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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.

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.

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

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EDITOR
Tundi Agardy, Ph.D.

PROJECT SUPERVISOR
John B. Davis

CORRESPONDENCE:
MEAM
School of Marine Affairs
University of Washington
3707 Brooklyn Ave. N.E.
Seattle, WA 98105, U.S.
meam@u.washington.edu
Tel: +1 206 685 1582

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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 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 Catskills 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 also 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;
- 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 thus 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 is important in removing pollution from stream water, not just individual streams (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.

For more information

Al Appleton, New York City, NY, US. E-mail: appletons5@aol.com

Wendy Craik, Murray-Darling Basin Commission, Canberra, Australia. E-mail: wendy.craik@mdbc.gov.au

Dann Sklarew, IW:LEARN, Washington, DC, US. E-mail: dann@iwlearn.org

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.

The EBM Toolbox

Models for watershed EBM

Editor's note: The goal of The EBM Toolbox is to promote awareness of software tools for facilitating EBM processes, and to provide advice on using those tools effectively. It is brought to you by the EBM Tools Network (www.ebmtools.org), a voluntary alliance of leading tool users, developers, and training providers.

By Sarah Carr

Many pollutants to the marine environment, particularly excess nutrients and sediments, come from terrestrial sources. Effective watershed management is therefore critical to marine EBM, and watershed models are an essential part of the EBM toolkit. Watershed models use factors such as rainfall, land cover, soil type, impervious surface coverage, and slope to predict runoff from watersheds into bodies of water. When coupled with marine ecosystem models, watershed models can help predict how changes in land use (such as urban growth and conversion of agricultural lands) and pollution management (such as improved sewage treatment and fertilizer application) will affect marine ecosystems.

Tools that help predict these types of impacts range from relatively simple to quite complex. A few examples of available watershed models include:

• **Impervious Surface Analysis Tool (ISAT)** — Estimates the percentage of impervious surface and, from this, water quality in a user-defined area (www.csc.noaa.gov/crs/cwq/isat.html).

• **Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT)** — Estimates runoff, pollutant, and sediment loads from a user-defined area and can compare pollutant concentrations in receiving waters to water quality standards (www.csc.noaa.gov/crs/cwq/nspect.html).

• **Chesapeake Bay Watershed Model** (a customized regional model based on the general Hydrologic Simulation Program Fortran [HSPF] watershed model) — Estimates runoff, pollutant, and sediment loads to the Bay through comprehensive simulations of relevant hydrologic and nutrient cycles (www.chesapeakebay.net/modeling.aspx). It is linked to an estuary model for the Bay. Together, these models have been used to set limits on nutrient input into the Bay, track nutrient loads, and determine how further reductions in nutrient and sediment loads would affect Bay water quality.

Resources for learning about other useful watershed models are:

• "Using GIS Tools to Link Land Use Decisions to Water Resource Protection" — a brief by the National Association of Counties, at www.naco.org

• EPA's Watershed and Water Quality Modeling Technical Support Center — www.epa.gov/athens/wwqtsc/html/watershed_models.html.

(Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at www.ebmtools.org. Sign up for Network updates and contact Sarah at www.ebmtools.org/contact.)

Case Study: Watershed Management in the World's Most International River

The Danube River Basin covers parts of 19 countries in Europe, making it the world's most international river basin. In size it is also noteworthy: with a total area of 801,463 km², it is Europe's second largest river basin. The ecosystems of the Danube River Basin — and, by extension, the Black Sea, into which the Danube drains — are highly valuable in environmental, economic, historical and social terms. But they are also subject to increasing pressure and significant pollution from agriculture, industry and cities. Managing such a large region while meeting the needs of the 81 million people who reside there is an enormous challenge.

