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Watershed Governance in the United States: The Challenges Ahead

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In the twentieth century, the challenges faced by water resources managers in the United States included water resource development, structural flood control, and centralized drinking and wastewater treatment. In this century, the focus has shifted to the management of land uses to prevent polluted runoff and groundwater contamination, the restoration of the physical integrity of rivers to reverse declines in aquatic ecosystems, and the protection of the natural capital assets of watersheds to promote the delivery of ecosystem services. This shift is occurring in response to profound problems. Broad cross-sectional data indicate that riverine ecosystems are increasingly threatened by simplification attributable to excessive water withdrawals; channel modifications; erosion and sedimentation; deterioration of substrate quality; chemical contamination; as well as over fishing and exotic species introduction (Adler, 1995; Doppelt et al., 1993). Sediment, pathogens, and nutrients derived from runoff lead the list of pollutants for which Total Maximum Daily Load (TMDL) plans are required under Clean Water Act 303(d) (Table 1). Despite many billions in expenditures to build, operate and administer point-source (PS) pollution control facilities since 1970 (Doppelt, et al., 1993), nonpoint source (NPS) pollution remains as nothing short of one of the greatest environmental problems in the United States.

This shift in management challenges also requires an institutional transformation. If our institutions are to solve these new problems, they must move from a system of Congressional appropriations for largely federalized civil and environmental engineering projects and federal environmental regulation to a system of state-facilitated, locally-led watershed management. Unfortunately, most states lack institutions with political power and local legitimacy needed to manage watershed problems. In the absence of such strong institutions with decision-making authority, watersheds become politically passive actors that can compete neither with private sector land and water managers nor with public sector jurisdictions such as counties and state and federal agencies. In short, a dilemma similar to that faced by unplanned cities lies at the heart of watershed governance. Despite the fact that watersheds define meaningful physical geographic

Table 1. Top 15 Categories of Water Impairment Identified on 1998 303(d) Lists.

Cause of Impairment	Number of Listings
Sediments	6133
Pathogens	5281
Nutrients	4773
Metals	3984
Dissolved Oxygen	3758
Other Habitat Alterations	2106
Temperature	1884
Ph	1798
Impaired Biologic Community	1440
Pesticides	1432
Flow Alterations	1099
Mercury	1088
Organics	1069
Noxious Aquatic Plants	831
Ammonia	752

Source: http://www.epa.gov/owow/tmdl/states/national.html

units of the landscape in terms of hydrologic processes, landscape patterns at watershed scales reflect an aggregation of decisions made by individual landowners who are affected by non-water-oriented regional processes such as urban sprawl or agricultural decline. Nevertheless, watershed-scale landscape patterns largely determine the commodities and ecosystem services that a watershed is capable of producing and the problems that it will have to confront. Therefore, the primary variables that determine the performance of watersheds are not under the control of watershed managers.

Given this dilemma, the process of integrating watershed governance into concrete policy objectives has finally begun. Historical antecedents to watershed-based policy frameworks exist (Taylor and Gerath, 1996), but none as comprehensive as what is being witnessed today. For example, the most recent Army Corps of Engineers Strategic Plan identified environmental repair on a watershed basis as one of its primary goals (Department of the Army, 2002). Likewise, the USEPA recently committed itself to pursuing "multi-stakeholder efforts within hydrologically-defined boundaries to protect and restore our aquatic resources and ecosystems" (Mehan, 2002). This "watershed or 'place-based' approach" is, according to the initiative, "one of the most important guiding principles" for the current Administration. At least 20 states have also adopted some form of statewide watershed management policy for the purpose of guiding at least some aspects of water quality protection (U.S. EPA, 2002). Consequently, it is not surprising that the National Research Council recently concluded that "many factors are converging to cause citizens, scientists, resource managers, and government decision-makers to look increasingly to watershed management as an approach for addressing a wide range of water-related problems" (National Research Council, 1999).

At the local level, the 1990s witnessed a rapid development of watershed-scale planning initiatives. Labeled "place-based" or "locally-led," these initiatives now number well over 1,000 and continue to increase (www.epa.gov/adopt 2001, http://www.ctic.purdue.edu/CTIC/CTIC.html 2001). Efforts to organize environmental management activities along these lines have also appeared in Brazil (Porto et al., 1999), Australia (Ewing, 1999), and New Zealand. In New Zealand, a notable restructuring of environmental administration took place following passage of the Resource Management Act of 1991 which organized that country's environmental management along watershed boundaries (Ward et al., 2001; Cocklin and Furuseth, 1994). The modern watershed management movement represents numerous unique local efforts that seek to address on-going problems with NPS pollution and aquatic ecosystem decline while increasing local participation in natural resource management. With little funding or political authority, however, these groups face a daunting task. In short, watershed governance both at home and abroad faces ecologic-economic, political, and institutional challenges. Yet, a general approach to meeting these challenges may be emerging as a result of the formation of state and local watershed-based institutions combined with a changing federal role that includes an ecological economics approach.

