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I am delighted to join Sara Vickerman of Defenders of Wildlife and the other panelists to examine the evolving policy context and its implications for ecosystem services evaluation and investments. I bring the lens of a former decision maker and policy architect to the ecosystem services discussion.

As I contemplate the context of conservation and resource management, I see the confluence of two trends. First is the broadening compass of conservation action to landscape-scale evaluation and action. Efforts are telescoping outward to encompass whole watersheds and whole ecosystems and undertake actions at a scale that accommodates interconnected and intersecting land, water, and wildlife issues. Second is the deepening recognition that natural systems provide services—water purification, coastal storm surge mitigation, flood protection, temperature regulation, and more.

As these two trends unfold, how might they link in mutual reinforcement? Before turning to that question, let me offer a few summary comments on natural systems and their services. Several considerations have broadened interest in these natural services.

- *First is the search for new revenue streams for landowners to support sustainable practices*. For example, Florida initiated in 2005 its Ranchlands Environmental Services Project to field-test payment for environmental services in the northern Everglades ecosystem with 8 participating ranchers.

- *Second are potential cost savings for basic community services.* Consider Seattle's use of "green infrastructure," which reduces stormwater runoff volumes at a cost 25 percent less than the traditional alternative.

- *Third are opportunities to more cost-effectively meet regulatory requirements to achieve environmental performance.* The local surface water utility for the Tualatin Basin in Oregon, Clean Water Services (CSW) bundled into a single permitting action the renewals of four wastewater treatment permits and a stormwater permit. Rather than investing $60 million in expensive refrigeration systems, they worked with the adjacent farming community to plant 35 miles of shade trees along the river to cool water temperatures to required standards. The cost of the ecosystem service approach was $6 million, a tenth the cost of the mechanical cooling.

- *Fourth are costs associated with ecosystem service losses*. Over the past century, the annual number of natural disasters has increased more than 40-fold: rising from 10 in the first decades of the past century to 400 to 500 in the last decades of the 20th century. These hazards translated into costs that climbed from less than $1 billion in 1900 to over $200 billion in 2005. Eying these costs, communities are re-examining natural systems and their potential to meet their economic, environmental, and safety needs.

- *Fifth is growing interest in enhancing resilience in a context of changing conditions*. Climate change may result in increased incidence of high-intensity storm events and more variability in water availability. Investments in the protection or restoration of floodplains and coastal dunes and sea marshes have potential to enhance resilience. For example, evaluation of dune protection in North Carolina showed marked reductions in buildings destroyed or damaged from storm events compared to areas without dune protection.

Scientists and economists have significantly advanced our ability to both measure and value these goods and services, even in the absence of market transactions. I applaud those efforts and their importance. But I want to turn my sights now to my opening question. As increasing interest in landscape-scale conservation and ecosystem services unfolds, how might these efforts link in mutual reinforcement?

Numerous federal statutes, regulations, and practices include requirements, tools, or aspirations to measure damage to and creation and protection of ecosystem goods and services. Let us zero in on those that may hold particular potential to support landscape-scale conservation and natural asset markets.

I begin with a couple of general observations about the nexus between landscape-scale conservation and ecosystem services. First, meaningful measurement of ecosystem goods and services often requires measurement boundaries large enough to capture functional interrelationships among ecosystem components. Second, the universe of ecosystem service beneficiaries of a particular wetland, or floodplain, or vegetative cover may extend well beyond the immediate location of that natural feature. Third, though measurement of discrete ecosystem components, functions and values has characterized much work to date, more recent efforts are trending toward integrative metrics. These three features of ecosystem services and their valuation all support operating within a landscape-scale framework.

