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IRAN'S WATER CRISIS:
CULTURAL, POLITICAL, AND ETHICAL DIMENSIONS

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ABSTRACT. By the summer of 2001, most of Iran had been suffering a three-year drought, the worst in recent history. Water rationing was in place in Tehran and other cities, and large proportions of the country's crops and livestock were perishing. Yet many academics and other experts in Iran insist that the water crisis is only partly drought-related, and claim that mismanagement of water resources is the more significant cause. Underlying this discussion is a complex of overlapping yet often conflicting ethical systems – Iranian, Islamic, and modernist/industrialist – which are available to inform water policy in Iran. A review of the various arguments about the nature of the crisis and the range of solutions that have been proposed, including precedents from traditional Iranian water management and the ethics of water use in Islamic law, suggests that Iran's own cultural heritage provides alternatives to wholesale adoption of Western models.

KEY WORDS: Iran, Islamic law, qanat, sustainable development, water management, Zoroastrianism

Human societies living on the arid Iranian plateau in southwestern Asia have managed their meager water resources sustainably for thousands of years – until recently, at least. Since 1999 Iran has faced a water crisis so severe that in response, the Iranian government began accepting foreign aid for only the second time since the 1979 revolution (the first was on the occasion of a massive earthquake in 1990). How have human history's original experts in sustainable arid-lands water management come to face a modern crisis of such dramatic proportions?

IRAN'S MOST PRESSING CRISIS

From a violent revolution in 1979, to a devastating eight-year war with Iraq from 1980 to 1988, and continuing economic problems exacerbated by a US-led embargo throughout the 1990s, Iran's public and politicians alike have faced numerous challenges. Since 1999, however, a severe drought has led to nearly nation-wide water shortages that have eclipsed all other concerns.

The drought is estimated by the United Nations to have cost Iran 3.5 billion dollars in 2000, and mid-year estimates for 2001 were already at



2.5 billion (*Tehran Times*, 16 July 2001, p. 4). In July 2001 fifty villages in Kerman province in central Iran were evacuated for lack of water. Over one million head of livestock perished throughout the country in 2000 due to the drought, and three million tons of wheat and barley were lost. Projections for 2001 were even worse.

In the eastern city of Mashhad, Iran's second largest, daily water cuts were increased from five to eight hours as the city's water reserves fell by 80 per cent (*Iran Daily*, 14 July 2001, p. 3). In Esfahan province, 100,000 farm workers lost their jobs because of drought-induced crop failure. Severe water rationing in the historic city of Esfahan sparked angry street demonstrations,¹ as residents and tourists alike bemoaned the fact that the Zayandeh (literally, "life-giving") river – long one of the city's most inspiring landmarks – had gone completely dry for the second consecutive year. Power blackouts resulting from the depletion of reservoirs brought back memories of the early years of the revolution.

In the western part of the country, the Dez and Karkheh rivers, two major water sources, were depleted by 70 per cent compared to their 2000 volume, and it was predicted they might dry up completely (*Iran Daily*, 18 July 2001, p. 3). By June 2001, water rationing had been implemented in thirty Iranian cities, including the capital, Tehran, with twelve million inhabitants.

In southeastern Iran, near the borders with Pakistan and Afghanistan, Lake Hamoun, formerly the largest freshwater body in the country, had ceased to exist by September (MacFarquhar, 2001). Only two years before, fisherman had taken 12,000 tons of fish from that lake. Now there would be none. As a result of the lake's disappearance, strong winds and sandstorms led to increased soil erosion in ninety-four southeastern villages (*Tehran Times*, 29 July 2001, p. 14). The nearby city of Zahedan, home to over half a million impoverished Afghan refugees, was left to rely only on brackish groundwater, which was also predicted to dry up within a year or two (Whitaker, 2001).

