land use respects the lessons of watershed scale and function and land use scale and function, in the following ways:

- **Geographic scale of watersheds:** Management of land use and protection of watershed features occur at varying, nested geographic levels, ranging from the property owner's management of a particular site to the local government's planning and regulation of land within a local jurisdiction to a regional agency's planning and analysis at a watershed level to inter-agency coordination and projects on the levels of basin and sub-basin.
- **Functional scale of watersheds:** Regional watershed policies mandate protection of the hydrological functions and ecosystem services of watersheds, but the persistence of local land use power allows for incorporation of other eco-

196. A. Dan Tarlock & Lora A. Lucero, *Connecting Land, Water, and Growth*, 54 LAND USE L. & ZONING DIGEST 3, 7 (2002).

logical considerations and other spatial analyses into sustainable land use policies and practices.

- **Problem scale of watersheds:** Both regional watershed agencies and local land use agencies have roles in addressing water quality problems occurring and arising on many different levels.
- **Temporal scale of watersheds:** In a system with many different regional watershed agencies and local units of government addressing water quality problems and watershed health goals, we are likely to get more experimentation, innovation, and adaptation to changing conditions than in a system where a smaller number of entities managed land use and water quality. Nonetheless, there must be consistency of basic goals and policies within a watershed, and local governments must not be free to allow problems to arise and become acute before attempting remedial measures.
- **Functional scale of land use:** The model recognizes the variety and complexity of land use management functions and does not attempt to vest all such functions in a single agency, either with a regional watershed focus or a local land use focus. Instead, the model allocates to regional watershed agencies certain planning functions for watershed integrity and certain cross-cutting functions, such as providing information, encouraging cooperation, providing monitoring and feedback, and enforcing the requirement that local land use actions be consistent with regional watershed plans. It retains at the local level the regulatory and permitting functions, most public infrastructure programs (other than possibly watershed restoration projects and similar projects), planning functions in general (subject to watershed plans), and all the cross-cutting functions to the extent that they relate to land use generally, in contrast with watershed protection specifically.
- **Political scale of land use:** The model retains primary control over land use at the local level to serve democratic, socio-psychological, community, social justice, and pragmatic goals, especially given that regional watershed agencies will not necessarily escape the very political, social, and economic forces that constrain local governments in protecting the environment.

- **Resource scale of land use:** Regional watershed agencies and local units of government have their own respective strengths and resources that are institution-specific. The model attempts to divide responsibilities for clean-water land use among the two types of agencies based on their relative institutional competencies.
- **Temporal scale of land use:** Local governments have the capacity and probability of adapting to growing needs for aquatically sustainable land use policies and practices. However, the presence and work of regional watershed agencies, including the development of regional watershed plans, can contribute to the conditions that typically prompt environmental policy innovation at the local level.

In addition to these eight lessons of scale and function, a ninth lesson about legal scale and function promotes the mixed regional-local model: the lesson of freedom and boundaries. Legal systems ideally impose boundaries or limits on human and institutional behaviors, while at the same time giving people and institutions the authority, tools, and freedom to act. The component of boundaries emphasizes rules, restrictions or prohibitions, duties and requirements, liabilities, conflict, and responsibility and accountability. The component of freedom emphasizes power and authority, tools and techniques, innovation and creativity, choice and discretion, achievement, collaboration and cooperation, adaptation, and self-assertion. Legal systems should be thought of not so much as having a balance between two competing features (i.e., freedom and boundaries) as having a combination, or mix, of two necessary components of social dynamics. Indeed, we are well aware of the need of humans and human institutions to have both freedom and boundaries from work in a variety of disciplines, including psychology, political science, theology and religion, sociology, philosophy, and education, as well as from our own life experiences.

As we think about whether local governments can or will adopt land use policies, regulations, and practices that protect water quality and watersheds, we should think about legal reforms in terms of freedom and boundaries. A system that creates new land use regulatory authority at a watershed level and effectively eliminates local control over land use focuses primarily on boundaries. A system that leaves all decisions about land uses that have or could have impacts on watersheds to local govern-

ments and private property owners focuses primarily on freedom. The mixed regional-local model has both freedom and boundaries. It retains much of the authority, discretion, and tools that local governments have to control land use, while also providing some additional tools and resources from regional watershed agencies, and some additional authority to local governments to participate in the process of regional watershed planning. At the same time, though, it requires that local plans, policies, decisions, and actions be consistent with regional watershed plans and creates a mechanism for invalidating those acts that are inconsistent with these plans (i.e., a "hammer" to ensure compliance), thus providing some critical boundaries to local governments. In addition, the regional watershed agency will have both the power and the tools to engage in regional watershed planning, inter-agency cooperation, and coordination of local efforts.

VII. CONCLUSION

The extensive adverse impacts of land use on water quality and the health of watershed necessitate legal reforms to more effectively connect land use decision-making to protection of the services that watersheds provide. Given the complexities of watershed scale and function and land use scale and function, new watershed institutions will not necessarily achieve "clean-water land use" simply because they are created at watershed levels and given land use responsibilities. However, a mixed regional-local model offers much promise for advancing a policy of aquatically sustainable land use. It matches various institutional functions to appropriate scales, and it enhances the authority and tools of both local governments and regional watershed institutions, while providing the right mix of restrictions and requirements to promote the use of institutional authority in ecologically responsible ways.