



Viewpoint – The Next Nexus? Environmental Ethics, Water Policies, and Climate Change

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ABSTRACT: Water policies are based on ethical assumptions, and efforts to promote more sustainable policies need to address those underlying values. The history of water policies from 'command-and-control' to more ecological approaches reveals an ethical evolution, but adaptation to climate change will require further ethical shifts. The case of the Santa Fe river in New Mexico (USA) illustrates how values that go unrecognised interfere with sustainable management. Exploring the underlying value dynamics is an essential step in the policy reform process and takes on added urgency in the face of climate change and the need to formulate adaptive water strategies. Bringing the topic of values and ethics into the water policy discourse can help clarify management goals and promote more sustainable practices.

KEYWORDS: Environmental ethics, water policy, climate change, Santa Fe river

INTRODUCTION

A 'nexus' is defined as "[t]he bond, link, or tie existing between members of a group or series".¹ The term captures the interactive effects that characterize the process of development, as in the "population, agriculture, and environment nexus in Sub-Saharan Africa" (Cleaver and Schreiber, 1994). A recent Google search shows many development applications: 'The Trade-Development Nexus', 'The Security-Development Nexus', 'The Migration-Development Nexus', 'The Trade-Migration-Development Nexus', and 'The Climate Change and Rural Development Nexus'. South Africa's Minister for Water and Environment, Buyelwa Sonjica, refers to "the water, energy and climate change nexus" in her blog post for World Water Day in 2010. She notes, "[i]f the sector is to respond effectively to the water, development and the climate change challenge, it must promote *natural systems resilience*, increase infrastructural capacity, improve water governance and improve institutional adaptive capacity" (emphasis added).²

How can water policies promote the 'natural systems resilience' needed for sustainable water resources management and successful adaptation to climate change? I suggest that sustainable management hinges on supportive values and ethics which embrace healthy rivers as a management goal. My argument builds on Adrian Armstrong's recent paper in this same journal (Armstrong, 2009) where he lays out the case for a water ethic that is consistent with the 'Land Ethic' of the American conservationist Aldo Leopold. Armstrong uses the generic label of 'water ethic' to describe his particular ethical prescription. The term, water ethic, is better used to refer to the entire field of ethics as applied to water. What Armstrong is proposing is a water ethic which recognises the rights of Nature, rather than limiting ethical concern to human societies. By labelling his specific prescription with the general term, water ethic, however, we lose sight of the fundamental point that all water policies are based on

¹ American Heritage Dictionary 1969 edition.

² <http://climate-l.org/2010/03/22/guest-article-38-water-development-and-climate-change/>

ethical principles of some kind. Armstrong's vision of a water ethic (which I broadly share) would not fill a void, but would rather replace ethical systems already in effect.

In this article, I address two separate but related problems with the dominant, human-centred water ethic, which leaves Nature out of the picture. The first problem, and the focus of Armstrong's analysis, is that ignoring the needs of natural ecosystems results in water management which is inherently unsustainable. This assertion will be illustrated through a historical overview and a case study of the Santa Fe river in New Mexico, USA. The second problem concerns ethics as a subject of knowledge and inquiry. Policy-making that ignores underlying cultural values and ethical assumptions lacks transparency (even to the policy makers) and will almost certainly result in suboptimal decisions. Ethics makes a difference in how water is managed, and a different ethical system will result in different water decisions. Herein lies the promise, and also the challenge, of working on ethics as a pathway to reforming water policies and management practices in the face of climate change.

The two problems are linked, in my view, because greater clarity about the underlying values reflected in water policies is likely to favour more sustainable water behaviours and healthier water ecosystems. The implications for climate adaptation are that healthy water ecosystems will be more resilient to stress from the anticipated more severe droughts and floods.

EVOLVING PARADIGMS OF WATER MANAGEMENT

Open any book on the history of water development and the themes of conquest and control jump out from the chapters set in the 19th and early 20th centuries, whereas the chapters dealing with the 1980s and 1990s become more complicated and nuanced. Turn to the section on the past decade and the concern with climate change and the role of nature takes on a different tone. The comforting message from history is that our values and paradigms can and do change over time.