News reports and government press releases have consistently blamed the disaster on the drought, treating it as an uncontrollable natural disaster. However, Iranian academics working in fields as diverse as hydrology, soil science, economics, and urban planning all tell a different story. Iran has always had cycles of drought, they point out, and traditional water management practices would always get Iranians through. The fact that Iran seems unable now to cope with such a historically familiar reality suggests that

¹ These public disturbances were not reported in the media, but being present in Esfahan at the time, I was personally aware of them.

something has been lost by abandoning traditional practices for “modern” ones.

TRADITIONAL IRANIAN WATER MANAGEMENT

Although Iranians are about one per cent of the world's total human population, their share of the world's potable water reserves is only about 0.36 per cent (*Iran Daily*, 5 July 2001, p. 3). More than three thousand years ago, the inhabitants of the dry, mountainous regions of western Iran perfected a system for directing snowmelt through underground channels, called *qanats* (Lambton, 1978). Qanats, which are known as *kariz* in Central Asia and *khattara* in North Africa, were first developed in Kurdistan as a side result of mining activity by the early first millennium BCE at the latest. They are mentioned in the records of Sargon II for 714 BCE, who destroyed them but then adopted the technology for use throughout his empire. Under the Persian Achaemenids, their use spread to the Mediterranean, Arabia, and Central Asia. Later, from the eighth century onwards, Muslims built qanats in Morocco and Spain.

Qanat channels, which began in the mountains and carried water downwards to the plains, were accessed via manholes dug from the surface down to the channels themselves, which could then be maintained by intrepid individuals who would climb down and keep the passages clear. Since the channels were underground, evaporation loss was kept to a minimum, and water remained cool through the hot desert summers.² In this way the mountain runoff was made available to farms, country gardens, and towns.

From ancient times, Iranian civilization has possessed an ethical system that recognized both the ecological realities of the plateau's desert climate and the social imperative of conserving and distributing water in a way that ensures its availability to all. In Zoroastrianism, the original pre-Islamic religion of the Iranians, which is still practiced by a small minority today,³ each of the four elements is represented by a deity (*izad*) and revered through special invocations (*yasht*). Water is associated with the goddess Anahita (Nahid), whom Herodotus identified with Aphrodite. Another deity, Patet Apam, is described as guardian of rivers, springs, and the sea.

² Though the clay lining of qanat channels allowed some percolation, water temporarily lost in this way at least recharged the water table.

³ Zoroastrians in Iran today number around 30,000. Larger communities exist in India (where they are known as Parsees), in addition to smaller diaspora groups in North America and elsewhere (Boyce, 1992).

According to the Zoroastrian sacred text known as the Avesta, water must be kept pure and unpolluted. When Zoroastrians approach a stream, waterfall, or spring, they should recite an invocation called the Ardivisura Banu (or Abzavar), from the Aban yasht in the Avesta. The ritual calendar of the Zoroastrians marks the fall harvest, Paitishahem, by commemorating the primordial creation of water.

Traveling through Iran in the fifth century BCE, Herodotus reported that “Iranians do not defile the running water, do not spit in it. They do not even wash their hands with it and cannot stand seeing another polluting it.” Strabo (ca. 63 BCE-24 CE) corroborates this: “Iranians do not bathe in water, do not throw a cadaver or corpse into it. All in all they do not throw anything unclean in it” (Oshidari, 2001, p. 4).

Most of Iran’s Zoroastrians today live in the central desert regions of Yazd and Kerman. For them, the daily sprinkling of courtyards and alleyways (performed throughout Asia as a means of keeping down dust), is accompanied by the diffusing of fragrant herbs such as wild rue, frankincense, aloe, and marjoram, and still has a religious significance (Oshidari, 2001, p. 2).

The word “paradise” – derived from Old Persian *pairi daeza* and meaning a heavenly garden – is an ancient Iranian concept that has not lost its relevance or poignancy in the Middle East today. Flying over Iran, one is deeply struck by the contrast of deep green, rectangular gardens surrounded by endless expanses of light brown desert. Unlike the golf courses of modern Phoenix, which give a similar effect, these traditional gardens were watered by entirely natural and sustainable means, fed by qanats, springs, or a combination of both. Many such gardens still exist throughout the country.

