Tending the Rivers

An Interview with David Allan and Brian Richter

AP/WWP Photo by Bill Haber

The Mississippi River, shown here near New Orleans, Louisiana, is a trade route and recreational venue. The river provides habitat for diverse species of fish and wildlife and supports the largest continuous system of wetlands in North America.

Human life, health, and well-being depend upon clean, fresh water. So, why have we done so much to abuse the freshwater sources that we rely upon for our survival? Rivers and streams that bring us fresh water have been used as dumping grounds for waste, diverted from their natural courses, and drained for the exclusive use of only a few. The past couple of decades have brought a new level of understanding about the detrimental effects of these actions and stronger resolve to use water resources in a manner that can meet the needs of all users while preserving the ecosystems that surround them.

Two professionals in this field discussed these trends with Global Issues *managing editor Charlene Porter. Brian Richter is the director of Freshwater Initiative, a project of the environmental nongovernmental organization The Nature Conservancy and co-author of* Rivers for Life. *David Allan is a professor of conservation biology and ecosystem management at the University of Michigan and co-author of* Streams: Their Ecology and Life.

Question: Mr. Richter, in your 2003 book, *Rivers for Life,* you and co-author Sandra Postel called for a new mindset that would make preservation of ecosystem health an explicit goal of water development and management. To what degree is that idea taking hold today in the United States?

Richter: Interestingly, the development within the United States is a little bit slower, from my perspective, than it is in some other countries. It's an odd coincidence too because the United States began to address these issues in earnest in the late 1960s as national environmental legislation was being passed. Scientists, decision makers, and regulators in the United States started grappling with a lot of these issues then, but the thinking in the scientific community on water quantity management was at a different point at that time than it is now.

Q: In what respect?

Richter: At that time, river ecologists had a fairly broad, general understanding of the importance of hydrologic variability—the changes in river flows and the influences that those changes would have on plants and animals and the overall ecosystem. Regulators were tapping that knowledge to make regulatory decisions, and they moved toward an approach where they generally said the most critical thing is how low the river gets during a dry time of the year or during a drought period. What we saw develop in the United States was a strong orientation toward the question: "What is the minimum in-stream flow level needed to keep the plants and animals in this river in good shape?" We stayed stuck in that focus for the better part of three decades, and it wasn't until the early 1990s that you started to see some differences of opinion and concerns that we needed to pay attention to more than just the minimum stream-flow level. We needed to address the important role that higher river flows—and even floods—play in sustaining the diversity and proper functioning of a river ecosystem. It has been difficult to get water managers and dam operators to understand that some level of flooding needs to be maintained for river health.

Q: Professor Allan, ecosystem management is your specialty. How has the scientific thinking evolved over time?

Allan: Brian put it exactly right. For a very long time the issue was minimum flows. How low could the water levels go? How low could water quality go? What was the minimum standard based on dissolved oxygen [microscopic bubbles of oxygen gas in the water that are essential for aquatic life] which would respond to organic waste loading? Generally, it was a minimum approach toward protecting the environment and a maximum emphasis on making use of that resource.

What the field of ecosystem management brings to the table today is the recognition that our waters offer many benefits that we might have thought of as being intangible benefits, but they're looking more and more tangible all the time.

These benefits only come from healthy ecosystems. Water problems risk the health of fish populations, for instance, or the water purification capacity of the aquatic ecosystem; or the health of the riparian ecosystem, the streamside vegetation and trees that live along the stream and have roots in the shallow ground water. We've seen all those ecological consequences become more and more apparent, and that's leading us increasingly toward thinking of how to preserve those benefits.

So we're realizing the ecosystem is being harmed and that is coming back on us in diminished services [ecosystem services are processes by which the environment produces clean water and air, timber, fish habitats, and plant pollination], which increasingly we can start to value in dollars.

Q: Mr. Richter, you began the discussion saying that some countries may be moving ahead of the United States in developing a holistic approach to managing watersheds and river systems. Expand on that point.

Richter: In the United States, we began heavily developing our water resources and building dams during the 1950s and 1960s, and we began seeing environmental problems—such as the loss of species or reductions in fish populations—soon thereafter. Other countries were slower to develop their water resources. When problems began to develop in their countries in the 1980s and 1990s, their scientists looked around the world to see how other countries and other scientists were dealing with similar problems, how the knowledge base developed over the decades. They ended up fashioning some fundamentally different approaches to the questions that are critical to balanced management of the resource: How much water does the river need? How much of the natural variability in water flows is necessary to sustain the societal benefits that we derive from healthy ecosystems?