(Ecological) Economic Challenges

Applying an ecological-economic lens, one sees that a watershed is a storehouse of natural capital that produces both marketable commodities and non-marketable ecosystem services (Gottfried, 1992). These ecosystem services (e.g. nutrient cycling, carbon sequestration, soil formation and binding, sediment trapping, riparian corridors, wildlife habitat) are increasingly recognized as essential to society and of considerable economic value (Daily, 1997; Bjorklund et al., 1999; Daily et al., 2000). However, greater investments in natural capital are needed to ensure delivery of ecosystem services in the present and the future. Unfortunately, as Zimmerman (1951), Firey (1960), Hardin (1968), Randall (1983), Lee (1992), Gottfried et al. (1996) and other social scientists have articulated over the last half century, there is a narrow range of social circumstances under which resource managers are willing to make substantial personal investments in the present to achieve even more significant public benefits in the future. One critical implication is that ecosystem services and the natural capital that generates them will be under-produced since they are public goods that are viewed by landowners as positive externalities.

Embedded in watershed governance is the issue of property rights and their definitions by society at

large and the courts (see Byrne, 1995). In the legal context, property rights are a bundle of entitlements that specifies an individual's or institution's rights, privileges, and obligations in the use of some property, such as land. These entitlements are determined by society and can be changed through political action. Political discourse over the past two decades demonstrates that the rights of landowners to use their land as they see fit (e.g. in terms of agricultural production practices) often compete with the rights of communities to have access to clean water, healthy ecosystems, and other ecosystem service benefits (Kraft et al, in press). Conflicts between the community's poorly defined legal rights to ecosystem service benefits and land owners' better, but still imperfectly, defined rights to pursue personal goals through land-use choices are sharpened by the process of managing watersheds to overcome problems of polluted runoff and aquatic ecological decline. While state law through riparian and prior appropriation forms has worked to allocate water among consumptive and productive uses, the same cannot be said regarding the use of streams to dispose of excess runoff, eroded soil, and agri-chemicals and the use of aquifers to dispose of soluable pollutants. This important resource value of water remains open access and therefore subject to the dynamics of a tragedy of the commons.

Because land-use patterns largely determine both a watershed's response to outside inputs as well as its overall ecological health, successful watershed management requires an understanding of the dynamics of land-use change. Lee and others (1992) capture these issues with a series of questions that need to be answered if the relationships among land-use change, its causes, and its consequences for watersheds are to be understood:

1. How do economic and social factors influence land-use practices and thus landscape patterns?

2. What are the impacts of landscape patterns on environmental quality (ecological condition) and resource supply (goods and services)?

3. How can environmental quality and resource supply be managed to foster socioeconomic and ecological sustainability?

The issue of land use is particularly relevant where rapid urban development is occurring or in watersheds that are predominantly agricultural. Because about 50 percent of land in the U.S. is used agriculturally, it is not surprising that agriculture is the leading source of water pollutants and historical wetland drainage. Nevertheless, U.S. agriculture enjoys a "safe harbor" from many environmental regulations (Ruhl, 2000). For these reasons and others, it is instructive to take a closer look at the agriculture case. For example, it has been shown that the flow of ecosystem services from agricultural landscapes in Sweden is declining (Bjorklund et al., 1999). Negative environmental externalities in UK agriculture are large – over $300/ha/yr (Pretty et al., 2000). Under these circumstances, there are benefits to be achieved by integrating agricultural policy and environmental policy, especially water quality control. Conservation subsidies, such as the Conservation Reserve Program (CRP), make it possible for farmers to greatly reduce erosion and sedimentation (and perhaps fertilization) without incurring substantial reductions in farm income (Lant et al., under review). By partially shifting the very large federal expenditures in agricultural subsidies from price supports and other crop-based programs to the CRP and other ecosystem service-based subsidies such as the Wetland Reserve Program (WRP) and carbon credits, the decision environment of landowners in agricultural watersheds would be changed in a manner that would lead to changed land-use choices. Resulting land-use patterns would produce similar farm income, but fewer crops, more soil conservation, less water pollution, less flooding, and probably more carbon sequestration and wildlife habitat. In this way, public expenditures on agriculture would produce a valuable public benefit in the form of pollution load reductions in a TMDL context and an augmentation of ecosystem services now in decline in agricultural watersheds while both slightly reducing the market surplus of many crops and reducing subsidies that are viewed abroad as "protectionist."