In certain parts of Iran, ancient festivals connected with qanats continue to be practiced. Some villages in Esfahan province still celebrate an annual “qanat wedding,” in which women prepare a special soup (*ash*), then choose an elderly “bride” who is dressed up, washed in the qanat, and pours the soup into it. The villagers believe this ritual ensures that the qanat will continue to bring water for another year for the sake of its “bride.” No men are allowed to participate.

A similar ritual has a young boy bring water from one qanat (or well) to another so as to perform a “marriage” of the two water sources. Yet a third ritual, a collective masked rain dance, is performed by villagers in the Shahr-e Kord region in times of drought. Fire is carried by participants in all of these rituals, indicating their survival from Zoroastrian times (Ahmad Khatoonabadi, personal e-mail communication, 1 December, 2001).

ISLAMIC PRINCIPLES FOR WATER MANAGEMENT

In Iran today the population is about ninety-nine per cent Muslim. The Islamization of Iran began in the mid-seventh century CE following the Arab conquest, and progressed over the next several centuries. Iranian intellectuals played a major role in shaping the developing Islamic tradition, whether in the realms of law, theology, philosophy, science, and medicine, even the Arabic language that became the lingua franca of Muslim elites throughout the world.

The religion of Islam, as revealed in the Qur'an, which Muslims believe to be the word of God (Allah), emerged in the western part of the Arabian peninsula – a dry, mountainous region similar in many ways to the Iranian plateau. The Qur'an mentions water on more than sixty separate occasions, and rivers more than fifty times. There are also frequent references to the sea, to rain and hail, and fountains and springs. It is not surprising that the Qur'an, and for that matter pre-Islamic Arab tradition, place enormous emphasis on the importance of managing scant water resources sustainably and equitably.

Consistent with contemporary scientific understanding, the Qur'an states that water is the very source and origin of life: "We made from water every living thing" (Qur'an 21: 30). Water is also the source of nourishment and sustenance, a gift from God: "Behold! . . . In the rain which Allah sends down from the skies, and the life which he gives therewith to an earth that is dead . . ." (2: 164); "It is He who sendeth down rain from the skies; and with it we produce vegetation of all kinds" (6: 99); "It is He who sendeth down water from the sky in due measure and thereby We quicken the dead land" (43: 11); "And We send the water from the sky and give it to you to drink" (15: 22); "We send down pure water from the sky, that We may thereby give life to a dead land and provide drink for what we have created" (25: 48–49); and "We provided you with fresh water" (77: 27). The Qur'an also makes reference to groundwater and springs: "He leads it through springs in the earth" (39: 21); "From it also channels flow, each according to its measure (13: 17); and "Say: 'Think: if all the water that you have were to sink down into the earth, who would give running water its place?" (67: 30). Finally, water, with which Muslims must perform ablutions before praying and after sex, has the religious function of purifying the believer: ". . . and He caused rain to descend on you from heaven to clean you therewith" (8: 11).

It is noteworthy that the Arabic term *shari'a*, which later came to be the term for Islamic law, originally designated "the path which leads to the watering hole." Qur'anic descriptions of heaven, furthermore, depict it as being watered with flowing rivers (5: 119, 87: 17). The abundance of



Figure 1. Watering at midday beside dried out riverbed, Esfahan, Iran, July 2001. Photo by Richard C. Foltz.



Figure 2. Tourist boats in drydock near Khwaju bridge, Esfahan, Iran, July 2001. Photo by Richard C. Foltz.

water imagery in the Qur'an leads M. A. S. Abdel Haleem, a contemporary Islamic scholar, to assert that water has greater religious significance to Muslims than to followers of any other tradition (Abdel Haleem, 1998, p. 109).