In *Rivers for Life*, we highlight advances that were made in places like South Africa, Australia, and some European countries. The scientists are taking a fresh look at how to address these questions. Working with the regulators, decision makers, and water planners, these countries have been developing approaches that better address modern-day interests.

The United States ended up with a legacy of environmental legislation that was developed some decades ago, and it's proven to be more difficult in some respects to modify the legislation and regulatory approaches than it has been in countries that dealt with the issues as fresh cloth. These countries have, in essence, from a policy or regulatory standpoint, leapfrogged ahead of the United States in my perspective.

Q: The legislation you're talking about is the Clean Water Act, passed in the United States in the 1970s, which brought significant progress in calling for wastewater treatment and discharge regulation, and ended by and large the discharge of raw sewage and waste into our waterways. Professor Allan, has the Clean Water Act done what we wanted it to do?

Allan: The Clean Water Act has done a lot for us. I agree with Brian's point that a lot of our water law dates back to the 1970s. In fact, other water law goes back even further, to the Wild West era in the United States.

But the Clean Water Act certainly did good things for us. It instituted a whole lot of wastewater treatment at the secondary level; it definitely made water cleaner; and it brought language into the law about the physical, chemical, and biological integrity of freshwaters that gradually through the 1980s and 1990s led to the establishment of a panoply of biological assessment approaches that are now widely used by the states to assess the ecological health of freshwaters. The Clean Water Act continues to guide that activity, I think, in a very effective way.

But then we come up against new problems and we don't have anything to guide us. Here in the Great Lakes[1] region we're wrestling with the issue of water export. It isn't clear what laws and regulations could or should prevent export of Great Lakes water out of the basin or outside the boundaries of states that ring the basin. Tankers full of fresh water heading for Asia from the Great Lakes—who would have predicted that? So we're scrambling to find the appropriate response and the appropriate tools with which to structure a response.

Q: Certainly in that situation many competing interests need to be satisfied—national governments, states, local governments, scientists, and environmentalists. Trying to

make the right decision about the resource becomes that much more difficult when so many people and groups have an interest.

Richter: Yes. It's important to understand that it is challenging for policy, decision making, and planning to stay perfectly in step with the advancement of scientific knowledge. They're always going to lag behind scientific advancement. That's a universal challenge, and some countries do a better job of translating science into policy and law than others do. All around the world, systems, laws, and practices for managing water have been developed, based on levels of understanding at some time in the past.

So we have to view water-resources management as always being in a very, very long transition, dating back thousands of years to when some of the first irrigation works and dams were constructed in China. Against that long history, we see countries coming into different phases or different eras of water management, water development decision making, and some do a better job of capturing the changing societal values of our modern times than others.

As a scientist who has to work with policy decision makers, I think certain modes of decision making seem to facilitate the translation of science more easily and more quickly into policy, legislation, and planning than others. For instance, some countries provide opportunities for active engagement of their populace to express their values and interests in a safe and constructive environment where other stakeholders and interests can hear them. Those countries seem to foster more rapid and successful evolution in policy and decision making.

Q: On the theme of setting standards, making choices with the best available information, Professor Allan, you recently wrote an article in the *Journal of Applied Ecology* suggesting that river restoration schemes should aim to move a river toward the least degraded and most ecologically dynamic state possible. Is identifying that target as simple as it sounds?

Allan: I agree that's an ambitious goal, but we do have a lot of science that can help guide us in these directions. The emphasis is on moving in the right direction, toward a healthy, dynamic system.

A great deal of knowledge has been gained through scientific research about how to make a system healthier and more sustainable, and a great deal of knowledge has been gained through practice and implementation. The various goals we put forward in that article—the five-step plan for ecologically healthy rivers and for judging the success of restoration efforts—are appraised in a fairly qualitative way.[2] We can determine with reasonable confidence that this action will move the system more in the direction we expect it to be, which could be based on reference conditions, comparisons to other healthy rivers in the area, or experience with similar systems. We generally know when we're moving in the right direction and when we're not. Articulating key aspects of the right direction is what we tried to do in that paper.

NASA

A satellite image of North America's Great Lakes, from left to right: Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario.

Q: Let me play devil's advocate with you for a moment. Mr. Richter mentioned the long history in water management, and certainly there were times along the way when people decided, "Let's build this dam. That's a great idea." Or they said, "Let's build these levees and contain this river and prevent flooding." Decades pass, and it turns out these weren't such great ideas for the ecosystems. Knowing the history, what degree of confidence do you have that you are making the right calls now?