Let us look, for a few moments, at several statutes and policies that could strengthen this linkage of ecosystem services with landscape-scale conservation. I offer a very broad brush, stylized overview by bundling opportunities into three categories:

- Planning and Priority-setting Tools and Guidance, such as those used in National Environmental Policy Act evaluations, land-use planning by federal agencies, and Water Resources and Development Act principles and guidelines.
- Regulatory mitigation and impact reimbursement tools, including wetlands mitigation, conservation banking, FERD relicensing mitigation, and natural resource damages mitigation.
- Grants, Loans, and Other Investments, such as Farm Bill land conservation payments, Safe Drinking Water Act and Clean Water Act Revolving Loan Funds.

NEPA offers an appropriate starting point for reviewing policy opportunities to place ecosystem services evaluation within a landscape-scale context as it is the Nation's premier, overarching environmental policy foundation. Council of Environmental Quality NEPA regulations require that environmental impact statements include analysis of cumulative effects. The concept of cumulative effects builds on the recognition that a single, incremental action may have minimal ecological effects. But, combined with other actions in the same geographic area, effects may cumulatively impact resources and ecosystem components. CEQ regulations define these effects as impacts to "the components, structures, and functioning of affected ecosystems."

This language offers a clear nexus with evaluation of ecosystem goods and services. Cumulative effects analysis, through its broadened geographic and temporal focus, allows NEPA analysts to examine the effects of actions that alter general ecological processes, such as changing hydrologic patterns and sediment transport. Currently, CEQ has not established specific criteria for determining the appropriate scope and scale of the cumulative impact analysis. CEQ updating of its cumulative effects guidance to include definitions and methods for evaluating ecosystem services could strengthen both ecosystem services evaluation and use of landscape-scale analytic framework. A key challenge is how to extend the boundaries of evaluation beyond the individual public land unit. Is there a role for cooperating agency status as platform for such analysis? What about use of DOI's regulation on consensus-based collaborative management options that allows such options to be identified as preferred alternative? Or, less ambitiously, how can agencies undertake multi-unit environmental impact analyses—e.g., on Bureau of Land Management and Forest Service lands—to broaden the scale of analysis?

Federal agency resource management plans provide another, related context for applying a landscape scale and ecosystem services framework. Requiring calculation of ecosystem services benefits could support a more landscape-scale vantage point, as this scale is often a more relevant analytic context for ecosystem services evaluations. Denver's water authority has entered into an agreement to fund fuels treatments on forestland to maintain source water supplies and prevent erosion. Agency planning frameworks that look beyond their boundaries can illuminate these kinds of possibilities. BLM's eco-regional assessments offer a possible model.

Let us turn now to Water Resources Development Acts and the Principles and Guidelines that govern how the Army Corps of Engineers plans, constructs, operates and maintains water resources projects. The enormous size of water project appropriations means that the Corps' ecological evaluations can affect decisions where large ecological effects are at stake. Corps project evaluations are governed by the *Principles and Guidelines for Water and Related Resources Implementation Studies* (P & G). These guidelines describe an analytical framework and set of evaluation practices to forecast and describe natural resource conditions, formulate, evaluate and compare alternatives. The White House Council on Environmental Quality (CEQ), the Corps, and other federal agencies are revising the guidelines. Fuller accounting for the environmental benefits of water resource projects provides an opportunity to focus the analytic framework at a watershed/and landscape-scale.

Beyond federal provisions for land use planning, federal statutes and regulations also set forth mitigation and liability requirements. These, too, have potential to foster eco-regional or landscape scale conservation in priority areas.

Among these mitigation requirements, wetlands and habitat conservation mitigation banks are evolving in extent and project scale. Banking concepts provide a potential context for pooling mitigation into large conserved areas. They also potentially provide a context to develop "full-service" or multi-benefits credits.

A wetlands mitigation bank is a wetland area that has been restored, established, enhanced or preserved, which is set aside to compensate for future conversions of wetlands through development activities. The growing emphasis on wetlands functions rather than simply on acres lost and gained provides an important precursor to evaluating and quantifying ecosystem services.