The conventional water management paradigm

The conventional paradigm for managing water during the 19th and most of the 20th centuries was based on the principle of 'command-and-control'. Dams were built to impound rivers and release the water for power generation, or into canals for irrigation, industry, or urban water supply. River channels were straightened and deepened for ease of river transport and/or to evacuate flood waters faster; levees kept rivers contained and away from their natural floodplains. Urban run-off from rain and snow which fell on roofs, streets, and parking lots, was channelled into drains and sewers to flow into the nearest river as quickly as possible.

The principle of 'command and control' was, and still is, intricately intertwined with the principle of 'beneficial use' and, most particularly, *economically* beneficial use. Under the conventional paradigm, water should be tightly controlled in order to direct its service to a 'stream' of economic benefits. If water is not providing economic benefits for somebody, it is not being put to beneficial use. In the western part of the United States, an additional principle comes into play, that of 'prior appropriation'. Based on the idea of mineral prospecting, this principle grants permanent water rights to the first person to extract water for an economic use. The practical implication of this principle is that any water flowing in a stream that is not already claimed by someone else (for a particular economic use) can be claimed by a newcomer, so long as that newcomer can demonstrate that the water will be put to an economic application (e.g. used in a factory, or for irrigation, or for municipal drinking water, etc).

The idea of putting water to beneficial use is a very old concept. The Sri Lankan King Parakramabahu the Great (1153-1186 CE) famously said "[n]o drop of water that falls from the sky should be allowed to flow to the sea unused". He implemented his own advice by building reservoirs and canals to command and control the water. From a physical, engineering perspective, there are remarkable similarities between ancient Sri Lankan water management practices and the practices of today. During the construction of a sluice gate for a new reservoir in the Mahaweli development project, an ancient sluice

gate was discovered on the same location, from an earlier reservoir. What was different, aside from the contrast of stone vs. concrete and steel, was that the ancient stone sluice gate was constructed in the form of a seven-headed cobra deity. By honouring the water god, the ancient engineers were acknowledging the 'prior appropriation' right of the river spirit, and seeking both permission and protection.

Conventional water management shares the 'command-and-control' approach of medieval Sri Lanka, but without the spiritual underpinnings. This view of water and rivers as inert material resources possessing neither consciousness, nor spirit, nor any inherent rights that need to be respected comprises a key principle of the conventional paradigm: water management is a secular undertaking; rivers and lakes are regarded simply as accumulations of inert matter, rather than spiritual beings who need to be respected (Groenfeldt, 2008).

Historians have traced the development of the conventional water management paradigm to European and American political and cultural dynamics. Donald Worster (1985) provides an analysis of water development as an expression of frontier expansion into the American West during the 19th and early 20th centuries. David Blackbourn (2006) takes a similar approach in showing surprising parallels in the evolution of water engineering and the development of modern Germany over the past two centuries. Rivers, whether the Colorado or the Rhine, served as the backdrop for monument-building and the conquest of nature (see the February 2010 special issue of *Water Alternatives* on hydraulic bureaucracies). The cultural values and ethical codes are clear in the light of history. Taming nature was not only a virtue, but a responsibility of those in power. It would have seemed unethical *not* to straighten the inconvenient meanders of the Rhine and build dams on the Colorado.

Environmentalists have waged a long, and generally losing, war against the conventional water management paradigm and the destruction of unique natural landscapes. One of the first major battles was John Muir's effort in the early 1900s to protect his beloved Hetch Hetchy valley. Originally included as part of Yosemite National Park in California, the US government withdrew its protected status to allow construction of a reservoir for the growing city of San Francisco. Muir, founder of the Sierra Club, argued that there were many other potential sources of water for San Francisco, but only one Hetch Hetchy valley. His impassioned pleas fell on deaf ears: "Dam Hetch Hetchy! As well dam for water-tanks the people's cathedrals and churches, for no holier temple has ever been consecrated by the heart of man" (Muir, 1912).