Allan: Well, that's a fair position to take and a very hard one to defend against. There is the risk that the arrogance of the current generation will lead to the conviction that, "We know how to do things right. We won't make mistakes. They made mistakes in the 1950s and 1960s but we're smarter now." I take that as a fair admonition, but we have a better chance today for moving in the right direction rather than the wrong direction. Common sense, along with scientific knowledge, is a useful guide to sensible management decisions.

Richter: It goes back to the definition of sustainability that came out of the Brundtland Commission some years ago.[3]

They put a lot of emphasis on not reducing or negating the possibilities for future generations. That's a wise standard for us to keep in mind. A lot of changes to water resources and freshwater ecosystems in the past are now very, very difficult to reverse in our generation.

Some development decisions that we make will foreclose options for future generations, and we always need to be mindful of that. That being said, societies in different parts of the world will have different imperatives. I just spent a couple of eye-opening weeks in Western China, where there's a lot of discussion about constructing new hydroelectric power dams. The motivation is their interest in providing electricity to the remote villages of Western China. They see that as being a very important aspect of poverty alleviation and improving the quality of the lives of citizens in that part of the country.

These questions are very challenging from a societal standpoint, but to exercise the precautionary principle to the extent that we can and to be careful about not foreclosing on the options of future generations is something we should bear in mind.

Allan: We live in a rapidly changing world. I teach a course this semester on global environmental change, and we go through the litany of things that have changed dramatically since 1950. People were much less concerned about limits at that time. Dams were being built, cities were expanding, water extraction was expanding, and there are still today many people who view resources as essentially without limit and for the use of the present generation. So it is a remarkable transition to be arguing today for limits and ecosystem rights and the resource needs of future generations. These are fairly major transitions of quite recent time.

Echoing the point Brian made, social priorities are going to play out differently in different places based on immediate needs. I spent time in rural Venezuela in the late 1990s and realized that 80 to 90 percent of their electricity was hydroelectric. If you didn't like dams, it meant you didn't want the electricity to have medicine in hospitals—you didn't have any refrigeration. Some fundamental human needs are going to dominate the dialogue in other parts of the world, but it's only recently that we have come up with this notion of being farsighted. We're still struggling with what it means to choose between future opportunities and present-day opportunities. Those are very hard to trade off.

Richter: I'm optimistic because two things have changed fairly substantially in recent decades. One is largely a scientific or technical capability to be able to understand and communicate what you're trading off when you make these development decisions. David mentioned earlier that one example of a very important ecosystem service might be the sustenance of healthy fisheries. In a lot of the developing world, populations are quite dependent at a subsistence level upon having access to fish. Fish protein is a very important part of their diets. And we now are able to foresee and to some limited degree predict what the likely changes will be in things like fisheries. Society can weigh a loss in fisheries capacity with the development of energy availability or flood control. We're able to create a much better-informed decision table. That gives me a lot of hope.

The second area that gives me hope is that governments are increasingly moving toward more transparent and inclusive models of decision making. A lot of these decisions used to be made fairly unilaterally by central bureaucracies or a limited number of individuals within a country's water or energy agency, or by the private sector purely for economic considerations. That decision-making process is now beginning to open up and be more receptive to input from other interest groups and stakeholders with an array of values.

Q: Professor Allan, do you have a hopeful note to close?

Allan: The knowledge that ecosystems provide services that are of such great value is only now becoming appreciated, even in this country. Just to mention the valuable uses of fresh water is breathtaking if you run down the list—the water we have for drinking, for domestic use, for agriculture and industry, for employment, and to support healthy fish populations that are an important source of protein, and so on. Healthy ecosystems aid flood control and water purification. There are cultural values in recreation and in the sense of increased well-being that many people feel when visiting a park, a nature reserve, or a river's edge. The water cycle feeds back into the condition of vegetation on land and the ability to maintain healthy forests.

As you start to get a better appreciation of all the reasons that these systems are important to us, you see that healthy ecosystems and healthy human populations go hand in hand. ■

(1) The five Great Lakes on the border between Canada and the United States hold about one-fifth of the world's fresh surface water supply, providing drinking water to almost 33 million people.

(2) Palmer, M.A., E.S. Bernhardt, J.D. Allan, et al. 2005. "Standards for ecologically successful river restoration." *Journal of Applied Ecology* 42:208-217.

(3) The Brundtland Report, also known as *Our Common Future,* influenced the worldview regarding the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. An international group of politicians, civil servants, and experts on the environment and development, chaired by Dr. Gro Harlem Brundtland of Norway, defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This statement has become a core principle in the field of sustainable development.

The opinions expressed in this interview do not necessarily reflect the views or policies of the U.S. government.