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Watershed Management: Putting EBM into Practice, Upstream from the Marine Environment

The effectiveness of watershed management has direct bearing on the scope and scale of challenges we face with marine EBM. Freshwater ecosystems that are degraded or poorly managed contribute in turn to degradation of marine ecosystems, including in the form of altered productivity and loss of ecosystem services. Freshwater systems deliver pollutants to coastal waters, changing the nature of many coastal environments and even affecting benthic and pelagic ecosystems offshore. Loss of estuarine habitats, often the result of poor watershed management, denies marine ecosystems the nursery areas needed by many marine species.

Agencies have been working to manage river basins and watersheds for a longer period of time than they have attempted to practice EBM at sea. Watershed management is much like marine EBM in that management aims to meet multiple objectives, working across large spatial scales by coordinating the actions of many communities and sectors. Understanding how watershed EBM has evolved, therefore, can be instructive on the potential for EBM in marine settings. Market-based mechanisms to enable better watershed management, for example, are cropping up to complement government-based regional management frameworks. In this issue of MEAM, we examine some of these mechanisms, and how they promote watershed EBM.

[Editor's note: For definitions of "watershed" and "river basin", please see the box at the end of this article.]

Managing for freshwater

Inland waters provide many public goods and services that would be extremely expensive or impossible to replace - drinking water, sanitation, irrigation, energy generation, transport, and others. Contemporary global withdrawal of freshwater uses 25% of continental run-off each year. However, only 15% of the global population lives in relative water abundance, and that figure will drop as population pressures mount and water-overuse threatens renewable water sources (www.millenniumassessment.org). While water demand is increasing, pollution from industry, urban centers, and agricultural runoff is limiting the amount of water available for domestic use and food production.

Managing for freshwater means managing watersheds. In addition to the human services described above, watersheds provide many ecological functions, including as habitat for often-endemic populations of freshwater species. (A new study by the World Wildlife Fund and The Nature Conservancy indicates that parts of major rivers such as the Amazon, Congo, Ganges, and Yangtze, as well as rivers and streams of the southeastern US, are outstanding for rich fish populations and high numbers of species found nowhere else - www.feow.org.) Major trade-offs have occurred among the various sorts of ecosystem services provided by inland waters, leading to substantial adverse changes in a) habitats and species and b) services, such as freshwater and food supply. Such trade-offs occur because utilizing freshwater systems for energy generation, or engineering river fragmentation (i.e., modification of a river through dams, reservoirs, interbasin transfers, and irrigation), can diminish the ability of these ecosystems to support biodiversity.

Anticipating and deciding among these trade-offs is a key element of watershed management. In the WWF/TNC study described above, 55 out of a total of 426 freshwater ecoregions worldwide were considered to be under "high stress" due to a combination of agriculture, industry, domestic water use and livestock - threatening the species and habitats these ecosystems support. This represents more than 10 percent of the world's freshwater ecoregions.

Regional cooperation to address issues of water use and allocation - as well as threats to freshwater systems originating from pollution, over-fishing, and changes in riparian landscapes - is key to managing river systems and watersheds effectively. Dann Sklarew, chief technical advisor to the International Waters Learning Exchange and Resource Network (IW:LEARN), a GEF-funded project, says management must create a sense of community and shared purpose across a watershed ecosystem.

"However, political, ethnic and economic competition over resources may involve millions or even hundreds of millions of people," says Sklarew. "The influence of external actors is not entirely under the jurisdictional control of riparian governments."

There are many examples of watershed/waterbasin management frameworks and institutions in existence around the world, including the Mekong River Commission (Vietnam, Thailand, Laos, Cambodia - www.mrcmekong.org), the International Commission for the Protection of the Danube River (14 countries - www.icpdr.org), and the drought-parched Murray/Darling Basin in Australia (involving the states of South Australia and New South Wales). However, this sort of large-scale, top-down, command-and-control form of management has its limitations without effective local involvement at much smaller scales.

Market-based mechanisms can buttress government-led management efforts and act to forge a sense of community across regions. Al Appleton, former commissioner of New York City's Department of Environmental Protection and now an international consultant on water issues, describes a project undertaken to safeguard the city's drinking water supply. New York City made an investment of US $300,000 to facilitate sustainable farming practices in the New York City watershed, enlisting the help and entrepreneurial spirit of farmers in the Catskill Mountains to implement voluntary measures to preserve water quality. These measures included establishing riparian/stream buffers on private lands, reducing fertilizer/pesticide use, and conserving wetlands that naturally filter water flowing through them. To encourage the farmers' implementation of such measures, the City offered financial incentives.