The greening of conventional water management

The sad history of environmental failures to preserve river ecosystems in the United States is documented in Marc Reisner's *Cadillac Desert* (Reisner, 1993, original 1986). Invariably, pleas to leave rivers intact for posterity were no match for money and politics. While countless individual battles were lost, however, the overall campaign to protect rivers from unchecked dam development did have some success. In a later book, *Overtapped Oasis*, Reisner and Bates (1990) review the history of Western water development up to that time, and note that the bleak picture Reisner had painted only a few years ago in *Cadillac Desert* was already looking better. The era of new dam construction in the US had come to a close, partly because the best locations for dams already had them, and partly because the environmental costs were being more carefully assessed through economic cost-benefit analyses.

Today, it is clear that Reisner's hope for more environmental awareness about water management is being at least partly realized. Restoration projects aimed at mitigating the ecological damage from unfortunate construction projects of the past have become routine.³ The conventions of water management are shifting towards more emphasis on sustainability and ecosystem services, but there is far more rhetoric than action in adopting ecological principles. Water management continues to be

³ For example, the US Army Corps of Engineers is partnering with The Nature Conservancy to write new guidelines for managing dams in support of environmental flows as well as power generation and flood control. See www.nature.org/initiatives/freshwater/partnership for details.

defined as a series of physical challenges to be solved through engineering. A fundamentally new approach is needed, and fortunately, has already been developed by ecologists, biologists, and resource economists. This model exists in a parallel scientific universe of conferences, societies, books, and professional papers which describe an ecosystem perspective of man's relationship to water.⁴ This approach, which I call 'ecological water management' offers a way of working with, rather than against, nature's water cycles of precipitation, flow, and infiltration.

Ecological water management

The new paradigm of 'ecological water management' builds on natural riparian principles and ecological relationships that are becoming increasingly well understood (Richter et al., 2003; Postel and Richter, 2003; Brierley and Fryirs, 2008; Arthington et al., 2010). But in spite of strong scientific credentials, ecological water management is still considered an 'alternative' approach that has yet to successfully challenge the status quo of water resources management.

Articulated at the World Water Forum in 2000 as *A Vision for Water and Nature*,⁵ the ecological water management model is predicated on sustainable ecosystems. A fundamental feature of ecological water management, in contrast to 'command-and-control' approaches, is a commitment to environmental flow (Postel and Richter, 2003). An environmental flow is the natural water regime of a river, wetland or coastal zone which maintains the ecosystem. A minimum environmental flow is the smallest amount of water required at any given time to allow the ecosystem to function. Environmental flows provide critical contributions to both river health and ultimately to economic development, ensuring the continued availability of the many benefits that healthy river and groundwater systems bring to society (Dyson et al., 2003).

Since the 1990s, the concept of environmental flows has been gradually incorporated into water laws from Europe to South Africa to Australia. The South African *National Water Act* adopted in 1998 granted water resources the status of public goods, under state control; the national government is the custodian of the water resources and its powers are exercised as a public trust. It has the responsibility for the equitable allocation and usage of water and the transfer of water between catchments. The Act establishes a 'reserve' consisting of an unallocated portion of water that is not subject to competition with other water uses. It refers to both quality and quantity of water and has two segments: the basic human-need reserve and the ecological reserve. The first one refers to the amount of water for drinking, food and personal hygiene and the second one to the amount of water required to protect the aquatic ecosystems.

In Europe, the Water Framework Directive, enacted in 2001, requires sustainable water levels and flows to maintain or restore riparian habitats. Member States are required to achieve good surface water and groundwater status by 2015, which refers to ecological and chemical status of surface waters, and chemical quality and quantitative status of groundwater, with rates of abstraction sustainable over the long term. Other dimensions of ecological water management include the morphology of river channels (which should be meandering with functioning floodplains and natural vegetation) storm water management (capturing, slowing, and spreading water so it can infiltrate into the soil), and water use whether for domestic, industrial, or agricultural purposes. In each domain of water management there are opportunities to utilize ecological principles to capture, store, purify, and reuse water.

⁴ See the websites of the Instream Flow Council (www.instreamflowcouncil.org), the Environmental Flow Network (www.eflownet.org) and the Society for Ecological Restoration (www.ser.org).

⁵ The full text of the Vision for Water and Nature can be downloaded at: www.rivernet.org/general/docs/visionwaturnature.pdf

The water response to climate change

As people accept that climate change is real and here to stay, they are likely to realize that while reducing greenhouse gas emissions is all about energy, adapting to climate change will be all about water (Rijsberman, 2008).