Recognizing the great importance of the freshwater ecosystem to the inhabitants of the basin and their national economies, the riparian countries of the Danube Basin agreed to manage the watershed cooperatively. The International Commission for the Protection of the Danube River (ICPDR — www.icpdr.org) was established in 1998 to implement the Danube River Protection Convention. The goals of the Convention are:

- Safeguarding the Danube's water resources for future generations;
- Maintaining naturally balanced waters free from excess nutrients;
- Reducing risk from toxic chemicals;
- Restoring river systems to health and use them sustainably; and
- Allowing damage-free floods.

There are significant water management issues in the Danube Basin District that persist to this day. For surface waters, the major issues are pollution (from organic substances, nutrients, and hazardous materials) and alterations to the basin's hydromorphology — i.e., the shape, boundaries, and content of its rivers and other surface water bodies. In addition, there are transboundary groundwater issues relating to alterations in quality and quantity.

Philip Weller, executive secretary of the ICPDR, says the greatest challenge the Commission has faced is establishing effective mechanisms for cooperation. "Key elements are now in place: a legal framework for cooperation, a functioning Commission, and political commitment from all the countries," he says. "These efforts have been strengthened by the adoption in December 2000 of the Water Framework Directive (WFD) of the European Union. The WFD requires all EU surface inland, transitional and coastal waters, and groundwaters to reach 'good status' or 'good ecological potential' by 2015. This is achieved by meeting demanding environmental objectives, especially ecological and chemical targets."

In response, the countries cooperating under the Danube River Protection Convention, including those outside the EU, agreed to implement the WFD throughout the entire Danube River Basin district. The WFD has required the completion of a Danube River Basin Management Plan (DRBMP) and its Joint Programme of Measures by 2009 (see www.icpdr.org).

A new document by the ICPDR, "Significant Water Management Issues in the Danube River Basin District", guides the Commission and Danube countries in general in preparing the full management plan. It highlights management issues for surface waters and transboundary groundwater, and applies to each issue an accompanying vision and management objectives, to be achieved by 2015.

Other issues, such as changes in water quantity (e.g., floods and droughts), climate change and sediment transport, are also being investigated. Another important goal for the DRBMP is to inter-link flood management and flood protection, with the measures to achieve the WFD objectives.

The Danube. The Danube River starts in southern Germany and flows through or along the border of nine other countries — Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Moldova, and Ukraine — before draining to the Black Sea. (On this map, the Danube is the line that links the capital cities of Vienna, Bratislava, Budapest, and Belgrade.) The Danube River Basin also includes parts of Italy, Poland, Switzerland, Czech Republic, Slovenia, Bosnia and Herzegovina, Montenegro, Republic of Macedonia, and Albania.

Weller says cooperative management at all levels will be necessary for these efforts to work. "While effective watershed management requires that the overall framework involve the governments of the countries with territory in that basin, there has to be a way to ensure that at other levels the actions are taken that really make a difference," he says. "In our case, the senior governmental officials are responsible to the convention but they have ways of involving local communities and officials of municipalities, etc."

ICPDR recognizes that the private sector needs to be involved, too: changes in corporate practice are essential to achieve progress in meeting the obligations and activities under the Danube River Protection Convention. The Commission has put forward "Guidelines for Cooperation with Business" to drive its interaction with the private sector. These interactions include creating positive actions at the local level (such as joint actions on public events and river clean-up campaigns) and harnessing the marketing strengths of the business sector to further river basin-wide management goals. For example, ICPDR has worked with Coca-Cola to promote public awareness through "Danube Day Celebrations" and support conservation projects in countries in which The Coca-Cola Company and Coca Cola Hellenic Bottling Company have substantial operations and business presence. Similarly, Alcoa, the world's leading producer of primary and fabricated aluminum, provides substantial support for pollution monitoring work in transboundary areas under the new Business Friends of the Danube Program, just launched by ICPDR.

The most substantial progress on the ground occurs at smaller scales, such as in the ICPDR's sub-program in the Tisza watershed, the largest tributary to the Danube. The Tisza River drains an area of 157,186 km² in five countries (Slovakia, Ukraine, Hungary, Romania, Serbia and Montenegro). These countries agreed on a system of close transboundary co-operation, aiming to achieve integrated management of the Tisza River Basin. The Tisza deserves mention in a discussion of watershed management, because of interesting local-level market-based initiatives taking place there.