In rapidly urbanizing watersheds, similar forms of economic incentives and disincentives could be identified, such as tradable impervious surface permits that would limit the total area under this deleterious form of land cover while maintaining flexibility in land use choices. Such a system is proving practical in the Lake Tahoe basin (Tracy, 2003).

Political Challenges

Watersheds do not normally constitute formal, organized political jurisdictions. Consequently, both the plans and planning processes of watershed-based institutions face the challenge of acquiring political legitimacy and legal authority. Deyle (1995) observes that the fragmented decision-making that is typical of watershed management constitutes an "organized anarchy" where the involvement of stakeholders is fluid while the goals and means of achieving them are poorly specified. Thus, too often the planning process produces the "pet" solutions of agents who are only temporarily cooperating to address a particular watershed-based resource problem. Alternatively, planning groups that organize around principles of decision-making by consensus arrive at solutions which may represent the least common denominator but which fail to substantially improve environmental conditions in the watershed. To be effective at the critical step of implementation, the watershed planning process, the resulting plan and management measures and practices therein, and anticipated outcomes from plan implementation at the parcel, farm, and regional level must be seen as legitimate by various stakeholder groups in the watershed (Kraft et al., in press).

While the literature on legitimacy and natural resource use is quite varied, there are a number of reoccurring themes. Because legitimacy is the degree of social acceptance of an institution, rules, outcomes, etc., it frequently reflects both the willingness of citizens to accept and follow sets of rules and processes and the perceived obligation to abide by those rules. In managerial situations, measures must be designed based on existing law to be legitimate (see Tyler, 1990; Hatcher et al., 2000; Jentoft, 2000). If watershed planning is going to be the mechanism for dealing with NPS pollution and aquatic ecosystem management, the question which must be answered is: "How is legitimacy conferred on the planning process and the plans such that they are actually implemented and sustained?"

The recent embrace of local planning initiatives with their commitment to "participatory democracy" is influenced by Habermas's theories of democratic deliberation (Dryzek, 2000; Swanson, 2001; Valadez, 2001; Weber, 2000). Though democratic in its procedures, many scholars argue that electoral politics lacks democracy in substance while participatory democracy at the local level is more conducive to substantive democracy.

Recent case study research focused on Illinois' Cache River addresses these issues directly (Adams, under review). Despite partial success in improving environmental conditions in the watershed and in increasing land values in an economically depressed region, the study suggests that the legitimacy of the watershed planning process is questionable. In-depth interviews with participants in the planning process revealed that the process lacked legitimacy for many of the farmers involved; land owners probably do not feel that they have an obligation to follow the plan's recommendations if doing so is contrary to their perceived interests. This view stemmed from three factors.

1. Lack of Representation. The federal agency that organized the planning process, the USDA Natural Resources Conservation Service (NRCS), in cooperation with The Nature Conservancy (TNC) and a consortium of government agencies, defined "stakeholders" as farmers who participated in the Soil and Water Conservation Districts (SWCDs). These farmers were hand selected by SWCD directors for the Planning Committee rather than being elected. Missing from the table were both non-landowners and locally elected officials, despite the fact that local residents saw the involvement of the latter as critical to legitimacy.

2. Problem Definition. The TNC and NRCS, who led a Technical Committee ostensibly to support the Planning Committee, defined the problem as concerning "resource management." However, virtually every member of the Planning Committee was equally as concerned with the social issues of the region – poverty, depopulation, drugs, education – issues that were defined as beyond the committee's charge.

3. Implementation. Implementation devolved to the Technical Committee. Government agencies and TNC used the plan to enhance local federal expenditures on CRP, WRP, and land acquisition for the Cypress Creek National Wildlife Refuge to considerable positive environmental effect, but they did not address other concerns of greater importance to community representatives.

These outcomes indicate that while the watershed planning process was quite successful in generating investments in natural capital it was not successful in investing in local social capital, and may have undermined it. These results mark an important distinction in watershed initiatives between "place-based," which does describe the Cache River case, and "locally-led," which does not.

Institutional Challenges

So how does one both empower watershed-based institutions to tackle the steep challenges of watershed management while building their local legitimacy to do so? Because watershed-based political institutions would serve only limited purposes, conventional political entities such as cities and counties would surely continue to exist for many other purposes. Thus, watershed management must confront the question of how watershed-based political institutions would "overlay" the existing political framework such that these divisions of authority would be clear and respected. Additionally, how would these institutions interface with drainage districts, SWCDs, levee districts, and other local water-related bodies? In tackling these issues, Ruhl et al. (in press) identify five characteristics that a watershed-based institution must possess.

1. The institutional structure for watershed management must enjoy the type of power and authority generally associated with centralized administrative governments, such as the federal or state governments, but must also be capable of establishing democratically based legitimacy at regional and local levels where many regulatory actions are implemented. This requires a nested hierarchy of interrelated federal, state, and local governmental authorities.