The notion of community (*umma*) is of central importance in Islam, and social justice is one of the most prominent themes in the divine revelation. According to the Qur'an, water is community property: "And tell them that the water is to be divided between them" (54: 28). The traditions of the Prophet Muhammad (*hadiths* – which following the Qur'an constitute the second source of Islamic law) report him as saying, "People share three things: water, pasture and fire" (Abu Dawood, *Sunan*). The *hadiths* also prohibit the withholding of water from those who need it, and from using it wastefully: "Excess in the use of water is forbidden, even if you have the resources of a whole river" (Tirmidhi).

Classical Islamic jurisprudence was formulated mainly during the eighth and ninth centuries of the Common Era and set down in the texts of four schools recognized by Sunni Muslims (the Shafi'i, the Maliki, the Hanafi, and the Hanbali), plus a fifth school, the Ja'fari, which is accepted only by Shi'ites. The latter are a minority within the Muslim world as a whole, but in Iran they constitute a majority of perhaps ninety per cent. For the most part, Islamic jurisprudence has remained a theoretical construct, an ideal toward which Muslim societies should strive, rather than a system actually practiced.⁴ Even in the Islamic Republic of Iran today, the official view is that the country is "working toward" an Islamic state; it does not claim yet to be one.

Within the classical legal system, water rights are determined first and foremost by the need to quench thirst (Wilkinson, 1990, p. 60). This primary right was accorded not only to humans, but to animals as well (Wescoat, 1995). Thus, irrigation systems must be available to all who are in need, and must not be polluted so as to protect the rights of downstream users. Furthermore, according to John C. Wilkinson, "New upstream appropriations may only take place if they do not affect . . . prior rights" (Wilkinson, 1990, p. 61). According to the *hadiths*, the Prophet stipulated that "no more than an ankle's depth" of water could be taken – that is, providing adequate moisture storage in the soil for a seasonal crop. Wilkinson notes that the terms of the Prophet's restriction arise from the Arabian context, where water flows typically result from flash floods. Classical jurisprudence, seeking "the spirit of the law," therefore determined

⁴ Legal codes as actually practiced in Muslim societies are designated by the term *qanun* law, in contradistinction to the *shari'a* ideal.

that the intent was to prevent accumulation of excess water for purposes of speculation (Wilkinson, 1990, pp. 61–62).

The hadiths also establish the principle of protected zones (*harim*), which include watercourses, rivers, and, significantly, their adjoining lands, including lands adjacent to wells. The *harim* is “the buffer zone surrounding a water body within which human activities, apart from the lawful use of water, are prohibited. The cardinal rule of *harims* adjoining waters is that they must remain undeveloped” (Ahmad, 1999, p. 184).

Islamic criteria for water purity, which perhaps reflect ritual more than health concerns, state that water is polluted (*najis*) if it has undergone noticeable changes in color, taste, or smell as compared to its “clean” (*tahir*) state at the source. In short, as Wilkinson summarizes, the norms for managing water that are found in classical Islamic legal sources are comprehensive, sustainable, and just: “The existence of both surface and groundwater flows are recognized and the *harim* rules ensure that tapping does not occur, nor that a new irrigation system or well are constructed too close to an existing one. The existence of problems of water quality and pollution, as well as of water quantity, are also treated in the Islamic code” (Wilkinson, 1990, p. 63; Ahmad, 1999, pp. 181–183). Islamic laws pertaining specifically to qanats were set down in a ninth-century manual, *Kitab al-qani* (The Book of Qanats).

Water distribution systems in traditional Muslim societies such as Iran’s, whether irrigation networks in rural areas or urban water supplies for public use, often fell under the classification of *waqfs* (Persian *vaqf*), which are pious endowments for the public good, protected from both taxation and government seizure. Those who made *waqf* endowments – usually wealthy families – were able not only to protect their wealth by investing it in this way, but might also exercise enormous power within their communities by controlling systems vital to the community’s survival. In Esfahan province, a system of regulating the distribution of water from the Zayandeh river was stipulated by an early sixteenth century document, popularly but anachronistically attributed to the Safavid minister Shaykh Baha’i (Lambton, 1937–39, p. 663; 1986). Much of the traditional canal system still exists, although throughout the recent drought the channels have remained dry.