International consultant Al Appleton has played an advisory role in the Tisza program. "The key to its success is channeling local self-interest into a mutual problem-solving mode, and being goal-oriented," says Appleton. "This gives you another asset: you don't have to create local leadership. Instead, local leaders who see opportunity come out of the woodwork to explore working with you." He says that while other river management programs are often hobbled by planning that doesn't translate to effective management on the ground, Tisza has been different. "[The Tisza program] has tapped into local energy and creativity," he says.

In a region as large as the Danube watershed, there must be overarching visions and goals, but those general goals have to be supported by specific actions and activities at national and local levels. Weller says the ICPDR is operating at all levels, but feels it is best for the ICPDR to avoid dictating specific projects on the ground. "We have achieved a great deal under our circumstances by providing leadership and support for change," he says. "We have not dictated actions but demonstrated the need for specific actions and left it to the countries to ensure that those actions happen. The legal requirements of the EU Water Framework Directive, which guides European water policy (http://ec.europa.eu/environment/water/water-framework/index_en.html), have helped force action, and provided funding, in those countries that are part of the EU."

For more information

Philip Weller, ICPDR, Vienna, Austria. E-mail: icpdr@unvienna.org

Notes & News

Massachusetts passes ocean law

In May 2008, the US state of Massachusetts passed a law that lays the groundwork for a comprehensive plan to manage the state's coastal waters. Intended to balance natural resource preservation with traditional and new uses, the law is the US's first state-level management legislation covering all marine areas under state jurisdiction. The new law requires that the state draft a management plan for its waters by the end of 2009. Although the law does not specifically call for ecosystem-based management, it requires the state to "value biodiversity and ecosystem health" and "respect the interdependence of ecosystems" in its planning. The Massachusetts Oceans Act of 2008 is available online at www.mass.gov/legis/laws/seslaw08/sl080114.htm.

Essays on ocean governance

A new book by the Regional Programme on Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) provides 25 essays on global and regional ocean governance. The 770-page book *Securing the Oceans* costs US $56, and is available at www.pemsea.org/about-pemsea/pemsea-news/securing-the-oceans-essays-on-ocean-governance-published-jointly-by-pemsea-and-nippon-foundation.

Book describes collaborative coastal management in Tanzania

A new book published by IUCN, the Government of Tanzania, and Irish Aid offers lessons learned from a 12-year effort to apply coastal resource management in the Tanga region of northern Tanzania. The book describes the ongoing Tanga Coastal Zone Conservation and Development Programme (TCZCDP), and places particular emphasis on the use of adaptive management techniques. TCZCDP aims to improve the ecological integrity of the region's coastal zone while also providing for sustainable development of coastal populations. The 176-page book *Putting Adaptive Management into Practice: Collaborative Coastal Management in Tanga, Northern Tanzania* is available in hard copy from the IUCN Eastern Africa Regional Office at earo@iucn.org.

Perspective: A Bird's Eye View of the Chesapeake

By Al Appleton

Seen from afar, the quest to clean up Chesapeake Bay seems a bit tattered about the edges. After four decades of highly publicized, highly praised effort, and of meaningful accomplishment in many measures of water quality, the music emanating around Chesapeake sings not of triumph but of frustration. The Chesapeake Bay Foundation, for instance, has consistently given the Bay's recovery failing grades for lack of progress on habitat restoration, improvements in fisheries, and mitigation of the nutrient overloading problem.

Why is the Bay stuck -- and in some instances even getting worse? After 40 years don't we, and shouldn't we, know everything we need to know about Chesapeake? Shouldn't we understand by this time exactly what we want to do? And if we say the problem is money, why don't we have it? If we do know what to do, then nothing should be easier to get than funding to do it, for when success is certain, the political system will make a stampede to the podium. Moreover, Chesapeake advocates take great and justifiable pride in the demonstrated willingness of Chesapeake area citizens to support the cleanup of the Bay.