Climate change is adding a new dimension to water management. Within the conventional water management paradigm, climate change adds urgency to more and bigger technical fixes. The inclination is to go 'back to the future' of command-and-control approaches and re-engineer a solution to climate change: Build more dams to store more water, more pipelines to cross basin boundaries and more pumping to tap ever-deeper sources of groundwater.

Environmental voices have been calling for greater water conservation efforts and smarter 'conjunctive use' strategies to rely on surface water during wet years and let the groundwater build up for the dry years (Nelson et al., 2007). Along with the calls for new and greener technologies, there is also an emerging consensus among environmental groups that restoring ecological health to rivers, lakes, and groundwater is essential to provide the resilience that will be needed to weather the anticipated greater swings of longer droughts and bigger floods (Seavy et al., 2009). Our best hope as humans, according to this approach, is to rely on "Nature's own infrastructure" (Smith and Barchiesi, 2009). If we can keep Nature functioning, we can survive the tribulations of climate change and prevent further damage to the rivers, lakes and aquifers on which our still growing population will depend.

The dilemma of finding consensus around the best response to climate change stems from the fundamental incompatibility between the conventional and ecological water management paradigms. Building more dams on already dewatered rivers (as often proposed in the conventional paradigm) will further damage the very ecosystems that the ecological paradigm is trying to restore. Proponents of an ecological approach have science, at least ecological science, on their side. There is a clear trend within the scientific community in favour of ecological solutions which lend themselves to unanticipated synergies, rather than conventional responses which often result in unexpected collateral damage. But proponents of the conventional paradigm still have politics on their side, as discussed below.

COMPETING PARADIGMS: THE CASE OF THE SANTA FE RIVER (NEW MEXICO, USA)

The Santa Fe river emerges from high (3,900 m) mountains to the East of Santa Fe City and flows 70 km in a westerly direction to join the Rio Grande. Two reservoirs in the mountains impound the entire flow of the river for city reservoirs, providing about half the water the city uses each year. The other half of the water comes from deep wells in and near the city, including from the Santa Fe river aquifer. Santa Fe's water policies are based on 19th century Western US water law and can be summarised in the phrase, 'First in time, first in right'. Earlier claims to water trump later claims, other things being equal. The most important of these other things is putting the water to 'beneficial use', which means an economically productive purpose. Omitted from the law is any consideration of the water resource itself. Neither the rights of nature in general nor the rights of a river in particular, are accorded a seat at the legal table.

History of water use along the Santa Fe river

Indigenous Pueblo Indian tribes were already using the Santa Fe river for irrigation when the Spanish arrived in the late 1500s. With the establishment of Santa Fe as a provincial capital in 1610, agricultural use of water intensified. The Santa Fe river provided water to a growing network of Spanish canals (*acequias*) which provided the food for the growing settlement. More than 30 *acequias* were established, irrigating roughly 800 hectares of farmland, and diverting so much water that stretches of the river were dry during the summer months.

Based on the cultural values underlying contemporary acequia agriculture (Rodriguez, 2006), it seems safe to suggest that the colonial Spanish viewed the river primarily as a means of cultivating a secure food supply in this semiarid environment. The rights of nature were implicitly assumed: "[t]he tacit, underlying premise [of acequia irrigators] is that all living creatures have a right to water". Another core belief related to water was that it should be shared: "[t]he principle of water sharing belongs to a larger moral economy that promotes cooperative economic behaviour through inculcating the core value of *respecto* and gendered norms of personal comportment" (Rodriguez, 2006).

The 19th century saw major changes in the cultural orientation towards the river. The United States annexed the territory of New Mexico in 1848. Thirty years later, the first dam was built on the river, to provide municipal water for the newly established Santa Fe Water Company. Initially, the Water Company stored less than 10% of the river's flow for its customers, but by the mid-1900s, that proportion increased to nearly 50%. Henceforth, the river's water would be the basis for continued urban expansion, rather than agricultural production.