While across the Iranian plateau today the traditional qanat systems continue to provide water for as much as one third of irrigated land (some 15 million acres – English, 1998, p. 198), these traditional systems are increasingly being abandoned in favor of “modern” practices such as the damming of rivers and the pumping of groundwater. Likewise, control of

water resources has been transferred from pious endowments to government bodies. These changes have been brought about as a result of the application of development models imported from the West.

MODERN DEVELOPMENT AND THE CHALLENGE TO TRADITIONAL VALUES

In this respect, Iran's recent development has followed a pattern seen throughout the non-Western world. Beginning in the 1930s, Reza Shah, founder of the short-lived Pahlavi dynasty, dismantled the Safavid system of water management as part of his policy of switching from traditional to cash crops, mainly from rice to cotton (Lambton, 1937–39, p. 663). In the 1960s, his son, the late Shah Mohammad Reza Pahlavi, instituted land reforms as part of his American-inspired "White Revolution," a program accompanied by the building of factories in or near major urban areas with little concern for local ecosystems. Plants such as the immense Mobarakeh Steel Mill near Esfahan were constructed in the middle of the desert, without regard for the effects their massive consumption of scarce water resources would have on competing needs.⁵

It was believed that the new hydrological technologies borrowed from the West would be more than adequate to meet the rapidly industrializing country's skyrocketing demand for water. As in the western United States, it was assumed that arid regions could be industrialized by making the necessary water resources available through the building of dams, the pumping of groundwater, and by bringing water from remote sources. The disastrous effects of this assumption have begun to appear in Iran as in the US, Israel, India, and elsewhere.

Over the past four decades, Iranian farmers and others close to the land have watched water tables drop as one well after another dries up and formerly fertile lands are forcibly taken out of production. The current drought's effects of water rationing, power cuts, and dried up riverbeds have finally caused urban Iranians to take note of these changes as well, though many still imagine that what they are seeing is a passing crisis and not a permanent trend. Iranian policy-makers in the post-revolutionary period have not yet begun seriously to question and re-assess the norms inherited from the former regime, which have so far been maintained.

⁵ Since the depletion of groundwater reservoirs occurs over time, the effects of this development were not seen immediately.

ISLAMIC NORMS REMAIN MARGINALIZED

The revolutionary government of Iran, which arose following the Shah's departure in late 1978, declared the country an Islamic republic the following year. Under the nation's new constitution it was therefore established that, in theory at least, legislation should follow the principles of Islamic law (*shari'a*). In the realm of water management, however, as in so many other areas, the exigencies of industrial development have superseded many of the principles established by Islamic law.⁶

To cite but a few examples, throughout the present crisis factories have continued to consume massive quantities of water even as entire neighborhoods are cut off from supplies needed for drinking and basic hygiene. These same factories pollute the rivers and groundwater that serve as public water sources, as does the pasturing of livestock. In fact, it could reasonably be argued that almost the totality of water management policy as currently practiced in Iran fails to meet Islamic standards.

This is not to say that all the bodies within Iran's governing structure are oblivious to the development policy aspects of the water crisis. The Department of Environmental Protection (DOE), which is headed by Iran's only female vice president, Massumeh Ebtekar, employs dozens of knowledgeable experts (many of whom have been Western-trained) who are at least privately critical of the dominant norms. The DOE has actively sought to promote the retrieval of Islamic values pertaining to the natural environment, holding international conferences and publishing treatises by religious figures.⁷ Since 1996 the DOE has called upon Muslim environmentalists to "urge their Friday prayer leaders to include environmental messages in their sermons" (Department of the Environment, 1996, p. 27).