This strategy is an example of a Payment for Ecosystem Services arrangement, or PES. In the context of watershed management, PES occurs when beneficiaries of ecosystem services downstream pay fair compensation (in cash or in kind) to upstream parties who protect the ecosystems that provide such services. "New York City's PES initiative really paid off," says Appleton. "It saved the City tens of billions of dollars in water treatment costs, and it rewarded farmers financially, allowing them to maintain their traditional, small-scale farming livelihoods." The program is described in more detail in a 2002 paper by Appleton at www.forest-trends.org/documents/meetings/tokyo_2002/NYC_H2O_Ecosystem_Services.pdf.

Establishing PES markets and other incentive mechanisms can facilitate engagement at all scales, ensuring that smaller streams are conserved as well as major river systems. The May 2008 issue of Basins & Coasts, a USAID-funded publication, focused on aquatic PES around the world (www.imcafs.org/coastsheds/index.php). Among its findings:

- PES programs have been applied for integration of environmental conservation, poverty reduction, good governance, and enterprise development;
- PES schemes designed around a package of services are more likely to attract providers of services;
- Watershed level PES schemes are most successful if implemented at small scales where hydrological connections and quantifiable benefits are clear;
- Without adequate support from local communities, in terms of service users and service providers, PES schemes will likely fail;
- Watershed monitoring programs must be put in place to compare environmental and socio-economic performances before and after PES schemes are put into place;
- The most common impediment to PES schemes is a lack of clear understanding between land and water management and the desired environmental outcomes; and
- Successful programs commoditize services clearly so that service buyers are able to appreciate what they are getting for their investments.

Business interests and communities are waking up to the fact that better watershed management can mean increased ecosystem services - free and vitally important services - and reduced costs of doing business. In such PES schemes, investing in monitoring, verification, and adaptive management is critical to determining if EBM or watershed management is effective; to improving outcomes; and to raising the comfort level of the business community for investing in PES markets.

Elements of watershed management success

The public expects government to safeguard water resources. Take for instance the February 19, 2008, *Declaration of Water* of the National Constitutional Assembly of Ecuador:

> "The State should guarantee the preservation, conservation, protection, restoration, sustainable use and integrated management of watersheds, including necessary quality and quantity of ecological flows to sustain the integrity of

> all ecosystems associated with the hydrologic cycle, in order to safeguard the satisfaction of individual and collective human needs in function with societal health, including respecting the rights of nature and preserving biological diversity."

But government agencies will also have to learn to improve their evaluation of how well such cooperative management agreements are working, and be ready to respond in an adaptive manner. Government agencies often believe they are doing a better job at ecosystem management than they are perceived to be doing by stakeholders or the public at large. (See, for example, the paper "Surveying Diverse Stakeholder Groups", published in 2002 in the journal *Society & Natural Resources*. The abstract is available at www.informaworld.com/smpp/content~content=a713848024~db=all~order=page.) Cultural barriers to EBM within agencies, including resistance to change, innovation, experimentation and risk, may be common, as a recent paper evaluating the US Bureau of Land Management and the Forest Service attests (the abstract is available online at www.blackwell-synergy.com/doi/abs/10.1111/j.1523-1739.2007.00860.x).

Regional cooperation is not solely the purview of national governments and high-level agencies. The engagement of all segments of society across watersheds can be crucial. This is exemplified by a model described in the 13 March 2008 issue of *Nature*, which shows that small stream systems are important in "absorbing" pollutants and thus preventing the downstream eutrophication of coastal seas. (In this way, stream habitats may be as important as riparian buffers in mitigating the effects of run-off and preventing polluted freshwater from reaching coasts.) The study goes on to show that an entire stream network, not just individual streams, is important in removing pollution (see the abstract at www.nature.com/nature/journal/v452/n7184/abs/nature06686.html.)

Building wide participation and stakeholder involvement is easier said than done. The large and sometimes unwieldy bureaucracies in river basin-scale management can sometimes be too inflexible to reach out to stakeholders and involve them in meaningful ways. To facilitate expansion of stakeholder involvement, IW:LEARN offers training programs for increasing participation, and is developing a handbook on the subject. The handbook (currently in advanced-draft form and available at www.iwlearn.net/abt_iwlearn/events/p2) guides managers through a wide array of information: on the benefits of public participation in water management; on challenges to such participation; on choosing the best representatives of stakeholder groups; on strategic communications; and many other aspects. The draft handbook states:

> "Think of stakeholder involvement not as something to be performed separately from other project components (to raise awareness, strengthen capacity, or obtain feedback from certain stakeholders) but as an integral element of all project components and activities. Of course, this will not always be possible (or appropriate), but it is useful to think carefully about when and how stakeholder involvement could benefit project process, outcomes, and sustainability by being more thoroughly integrated into project planning and execution."