Today, the river is operated with the objective of storing as much water as possible in the reservoirs. The rights to the river's water were extracted from the acequia farmers through legal manoeuvres by the private water company, which later sold the rights to the City of Santa Fe. The city's rights comprise about 85% of the river's average flow (which is highly variable). An additional 5% is owned by the heirs of the early farmers (now used for urban gardens) and the remaining 10% is unallocated, usually spilling from the reservoirs when the mountain snowpack melts in late spring. The reservoir dams are operated by city engineers. Water is normally released from the dams in anticipation of spring floods, and (in a recent policy evolution) for aesthetic purposes during the summer months. During the rest of the year, the river is a dry, heavily eroded ditch. The policy of keeping the river intentionally dry earned it the designation as 'America's Most Endangered River' in 2007.⁶ Partly in response to this negative publicity, the City government, which controls the reservoirs, shifted its policy to allow for summer water releases into the river provided the reservoirs are three-fourths full rather than completely full. A year-round minimum environmental flow, however, as required in other countries, is not under serious consideration. The City's policy remains one of prioritizing storage at the expense of flow.

What's a river for?

In the prevailing view of Santa Fe's municipal government (whose view matters most, since the municipality owns the river's water rights), the primary and almost exclusive purpose of the river is to provide water for the city's municipal water supply, thereby supporting existing homes and businesses and allowing future expansion. The idea that the river itself has a rightful claim to some of its water lies outside the prevailing ethic, which is based on a legal perspective. If you have a right to the water, and if you are complying with the legal requirement that the water be put to 'beneficial use', there is no legal or moral restriction on water withdrawals.

Peeling back the legal and economic veneers, we can expose a layer of cultural values that is otherwise obscured. The willingness to accept the City's legal entitlement as an adequate justification for dewatering the river implies consent with the principle of water as a commodity that can be freely owned and traded. The environmental ethic being expressed is that water is a natural resource that should be utilised for economically productive purposes. A corollary to the 'water-as-resource' principle is that the ecological health of the river lies outside the concern of water resources management. The municipal government of Santa Fe is expressing an ethical code which prescribes withdrawing from the river the full amount of water which is legally allowable (i.e. the annual water rights which the city 'owns'⁷). In this way, the city's water managers are maximizing the 'beneficial use' of the river's water. If

⁶ The designation was made by American Rivers, a national environmental group based in Washington, DC. For details, see www.americanrivers.org/assets/pdfs/mer-past-reports/mer-3_28_07c76c.pdf

⁷ Legally speaking, the city has a licence to utilise 5,040 acre-feet of water (6,216,748 m³) annually from the Santa Fe river for "municipal purposes".

the water remained in the river as environmental flow, there would be less water available for economically beneficial use. From the perspective of the city water managers, allocating some of the city's water allotment to environmental flow in the river would constitute unethical behaviour, since it would result in a lower level of beneficial use.

Even if the water managers felt personally attracted to the possibility of allocating water for environmental flow, there is little incentive for challenging the official ethic. A further complication is the definition of 'beneficial use'. The normal interpretation includes domestic household use, business use (e.g. hotels, offices) landscape or crop irrigation, or any industrial purpose. Local water attorneys are divided in their opinion as to whether leaving water in the river for environmental benefit would safely qualify as a 'beneficial' use under the law. The general consensus is that it would, but even a very small risk that environmental flow would not qualify is enough to dissuade the faint of heart. Why risk a legal challenge for the purpose of environmental flow, which is not even part of the dominant ethic?

Applying 'ecological water management' to the Santa Fe river

The official disregard for the ecological health of the Santa Fe river, which flows through the middle of a state capital which is also a popular tourist destination, has stimulated local efforts to restore a 'living river'. An initiative from within the city's governing council led to a Santa Fe River Corridor Master Plan in 1995 which endorsed the objective of a permanently flowing Santa Fe river. The Santa Fe Watershed Association (www.santafewatershed.org) was established as an NGO in 1999 by a coalition of environmentalists, community activists, and business owners with the aim of "[b]ringing the Santa Fe River back to life; restoring the heart to our community". The justification for this objective was couched in a blend of utilitarian and environmental values:

We advocate surface and groundwater management that balances human use with natural resource protection. We encourage government and civic leaders to place high priority on sustaining seasonal stream flow in the river, yielding hydrologic, recreational, aesthetic, and environmental value to the community. We are committed to safeguarding the long-term integrity of the river and the entire watershed.⁸