Unfortunately, there has thus far been little overt interest on the part of Iran's religious scholars to take a leadership role in educating Muslims about environmental values. According to Baqer Talebi, a young seminarian at the prestigious Fayzieh college in the holy shrine city of Qom, most Iranians fail to see environmental problems as a religious issue. "If I were to go back to my home village and, wearing my mullah's gown, personally open up the channels so that people could get water, it would be seen by the public as a religious act. But I'm not doing that, and neither are

⁶ The continuing problems of corruption and ideologically-driven appointments to key positions are additional factors often cited by the regime's critics.

⁷ The DOE sponsored a conference on Islam and the Environment in December 1999 in Tehran, and an international symposium on Religion, Culture, and the Environment in May 2001. In addition to conference proceedings, they have also published tracts such as Mostafa Mohaqeq Damad's *A Discourse on Nature and the Environment from an Islamic Perspective* (Damad, 2001). See also Foltz, 2000, 2001.

any other mullahs, and we're not going to because our professional culture has been that we have 'more pressing' concerns" (private conversation, 3 August 2001). Talebi expressed his own personal dismay in making this assessment, yet while he asserted that environmental issues ought indeed to be a significant component of religious teaching, he doubted that this could actually occur in the extremely tradition-minded world of formal Shi'ite scholarship.

Ayatollah Musavi Ardebili, one of Qom's most prominent elder clerics, is more optimistic. Speaking privately with me in August of 2001, he conceded that environmental degradation had not been addressed in any meaningful way by Iran's religious scholars, but he affirmed that this was a vital issue facing Muslims in today's world and one that clerics were duty-bound to better inform themselves about.

Ayatollah Hasan Emami of Esfahan, who, unlike the majority of Iran's leading religious figures, chooses not to live in Qom and has criticized Iran's present form of government, takes an even stronger position. He rejects the assessment that Iran's religious leaders have been lax in promoting Islamic environmental values. "I have personally been teaching my students about environmental responsibility every day for over twenty years," he told me (private conversation, 6 August 2001). To further prove his point, Ayatollah Emami presented me with a newly published book on environmental jurisprudence, *Al-fiqh al-bi'ah*, written by contemporary Shi'ite scholar Ayatollah Muhammad Husayni Shirazi.

Given Iranians' current attitudes toward their government, however, any attention to such matters on the part of leading Islamic figures may be a double-edged sword. Many feel that any kind of Islamic discourse in Iran today has been discredited by a government widely seen as corrupt and ineffective. Mostafa Qaderian, a public relations officer for the Esfahan office of the Department of Environment, doubts that with the present political climate ordinary Iranians will be swayed by Islamic arguments regarding environmental practices. Himself a devout Muslim, Qaderian admits that "Since people have become a little alienated from Islam under the present regime, it is perhaps better to have such discussions only with those genuinely interested in Islamic studies" (private conversation, 1 August 2001).

DROUGHT OR MISMANAGEMENT?

The present shortages and resulting government-led educational campaigns have at least begun to raise awareness among urban Iranians of their unsustainable habits in regard to water use. The average water

consumption in Tehran – where one sixth of the country’s population lives – is sixty-three gallons per day, nearly double that of Western European nations (MacFarquhar, 2001). According to Iran’s Deputy Energy Minister Rasul Zargar, up to thirty-seven per cent of Iran’s drinking water is lost because of outdated, leaking distribution systems (*Tehran Times*, 15 July 2001, p. 4). Similarly, sixty per cent of the eighty-two billion cubic meters of water used in the agricultural sector fails to reach crops.

During the summer of 2001, the Iranian government began an earnest campaign to inform the public about water conservation, through billboards, speeches, and educational materials distributed through schools. A four-day conference on optimizing water consumption was held in Tehran in September, 2001. Earlier in the summer, Ali Asghar Qane’, director of the Water and Sewage Company of the city of Kashan, spoke to the news media about the water crisis. Though he made no reference to the street demonstrations in Esfahan, Qane’ predicted that “If the water crisis is ignored, social tensions will be created” (*Tehran Times*, 16 July 2001, p. 4).

