Water for life

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The phrase "water scarcity" now seems to roll off the tongues of corporate executives as often as it does those of environmental leaders. At the recent World Economic Forum in Davos, Switzerland, several captains of industry spoke fervently about the many challenges posed by water scarcity, while a Forum report warned of "water bankruptcy" and that "we simply cannot manage water in the future as we have in the past, or the economic web will collapse".

On the one hand, this is a good sign. Wider recognition that water constraints pose serious risks to food production, economic growth, and political stability the world over is the first step toward tackling these game-changing challenges. On the other hand, there is little evidence that decision makers have absorbed the most important lesson of 20th-century water management: water strategies that ignore the health of freshwater ecosystems offer short-term benefits at best, often end up costing more than they are worth, and severely compromise the prospects of future generations.

To date, the benefits of water development – dams, reservoirs, levees, river diversions, and groundwater wells – have largely been measured in metrics such as additional hectares irrigated, kilowatt-hours generated, cities safeguarded from floods, and populations supplied with drinking water. These gains have undoubtedly raised living standards and fueled economic prosperity for large segments of the human population. However, we have failed, nearly across the board, to measure the true costs of this infrastructure development – in particular, the lost goods and services due to the serious and steady decline in the health of freshwater ecosystems.

Consider *these* metrics. An estimated 25–55% of the world's wetlands have been drained, 35% of global river flows are now intercepted by large dams and reservoirs, and more than 100 billion tons of nutrient-rich sediment that would otherwise have replenished river channels, deltas, and coastal zones instead sit trapped in reservoirs. Some 60% of the 227 largest rivers in the world – and a much higher percentage of those in Europe, Japan, and the US – have been fragmented by dams, diversions, and levees. Rather than flowing to the natural rhythms of the hydrologic cycle, these rivers are turned on and off like plumbing works, eliminating the natural flow patterns and habitats upon which myriad life forms depend.

The economic costs of these lost ecological services, though untallied, are high and increasing. Scientists participating in the 2005 Millennium Ecosystem Assessment, estimated that wetlands alone provide water purification, flood mitigation, and other services worth US$200–940 billion per year. On a smaller scale, the water department in Kansas City, MO, has spent $4 million to improve its drinking water intake from the Missouri River. Why? The trapping of sediment by upstream dams, probably in combination with dredging for shipping purposes, has caused the river's channel to sink. Multiply that $4-million expenditure to compensate for the loss of this important ecosystem service – that is, sediment delivery and channel maintenance – many times over and we arrive at a serious chunk of change.

The name of the game in 21st-century water management must be the integration of ecological health and ecosystem services into water planning, policy, and management. In our book, *Rivers for life* (Island Press), my coauthor, Brian Richter, and I recommend the setting of a "sustainability boundary" to cap the loss of services from watersheds, river systems, and other ecological infrastructure. The beauty of such a boundary is twofold. First, in economic terms, it maximizes the total value of freshwater ecosystems by taking into account both extractive and "instream" benefits. Second, it drives up water productivity – the value derived from each liter of water removed from its place in nature and put to use in agriculture, industry, or urban areas. We will need at least a doubling of water productivity over the next two decades to have a chance of adequately meeting human needs, while keeping a meaningful portion of ecological infrastructure intact.

This is not a pie-in-the-sky recommendation. In several nations and regions, including Australia, the European Union, South Africa, Latin America, and the US, pioneering policies to safeguard freshwater ecosystem services are in place and are currently being implemented. The scientific underpinnings of these initiatives may not be perfect, but in this time of rapid ecological degradation, it seems critical not to let the "perfect" be the enemy of the "good", and to learn while doing. For this new era of water management to succeed, ecosystem scientists must play a central role in its design and implementation.

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