Pieces of this agenda have gradually been incorporated into city policies. The municipal government has officially endorsed the goal of a 'living river' including an eventual environmental flow allocation of roughly 20% of normal river flow, except in dry years when environmental flow would be reduced to zero. The new flow regime is slated to begin upon completion of a new supply pipeline in 2012. The precise amount of water necessary for an effective environmental flow is a matter of debate even among environmentalists, but the city's planning provision for shutting off the river completely during dry years clearly lies outside the generally accepted concept of 'environmental flow'. In the absence of any legal requirements establishing ecological standards, river advocacy groups must rely on persuasion and community support.

City officials accept the general concept that a flowing river is desirable, but they stop short of endorsing the principle of environmental flow. They argue that there is not 'enough' water available to support a flowing river, at least until the new pipeline is completed (pumping water out of the Rio Grande 20 km away), and even then only in normal or above-normal precipitation years. As one city water manager explained to me, "the river has to live within its means". In the eyes of the water managers, the river is a water 'consumer' which competes with other human consumptive demands for drinking water, irrigated gardens and lawns, golf courses, and new housing and office buildings. Each of these competing demands needs to be 'balanced' and this balancing is seen as the art of water management. Allocating scarce water to the river to support its ecological function is viewed as a concession to a particular interest group: the river and its proponents.

⁸ Santa Fe Watershed Association brochure, 2005.

The problem: Cultural values and ethics

Why is the Santa Fe river considered a competing 'consumer' with no claim to its own water, when in South Africa, a minimum water flow is legally protected as an 'ecological reserve'? The problem is not lack of scientific knowledge or expertise among Santa Fe's water managers. It lies in the realm of cultural values, and specifically values related to the role of nature, i.e. environmental ethics. In Santa Fe, the river is considered an inanimate thing, a physical channel through which water sometimes flows. It is not the subject of ethical concern, much less religious veneration. The river is not even seen as a provider of water, which now comes from dams, wells, and pipes. Nature has ceased to have direct relevance to the issues of water management. The river has become a 'community amenity' like a park or a garden. Nature has been tamed and can now be managed through technology; water can be allocated according to a prudent and balanced assessment of society's competing water demands.

What are the specific cultural values being expressed in Santa Fe's operative water ethic? The most obvious value is that water is for people first and foremost. While there is some ambiguity about whether environmental flow can be considered a beneficial use, there is no doubt that any argument in favour of such an interpretation would be based on the benefits to people which would be realised through the environmental flow. Arguing the case that the river's health has an intrinsic value apart from human benefit has no support in state or federal law,⁹ and has no official support within city government. However, support for the intrinsic rights of nature is widespread among diverse elements of Santa Fe's community, particularly among some (but by no means all) environmentalists, artists, religious leaders, and independent thinkers. Indeed, Santa Fe has a well-deserved reputation as a haven for aesthetic, spiritual, and environmental advocates. The juxtaposition of avant-garde personal philosophies among many residents, side by side with highly conventional, and from an international perspective, retrograde water resources policies, highlights the persistence of cultural core values about the rightful balance between human interests and ecosystem health.

Aldo Leopold predicted that the rights of nature would eventually be recognised by societies as they (we) steadily evolve. From the ethic of individual loyalty which marked ancient society, to a more political ethic that recognised individual responsibility to the larger society, we are now poised for the third step of our moral evolution: recognising our collective responsibility to nature:

There is as yet no ethic dealing with man's relation to land and to the animals and plants which grow upon it... The land-relation is still strictly economic, entailing privileges but not obligations. The extension of ethics to this third element in human environment is... an evolutionary possibility and an ecological necessity. It is the third step in a sequence. The first two have already been taken. Individual thinkers since the days of Ezekiel and Isaiah have asserted that the despoliation of land is not only inexpedient but wrong. Society, however, has not yet affirmed their belief. I regard the present conservation movement as the embryo of such an affirmation (Leopold, 1970).¹⁰

It may well be the case that Western cultures, unlike indigenous ones, are not yet prepared to take that third step and acknowledge rights of nature. Yet even raising the question about whether nature ought to be considered as possessing some kind of water rights can enliven water policy discussions. But values and ethics cannot enter the discussion until they are acknowledged to exist. Santa Fe's water managers see themselves as operating in the only way possible. They see themselves as being responsible for balancing the needs of people and the environment, but they cannot imagine a balance that would give the greater priority to the environment. The problem is not simply one of cultural values, but one of failure to recognise that cultural values are operating, and that there are multiple

⁹ The federal Endangered Species Act (ESA) does protect critical habitat of species designated as "endangered" regardless of their importance to human welfare, but there is no critical habitat for endangered species along the Santa Fe river.