It is interesting to note that the water conservation billboards that the Tehran municipality has placed all around the capital appeal for the most part to scientific and social values rather than to explicitly Islamic or traditional ones. Carrying slogans such as “Abundance of water is a fantasy” and “What if there is no more water . . .?”, these advertisements seem to be employing strategies similar to those used by environmental organizations in the West.

In any case, it is not clear whether increased conservation by the public will be an adequate response to the crisis. Many have suggested that the water shortage is largely due to more serious systemic problems, which require more drastic changes in the way Iranians manage their water. Environmental activist Mansureh Shoja’i sums up the popular consensus when she states, “The water crisis is not the fault of the people; it is the fault of bad management” (private conversation, 6 August 2001).

Indeed, examples of bad management are not hard to find. Spending the summer months of 2001 in the city of Esfahan, I was profoundly struck by the irony of seeing city gardeners water grassy park lawns during the scorching mid-day heat, against the depressing backdrop of the dried up river bed that spans the city. Roaming the city parks day after day, I found this practice to be the norm. I also saw unattended hoses and faucets running full force into the ground, sometimes every hundred yards or so. Once I even found a gardener using his watering hose as a spray to clear the lawn of fallen leaves, in lieu of raking. This was during a period when some neighborhoods were entirely without water for days at a time.



Figure 3. City gardener raking with water, Esfahan, Iran, July 2001. Photo by Richard C. Foltz.



Figure 4. "What if there is no water . . .?" Billboard, central Tehran, Iran, August 2001. Photo by Richard C. Foltz.



Figure 5. "Modern Water Management," student painting, Esfahan University of Technology, 2000. Photo by Richard C. Foltz.

I took photographs of the various ways I saw water being wasted. Later, visiting the Esfahan office of the Department of Environmental Protection, I discovered that experts there were building up a similar photo collection, fully aware of the problem. So why do these practices persist? The answer most often given is that the city parks, with their bioregionally inappropriate English-style grass lawns, were the brainchild of certain city officials with connections to the landscaping business. Kickbacks are endemic in Iran, and urban officials are notorious for their unholy associations with construction and related industries.

"Our city officials don't understand that grassy lawns are not suitable for Iran's climate," explains Australian-trained Ahmad Khatoonabadi, a professor of environmental studies at Esfahan University of Technology. "But there are certain vested interests at work as well" (private conversation, 24 July 2001). Khatoonabadi notes another example of local politicians' non-ecological priorities: "They have thinned out the trees [which retain moisture and limit erosion] all along the bank of the Zayandeh river, for the simple reason that they feared children would get lost in the woods."⁸

⁸ Iranian cultural practices are at root here. Unlike in the US, where public neglect of children can legally constitute child abuse, in Iran when families go out for picnics and other excursions, adults typically lounge and converse together while children run about free and unsupervised for hours on end.

Wealthy families in Iran generally own lands outside the cities, called *baghs* (literally, "gardens"), which they use as weekend retreats. In keeping with their generic name, such properties are usually planted up with elaborate gardens that include flowerbeds, pools, and fountains, following ancient Iranian tradition. But few of these newer country gardens use traditional methods of maintenance. More and more land-owning families are installing their own private groundwater pumps as public supplies fail. Large private swimming pools are popular. When the wells dry up, the preferred solution is simply to dig a deeper well and get a larger pump. Of course, average Iranians lack the financial means to procure such methods.

In Esfahan, the summer heat is greatly increased in the absence of the river. In July and August of 2001, day temperatures regularly hovered around 105 degrees Fahrenheit, often failing to dip below 85 degrees at night. There was general agreement that the heat was far worse than anyone could remember, as well as recognition that in normal years the presence of water in the river had an important cooling effect. Family outings by the riverside have always been the number one leisure-time activities for Esfahanis; the endless crowds picnicking stoically beside a dried-out riverbed present a poignant image.