2. The institutional structure must have the authority and the responsibility to manage watershed issues "holistically" on a system level. This requires some form and level of authority over surface and ground water, over water quality and water quantity, and over key physical and biological effects on aquatic ecosystems such as flood control, soil conservation, wetlands conservation, fisheries, recreation, stream entrenchment, dams, reservoirs, pollutant sources, and land uses with significant watershed impacts.

3. The institutional structure must rely on more than voluntary measures. The full range of financing mechanisms (e.g., taxes, fees, surcharges, bond) and the full range of compliance instruments (regulatory, market-based, incentives, reporting and information requirements, planning requirements, voluntary) must be available.

4. The institutional structure must have the capacity—the budget, staff, and expertise—to carry out complex scientific, economic, and social analysis functions, and the responsibility to make policy and regulatory decisions through public, transparent procedures. Given the uncertainties involved in implementing policies to maintain and enhance natural capital, there must be a capacity to engage in ongoing adaptive management.

5. The institutional structure should be generalizable across watershed types, scales, and political units, and the information gathering capacity and protocols should be standardized so as to allow sharing of information vertically (e.g., within a state from local to higher levels) and horizontally (e.g., between local districts and between states).

Given these requirements, *states* will have to carry the primary burden of watershed governance. This conclusion is reinforced by the recent decision by the Bush administration to devolve responsibility for TMDLs to the states. Emphasizing the role of states inevitably results in 50 different solutions, but herein lays a tremendous opportunity to learn from the successes and failures among the states, ranging from Florida's powerful Water Management Districts to promising initiatives in Maryland, Nebraska, Oregon, Pennsylvania, Washington, Wisconsin, and other states.

Nevertheless, states should design their internal political frameworks around a hierarchy of physical watershed units, and should consider ways to achieve inter-state coordination. Ruhl et al. (in press) suggest a hierarchy consisting of:

1. A State Watershed Management Agency,

2. Regional Watershed Coordination Agencies at the scale of the 222 subregional USGS hydrological units, and

3. Local Watershed Management Councils where representatives are elected to serve on boards managing watersheds at the scale of 2150 USGS hydrologic units.

This promising approach concurs with the National Research Council's findings:

> Organizations for watershed management are most likely to be effective if their structure matches the scale of the problem. Individual local issues related to site planning, for example, should be the purview of local self-organized watershed councils, while larger organizations should deal with broader issues. These larger organizations, however, must include the nested smaller watershed groups within their area of interest, and must account for downstream interests (National Research Council, 1999: 15).

The Path Forward

Progress is being made – sometimes quite good progress. In writing the introduction for the AWRA Monograph "Human Dimensions of Watershed Management" (Lant, 1999), I mentioned that the monograph fell short of a systematic study identifying the ecologic, economic, political, and institutional factors that lead to the successful governance of watersheds. To my knowledge, this study remains to be undertaken. Lacking it, I can only rely on my best judgment born of a long-standing academic interest in these issues and the arguments presented above. Here are the elements I currently think are essential:

1. We need substantial changes in environmental and economic policies to more fully embrace ecological-economic and sustainable development approaches. These policies should provide economic disincentives for land and water management choices that degrade watersheds (e.g. over-fertilization, pesticide use, placement of impervious surface, wetland drainage, large-scale feedlots, inefficient application of irrigation water) and economic incentives for choices that improve watersheds (restoring wetlands and riparian vegetation, placing highly erodible farmland in wildlife cover, organic farming methods, sequestering carbon, removal of impervious surface, maintenance of minimum in-stream flows). Without a substantial modification in the economic landscape within which land and water managers make decisions to address the ecological-economic issues watershed face, continued runoff of pollutants, physical degradation of waterways, and aquatic ecological decline will overwhelm state and local efforts at watershed governance, no matter how well constituted.

2. We need to accelerate federal and federal-local cost sharing resources for specific efforts to restore the physical integrity of rivers (see Graf, 2001). These efforts include de-channelization, remediation of stream entrenchment, modification of navigation facilities and levees and wetland restoration as well as dam removal. The Army Corps of Engineers has demonstrated considerable foresight in positioning itself to take this effort on as a core part of its mission (Department of the Army, 2002).

3. We need to empower local watershed-based institutions as described above and equip them with the scientific tools they need (e.g. an upgraded stream gauging network, spatial decision support systems, locally calibrated and verified watershed models) to adaptively manage watersheds. In constructing these institutions, we need to explicitly and consciously build upon pre-existing local institutions that manifest local social capital and carry local legitimacy.

If these ingredients can be put in place, there is a good chance for success in meeting the steep challenges of watershed governance.

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