A successful strategy has the following components: a clear goal, an equally clear statement of what must be done to achieve it, a straightforward statement of how you are going to do that, and an appealing picture of all the good things that will happen when you do so.

When the Chesapeake effort began, it created crackling excitement with a vision of America's greatest estuary restored…of an abundance of beautiful swimmers…of vast flats of wetland grasses swaying with the tides…of skies full of waterfowl…of an Eastern shore mellow with historic communities, revitalized by carefully scaled new development, and spurred by restored nature and natural beauty…of a watershed of 16 million people sharing a new environmental ethic of harmony with the Bay.

Some parts of that vision have come true. The public loves Chesapeake and has made it the backdrop for an enormous boom in gracious outdoor living, one reveling in scenic splendor and outdoor recreation. The achievements of Chesapeake have been sufficient to spur an enormous transformation in the way humans use the Chesapeake coastal zone, both on the water in terms of boating oriented recreation, and off, in terms of crisp new housing and community centers development that happily try, not always successfully, to honor the Bay's historic traditions.

But that transformation has not led to the unified watershed ethic originally dreamed of. Instead, if anything,

Background on Chesapeake Bay

- **Chesapeake Bay:** The largest estuary in the US.
- **Chesapeake Bay watershed:** Includes parts of six states — Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia — as well as the District of Columbia.
- **Population of watershed:** More than 16 million people.
- **Greatest challenge:** Nutrient pollution, which fuels algae blooms and eutrophication in the Bay; the primary source is agricultural fertilizers and waste.
- **Other stressors:** Chemical contaminants, habitat loss, erosion, and overharvesting of the Bay's fisheries resources, most notably oysters, blue crabs, shad, and menhaden.
- **Chesapeake Bay Program:** Formed in the 1970s, a regional partnership of federal and state authorities and citizens' groups. Goals include to improve water quality, restore habitat, and manage fisheries.
- **Current condition:** Despite decades of work to protect and restore the Bay, its health remains poor: runoff continues to be a problem, dead zones are expanding in some areas, and fisheries have not recovered.

Websites

Chesapeake Bay Program
www.chesapeakebay.net

Maps of the Chesapeake Bay watershed
www.chesapeakebay.net/maps.aspx?menuitem=16825

Chesapeake Bay Foundation
www.cbf.org

Chesapeake Program, US Environmental Protection Agency
www.epa.gov/region3/chesapeake

Alliance for the Chesapeake Bay
www.alliancechesbay.org/pubs.cfm

Chesapeake Bay Commission
www.chesbay.state.va.us/history.html

Chesapeake Research Consortium
www.chesapeake.org

Editor's note

The link between watershed management and marine EBM is no better exemplified than in the case of Chesapeake Bay, on the east coast of the US. Significant efforts to improve the health of the Chesapeake over several decades have focused largely on reducing upstream pollution. So far, however, those efforts have been unsuccessful in returning the bay to good health (see box).

This essay by Al Appleton examines the challenges of watershed management and how efforts to restore Chesapeake Bay could be improved. Appleton is an independent environmental consultant who has advised on water management worldwide, including in the US, Hungary, the Dominican Republic, Shanghai, and the Northern Andes.

it has not only created new stresses on resources like wetlands and stream corridors, but has also heightened tensions with upstream agricultural users. It should not be forgotten that the Pennsylvania farm landscape is also an equally beloved landscape, and an equally historic one — even if the usage of nitrogen fertilizers it currently depends on for its economic viability is far removed from the traditional agricultural and community ethics upon which its fame rests. But then again, the Chesapeake of second homes and leisure living is also far removed from the world of watermen that gives Chesapeake much of its mythic quality.

There is another way that Chesapeake has failed to achieve the original vision of a unified watershed ethic. Bay cleanup and watershed management is now an organizational and institutional lattice of initiatives and relationships, of regulations and market methods each responding to its own imperatives, each elbowing for space and priority.