Setting relatively narrow goals that are well-understood by the public can be particularly useful. In the Murray-Darling Basin of Australia, the goal of the basin commission is first and foremost maximizing water availability and ensuring equitable access to it. Located in the south-east of Australia, the Murray-Darling Basin covers more than 1 million km^2, yet only 5% of rainfall there ends up in rivers. Wendy Craik is chief executive of the Murray-Darling Basin Commission (MDBC), which manages the basin and provides advice to a policy-making Ministerial Council. The commission has been generally viewed as a success, says Craik, despite recent years of extreme drought that has tried the ability of watershed management to meet its objectives. Part of this perceived success rests with the fact that MDBC programs are subjected to annual independent audits, which are reported to the Ministerial Council each year and made public.

"In our case, the greatest challenge to effective watershed management has been that the system under which we operate (entitlements, storage, allocations, etc.) was largely developed during a relatively wet period (1960s-1990s) and we now are in a very dry period," says Craik. "We need to modify our system to take into account climate change factors." Work through the MDBC is underway to do this. It is politically sensitive, however: irrigators will lose entitlements and allocations as a result of (a) lower water availability and (b) increased allotment of water for environmental purposes. Farmers are being encouraged to replace water-hungry crops like cotton and rice with other crops.

"This challenge is being met in a number of ways," says Craik. "First we, at MDBC, have developed a highly detailed yet flexible strategy, called 'Risks to Shared Water Resources' (www.mdbc.gov.au/nrm/risks_to_shared_water_resources_previous). On top of that, negotiations have been underway to turn the interjurisdictional MDBC into a Commonwealth authority." At present, MDBC is in an institutional limbo: it is neither a proper national authority nor single-state authority. Operating under a single jurisdiction, says Craik, would allow the MDBC to make hard decisions alone if necessary.

She cites progress in other areas. "The MDBC has recovered a large proportion of water toward its targets for six 'environmental icon' sites along the Murray," she says. "It has also constructed new fishways to ensure uninterrupted passage

from the mouth to Hume Dam (2000 km away)." In addition, the commission has begun a AU $300-milion program of construction to improve infrastructure for water management and delivery.

Craik and the MDBC recognize the importance of broad participation, both in meeting goals and in building awareness of program effectiveness. Craik emphasizes the importance of the Murray-Darling Initiative's Community Advisory Committee, a multistakeholder group that advises the Ministerial Council from a community viewpoint. She notes, however, that the States see working with the constituents as primarily their role, not the MDBC's.

Finally, establishing frameworks for cooperation and management do not guarantee success. The litmus test for success is whether such frameworks are leading to demonstrable positive outcomes on the ground. Compromises between targeting entire river basins, and working at a scale where communication and cooperation is easier, will have to be made. Governance arrangements, and the right mix of government-led regulatory policy, community-driven management, and development of markets, will have to be tailored for the socio-political circumstances of each particular watershed. As stated by Al Appleton, "Frameworks and incentive structures, if done right, are ways to avoid failure - but they do not guarantee success. To put it another way, good strategy is never improvised, but good tactics always are."

Summary of lessons learned

- Regional frameworks for cooperation are needed, particularly in international river basins. These frameworks must be matched by actual management on the ground, at smaller watershed scales in which the benefits of EBM are clearly recognized by upstream and downstream users.
- Clearly articulated goals should influence the scope and type of management required; strategies to achieve goals should dictate institutional structure, not vice versa.
- Creating a sense of community throughout the watershed is an important, though difficult, challenge. Governance operating at all scales and in synergy can facilitate meaningful involvement of communities, industry, and individuals.
- Market-based measures and incentive mechanisms, such as PES markets, can help create this sense of community and provide badly needed funds for sustainable water and land use.
- Agencies that are open to criticism and that actively seek evaluation and respond to criticisms are not only more likely to succeed in management, but are also more likely to be perceived as successful.

For more information

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BOX: Watersheds and river basins

In this issue of MEAM, the terms *watershed*, *river basin*, and *drainage basin* are used interchangeably. The terms refer to an area of land where water from rain or snow drains downhill to a body of water. This geographic area includes both the streams and rivers that convey the water as well as the land surface from which water drains to those channels.

Watersheds can be small or large: technically, each stream has its own upland watershed. By extension, the watershed for a large river consists of the watersheds for all its feeder streams. Note: outside of North America, the term *watershed* often refers to the divide that separates one drainage basin from another.

Like marine EBM, the management of watersheds consists of spatially bounded, regional initiatives. In general, watershed management oversees the land, vegetation and water resources of a drainage basin in accordance with predetermined objectives, such as conservation and sustainable development. Again, like marine EBM, it is often conceptualized as a holistic, integrated way of managing resources.