¹⁰ Excerpted from the chapter entitled, *The Land Ethic*. This chapter is available for download from www.waterculture.org/uploads/Leopold_TheLandEthic.pdf.

water ethics that could be employed to the task of balancing the needs of people and nature, even within the confines of the existing legal framework.

REFORMING WATER POLICIES THROUGH ENVIRONMENTAL ETHICS

How can debate about environmental ethics result in better water policies? Recent efforts to promote environmental flow as a core feature of sustainable water management (Dyson et al., 2003; Hirji and Davis, 2009) utilise economic principles to provide the justification for environmental action, and bring in legal reforms to institutionalise approaches which make economic and environmental sense (e.g. mandating a minimum environmental flow). The case of the Santa Fe river, however, suggests that environmental economics is limited in its influence. The municipal water managers who control reservoir releases into the Santa Fe river have no incentive to research the environmental economics of their management strategy. Local environmental NGOs such as the Santa Fe Watershed Association have a strong interest in environmental economics but lack the capacity to undertake research. Water management institutes¹¹ have shown little interest in becoming involved in the local concerns of the relatively small Santa Fe river, and might face criticisms from local and state authorities for interfering with local water decisions.

In the absence of an environmental economic analysis, the status quo management of the Santa Fe river can only be challenged conceptually, where, by definition, the status quo dominates. With no compelling case for implementing environmental flow in the Santa Fe river, there is correspondingly little interest in developing a supportive legal framework for such flows. The existing laws already serve the dominant economic interests. In the eyes of Santa Fe's political establishment, there is no environmental problem; the only water problem is one of supply, and the concept of environmental flow would only exasperate the supply problem by catering to yet another consumer, the river.

This is where a systematic analysis of the operative cultural values and ethical framework can help. A values analysis forces transparency of the current policies, and provides an opportunity for minority values to be expressed and debated. There is a governance dimension to this process as well, since it only helps to discuss issues if there is some possibility of a practical response. Governance reforms, such as a river basin council, a special commission, or watershed department provides an enabling institutional environment for stakeholder participation in water policies, but can also serve to legitimise the status quo. Values analysis of the principles underlying the prevailing water ethic is a way of speaking truth to power and fostering a healthy debate about the values that the concerned community wishes to express. The result might well come short of Leopold's vision of an enlightened environmental ethic, but at least the process will provide an opportunity to consider his ethical vision, along with many other ethical alternatives.

THE CLIMATE CHANGE NEXUS

The need for resilient water ecosystems that can adapt to climate change provides a frame for considering the values and ethics driving water policies. As noted above, there is an added reason to promote adaptation measures that will enhance the resilience of water ecosystems so they can weather the additional stress of droughts and floods. At the same time, climate change brings an urgency to the planning process; adaptive strategies need to be formulated as soon as possible, and choices need to be made. Perhaps the time pressure will encourage outside-the-box thinking, and a consideration of the values dimension.

Concerns about climate change and the security of Santa Fe's water supply offer a possible stimulus for new thinking about the management of river flows. The city's water supply derives from two

¹¹ There are a number of water research centres within the state's university system, and also within the two national laboratories located in New Mexico, Sandia and Los Alamos.

sources: (1) the Santa Fe river and its associated aquifer and (2) the nearby Rio Grande river and its associated aquifer. The anticipated effects of climate change include (a) relatively less snow and more rain, resulting in less natural water storage in the form of snowpack in the upper watershed, and (b) more severe and more frequent droughts and floods. The availability of surface water will almost certainly be more variable, even as there will be a need for greater storage capacity to withstand the anticipated multi-year droughts. Aquifer storage is likely to become a more important part of the water supply strategy and there will be a simultaneously greater need for empty reservoir capacity to serve as a flood buffer. For the Santa Fe river, the importance of river flows for recharging the aquifer could prompt a rethinking of reservoir releases.¹²