Patterned after wetlands mitigation banks, conservation banks refer to parcels of land protected and managed to conserve listed species under the Endangered Species Act. To provide greater consistency in their use, the Fish and Wildlife Service published conservation banking guidance in 2003. The use of conservation banks to date is extremely modest given the numbers of listed species, their geographic spread, and ESA regulatory requirements associated with listed species. But extensive land development, especially for traditional and renewable energy, creates a potential impetus for greater use of conservation banks.

A looming issue is how to use species conservation banks as a platform from which to build "full-service" or multiple-benefits banking. Linked to this issue is how to target conservation banks in high-priority habitat at scales sufficient to provide meaningful benefits.

Mitigation of impacts associated with hydropower facilities provides another significant opportunity to move beyond piecemeal, small-scale mitigation. Most non-federal hydropower dams require licensing under the provisions of the Federal Power Act. As part of this process, FERC must consider recommendations from state and federal fish and wildlife agencies. The Federal Power Act also authorizes the Secretaries of the Interior and Commerce to prescribe mitigation measures for hydropower facilities. Certain mitigation requirements pertaining to impacts on federal lands and provisions prescribed by FWS or NMFS are mandatory. As in wetlands mitigation and conservation banking, the mitigation provisions under the licensing process offer a potential source of funding for ecosystem services investments and a potential source of market demand. They also provide an opportunity for agencies to steer mitigation toward landscape-scale, high-priority, and multi-benefits conservation. These opportunities could be strengthened by:

- *Updating the Hydropower Interagency Memorandum of Understanding* to reference ecosystem services evaluation within the context of requirements to evaluate environmental impacts of projects;
- *Setting Mitigation Funding Priorities* through mitigation guidance that emphasizes enhancing ecosystem services outcomes could result in more effective, better targeted mitigation efforts

Natural resource damages (NRD) requirements present a similar opportunity to target conservation and restoration investments. Several U.S. environmental statutes establish liability for injury to natural resources. In economic terms, the goal of federal NRD liability is to "make the environment and public whole" following a pollution event. Current NRD emphasis is on restoration rather than a monetized estimate of lost value as the measure of damages. Several NRD implementation trends show potential for using NRD funds to supplement other conservation funding to achieve broader goals for restoring and sustaining ecosystems and their benefits.

First is increased use of Off-site Restoration. For example, $3 million in NRDA funds resulting from a settlement regarding harbor contamination in Rhode Island were combined with private-sector and nonprofit funds toward purchase of 1.5 million acres of loon nesting

habitat in Maine. Second is emphasis on Collaborative Projects. For example, $400,000 in NRD funds combined with Coast Guard and other nonprofit funding to protect and monitor common eider nesting habitat. The FWS estimated in 2009 that it leverages its annual NRD settlement funding allocation by a seven to one ratio.

Beyond planning, mitigation and liability policies, the federal government is a big direct investor—through direct payments, grants, and loans—in ecosystem goods and services. Most significant among these are Farm Bill Conservation programs. Farm Bill conservation programs have faced criticism for allocation of funds not always closely tied to high-priority ecosystems or high-value outcomes. Some form of ecological ranking or criteria – and thus ecological evaluation – is associated with each of the Farm Bill programs. The most developed ranking schemes to date are associated with the Wetland Reserve and Conservation Reserve (CRP) programs. Ranking or targeting factors in current use are primarily biophysical in nature, rather than based on measures of the economic or social benefits of a given biophysical outcome. One exception is the CRP's Environmental Benefits Index that includes both biophysical outcome measures (like soil erosion vulnerability) and social indicators (the number of well-water users in proximity to the land). The general principle that payments should be directed toward conservation that yields the largest environmental benefit is well established in policy discussions. Key proposals to improve program performance center on:

- consolidating programs that share common purposes and/or consolidating different payment types (rental payments, easements, incentives) into a single, multipurpose payment system;
- better targeting programs to high-priority conservation areas to achieve ecosystem benefits
- developing better performance indicators; and
- improving environmental returns on investment through use of landscape-scale approaches, competitive bidding to lower the cost of conservation program contracts, and linking payments more directly to environmental performance

Other federal programs offer less direct incentives to support ecosystem services. The Total Maximum Daily Load (TMDL) program under the Clean Water Act, focuses on water quality outcomes, with establishment of effluent loads that can be discharged consistent with achieving those outcomes. The TMDL program creates a context that is *potentially* conducive to "effluent trading" programs, since different dischargers face different costs to reduce their pollution loadings. The 2003 Water Quality Trading Policy and 2004 EPA Water Quality Trading Assessment Handbook were designed to facilitate water trading to lower compliance costs and improve water quality.