Where all this has led in 2008 is an environmental agenda that has become largely focused on nutrient control. Where one once read in the Chesapeake literature about what were essentially ecosystem goals, now one increasingly reads about nutrients, about how loading reductions have not been matched by water quality improvements, about the next scheme to nudge nutrient loadings down further, about how many pounds of loading the target is. This is as if in a 64,000 square mile watershed, one could specify the poundage of one of the most dynamic chemical components of life with the precision of a master carpenter. In 2002, an unusually wet year, nutrient runoff into the Bay tripled, a result that essentially knocks into a cocked hat all the attempts to define nutrient loadings by an annual discharge or even average figure, and suggests that there needs to be a lot more ecologically dynamic understanding of these loadings and how to address them.

From a public policy manager's point of view, restoring Chesapeake now means reconciling five worlds: the new coastal zone exurban world (prosperous rural communities that serve as commuter towns to urban areas); the remnants of the old Bay user world; the long time urban centers world; the upstream agriculture world; and the regulatory, institutional civic world.

Is it this multiplicity of world views that makes finding a nutrient solution so hard? On paper, nothing could be easier than solving the nutrient problem: just say no. But the problem is that current nutrient uses are intrinsic to several of those worlds, while the tools of the Clean Water institutional world have so far shown themselves to be unable to manage such a task. Moreover, the equities between these various worlds are complicated, much more complicated than the mutual "good guy vs. villain" discussions of normal political discourse. And even though this is clearly recognized by the insiders, that recognition has yet to translate into a real attempt to sort out differences and create a new story about the Bay and its watershed, one that all five worlds can live with.

So the essential question for watershed management is, how would one build those bridges between these worlds? However important reducing nutrients is, it is essentially reductionist, in that it is addressing only one element of intertwined social, ecological and economic systems. In an era of sustainability, we know enough to wonder about such an approach. We also know enough by now to realize that nutrient removal as a concept has little ability in itself to excite or energize the public.

Return to an ecosystem approach

So three things suggest themselves to a Chesapeake outsider like myself. First, one needs to go back to an ecosystem approach to agenda setting, but an ecosystem approach that looks not only at the Bay but at the entire watershed. Making agriculture more sustainable has huge ecological values, not just from a pollution perspective but also from a landscape and biodiversity one, as well as preserving agricultural communities. Worldwide the experience is the same: long-term, the more the tools of industrial agriculture are used, the more agricultural community and landscapes are undermined.

Second, the promise of sustainability — that doing right for the environment will do right for the economy and vice versa — needs to be more aggressively explored and made front and center. Getting the landscape and watershed economics right offers an enormous fund of wealth. This can be organized to provide the hard cash that implementing an ecosystem strategy for the entire water would need. These funds could be collected in ways that address some of the underlying ambiguities of the Chesapeake — such as upstream investment which, despite its benefits for local waters as well, is generating an enormous amount of wealth for downstream users. This wealth should rightfully be shared.

Finally, it is idle to pretend that institutional structures do not matter. After 40 years and all the justified pride in the innovations to environmental management the Chesapeake effort has created, it would nevertheless seem to be time to ask whether the tools are still right for the problems. It is often a fatal flaw of American public management to design the process first and then seek to fit the problem into its framework. Instead, strategy should decide what needs to be done and what tools are needed to do it, shaping the institution to the task.

It is an old saying that if you will an end, you must will the means. Even if nutrient reduction is the right focus, could it be said about Chesapeake that for such an end we have willed the means? And if the goal is the restoration of Chesapeake ecosystems and watersheds in all their splendor, what would we conclude if we asked the same question?

In our next issue: ocean zoning

The next issue of MEAM will look at marine spatial planning, with a particular focus on ocean zoning. We'll examine how the concept of zoning overlaps with that of marine EBM, as well as how they differ from each other.

Do you have examples of ocean zoning in practice, including successes or failures? If so, please let us know about them at editor@meam.net. Thank you — we look forward to hearing from you.