A scenario of environmental flows to recharge the aquifer, while helping fortify the riparian ecology (vegetation and river channel morphology) could result in a healthier, more resilient, 'living river'. Is such an outcome possible within the 'water-as-resource' utilitarian ethic of Santa Fe's water managers? There will certainly be pressure to respond to climate change by increasing surface storage capacity rather than allowing any river water to infiltrate into the aquifer. The priority of surface storage over aquifer storage has been the convention for the past half century. With no value accorded to riparian health, the additional environmental benefits from flows that infiltrate water into the aquifer would not be counted, and the comparison would be made on storage and recovery criteria alone: How much water can be recovered and at what cost, if the water is allowed to infiltrate into the aquifer rather than be stored in the reservoirs? With the higher temperatures and greater evaporation under climate change scenarios, coupled with the increased probabilities for extended droughts that would in any case render surface reservoirs useless, maintaining environmental flows might be seen as economically preferable even without any environmental considerations. Perhaps Santa Fe's water managers will be induced to take the environmentally enlightened option through utilitarian logic.

Climate change will put new stress on water management policies everywhere. The same types of choices confronting Santa Fe's water managers will become the norm. Faced with greater uncertainty and more extreme floods and droughts, will water policies aim for even greater control over unruly rivers, or will new alternatives be considered based on ecological principles?

Can water management embrace ecology without a crisis? Can we make pre-emptive reforms to water policies that embrace Nature as having a right to exist and a value above and beyond the ecosystem services that benefit humans? Based on my experience in trying to effect policy reforms in Santa Fe, my sense is that environmental ethics is not going to become a compelling rallying cry for reforming water management. Cultural values and ethics are inherently resistant to change; that is how cultures are maintained over time. Rather than attempting a frontal attack on well-entrenched values, a more effective strategy might be to look for ways that the existing value system could support environmentally important measures leading to larger reforms. An approach of seeking to change behaviours within the umbrella of existing values can start a multiplier effect that can influence values gradually and indirectly. The role of the crisis (e.g. climate change) can be to stimulate the initial behavioural change.

In the Santa Fe case, the need for multi-year carryover storage that is resistant to evaporation could serve as a stimulus for experimenting with 'aquifer storage and recovery' (ASR), using environmental flow in the river. By appealing to the intuitive logic of storing water underground for long periods of time, the idea of a normally flowing Santa Fe river becomes a delivery mechanism for storing large amounts of water underground as drought insurance. As the flowing river and growing aquifer become accepted as a normal aspect of safeguarding long-term (sustainable) water supply, the value placed on a flowing river could become an internalised aspect of the local culture.

When a healthy river is seen as a management objective, utilitarian objectives are forced into an accommodation with sustainability. Under such an approach, the City of Santa Fe would no longer be

¹² The connection between surface flows and aquifer recharge is discussed in a Watershed Association White Paper (Grant and Williams, 2009).

able to impound the entire flow of the Santa Fe river merely because this is an easy way to obtain water for the city supply over the short term. With the health of the Santa Fe river as a central management objective, the needs of urban water supply would have to be met in ways that do not endanger basic ecological functions. The dams would be operated as part of a conjunctive strategy with groundwater management, demand management (conservation), rainwater harvesting, and water reuse.

CONCLUSIONS

Environmental ethics are implicit in water policies and need to be made explicit so that policy makers, water managers, and the public at large can make conscious judgements about what the ethics ought to be. If Aldo Leopold is right in his prediction that human ethics will eventually evolve to encompass the well-being of Nature as an ethical priority, then we can also predict that ecosystem resilience will benefit when that ethical evolution takes effect. Our challenge in confronting climate change is to bring about that ethical enlightenment sooner rather than later. Unveiling and examining the values and ethics underlying water laws and economic policies is a precondition for a healthy societal debate about our rightful relationship with nature. While I am less sanguine than Leopold that society will make the right choice and align with the laws of Nature, the process of bringing ethics out into the open will at least offer us an opportunity to consider our options deliberately.

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