Through the end of 2006, EPA had sponsored eleven pilot projects to assess trading opportunities and issues in various regions. These efforts create some opportunity for urban water managers to pursue ecosystem services investments, especially efforts that link to the broader non-urban watershed and ecosystem restoration and conservation initiatives. *Long Island Sound, Connecticut and New York* adopted a basin-wide plan (the Long Island Sound Comprehensive Conservation and Management Plan) to reduce nitrogen loads in the sound by 58.5 percent over 15 years. The TMDL policy's virtue lies in the face that environmental planning and compliance are assessed on a watershed basis. Aggregate conditions, across a watershed's geography, are the focus of evaluation and quantification.

The concept of permit bubbles offers related opportunities. As the concept of ecosystem services has gained traction, permit bubbles, particularly in the context of water quality, provide a potential tool for supporting ecosystem service payments within a landscape-scale framework. EPA has approved the clustering or grouping of permits for wastewater, stormwater, and other related facilities. The most notable example of this clustering is that of the Tualatin Basin, in Oregon.

The local surface water utility, Clean Water Services watershed includes a number of towns, four wastewater systems, and stormwater runoff from multiple locations. The local water agency bundled into a single permitting action the renewals of four wastewater treatment permits and the stormwater permit. Rather than investing $60 million in expensive refrigeration systems, the agency worked with the adjacent farming community to plant shade trees along 35 miles of riverbank to cool water temperatures to required standards for $6 million.

Federal Loan Programs provide similar opportunities to emphasize ecosystem services protection within a landscape scale. EPA manages grant and loan programs under the Clean Water Act and the Safe Drinking Water Act that can support ecosystem services investments to protect water supplies, though these grants have only infrequently been used for these purposes. These include the Clean Water State Revolving Fund (SRF, Sec. 212), which offers loans for water quality improvements that have generally funded wastewater treatment infrastructure. However, these funds (over $1 billion, combined with another $4.7 billion in state monies) can be used to implement nonpoint source management plans and develop and implement estuary plans. Just 5 percent of projects target nonpoint source pollution mitigation. Under the Safe Drinking Water Act, State Revolving Fund loans (pegged in 2003 at $787 million in grants and $1.3 billion in loans) help fund public water system infrastructure. A third of these monies can be used for investment in water source protection that includes land acquisition.

Two examples in which states have used the land protection provisions of these loans and grants include:

- Ohio Water Restoration Sponsorship Program. Ohio's program provides significant loan rate reductions for wastewater treatment projects if the recipient uses a portion of the savings to invest in watershed protection and restoration.
- New Jersey Green Acres Program—the state adjusted its criteria to allocate CWA loan funds to give 3 times the weight to projects with a water supply protection benefit through land protections.

I have offered a thumbnail sketch of planning, mitigation, and payment policies that can potentially link ecosystem services investments with landscape-scale conservation. Though these tools have potential, to date their use to drive multi-benefit ecosystem services investments on a landscape-scale has been limited. Many ecosystem services activities, policies, and initiatives remain focused on a single benefit stream. They provide neither a framework for generating integrated, multifunctional benefits nor tools to support such integration. And few policy tools and practices require a landscape-scale, including cross-jurisdictional focus. But all of these tools, with revised emphasis and policy guidance, have statutory underpinnings consistent with a landscape-scale focus that measures performance in terms of ecosystem goods and services.