Overheated, thirsty Esfahanis consistently blame the government, not nature, for their predicament. Popular consensus is that, drought or no drought, the Zayandeh river normally has plenty of water to meet the needs of the region. In the 1970s, two tunnels were drilled through the Kuhrang mountains to the west, bringing abundant water from the mighty Karun river, which flows through Khuzestan province to the Persian Gulf. Two additional tunnels are underway.

But in the early 1990s, then-President Ali Akbar Hashemi Rafsanjani sponsored a project to build an aquaduct to divert the Zayandeh river's water to far-off Rafsanjan, his ancestral home. A few years later, his successor, Mohammad Khatami, had another one built to his native city, Yazd. Esfahanis feel their national political leaders have unfairly stolen their water for the sake of hometown favoritism.

Of course, the Esfahan economy is heavily dependent on water-intensive industries like the Mobarakeh steel mill. And much of the province's agricultural land has historically been used for the cultivation of rice, one of the most heavy water consumers of all crops. Raising barley would make more ecological sense, but rice is a staple without which no Iranian meal is considered complete. Iran's major rice-growing region is the humid Caspian littoral in the north. But Esfahan province, with its far drier climate, is the number two rice producer, and local pride will not give up its irrational competition with the north.

In light of the experience of the American West, specifically the massive dam-building enterprises of the early twentieth century so richly detailed by Marc Reisner in his book *Cadillac Desert*, it is somewhat discouraging to see that, despite continuous protests from within academia, the vast majority of Iran's government officials continue to believe that the best solution to the water crisis is simply to build more dams – as many as possible, in fact. This is in spite of the many recent scientific studies conducted by Iranian scholars, which, like similar studies elsewhere, have shown that such policies lead to net loss of available water resources.

One longtime opponent of Iran's dam-building policies is Mehdi Bassiri, Dean of the Faculty of Environmental Studies at Esfahan University of Technology and founder of the environmental non-government organization Esfahan Green Message. Bassiri, who holds a Ph.D. in range management from Colorado State University in the United States, is as critical of government policies as he is of naïve public attitudes. Tempering the popular tendency to blame everything on the government, Bassiri contends that the present water crisis is "fifty per cent drought-related and fifty per cent due to bad water management." He notes that "Once you start building dams, you disrupt the water cycle; excess water no longer replenishes the aquifers" (private conversation, 26 July 2001). In arid regions such as the Iranian plateau where water availability has always hovered near the margins, such disruptions can have exaggerated effects.

PROPOSED SOLUTIONS

The water crisis is a cause of great interest and concern to many Iranian academics working in areas connected with the environment. The search for solutions is a great source of frustration and anxiety. One approach that has had a measure of success is a homegrown variety of water table management (*abkhandari*).

This approach was pioneered by Ahang Kawsar, a professor at the Institute of Natural Resources in the southwestern city of Shiraz. Kawsar developed a system of water channels coming down from mountain areas, not unlike the traditional qanats. But in this new system, excess water is dispersed so as to feed the underground water table, thereby mitigating the effect of groundwater pumping. In Shiraz province, Kawsar's method succeeded in raising groundwater tables. Unfortunately, his vigorous support of eucalyptus plantations (which both dry up and poison the soil) has compromised his credibility among Iranian environmentalists. Also, as Kawsar himself has noted, his method quickly became a vehicle for the interests of a few local politicians. He also admitted that a system that

works in one topographical setting, as his did in Shiraz, cannot be blindly applied to all areas of the country.

Additional tunnels through the Zagros mountains to bring Karun river water into central Iran is another oft-cited solution. Ahmad Khatoonabadi cautiously endorses this idea. "If the third tunnel is completed," he says, "and if consumption patterns are made more logical, then the situation may be improved, but it will not be solved altogether" (private conversation, 24 July 2001). Khatoonabadi's colleague Mehdi Bassiri concurs regarding the need for more tunnels. "We need to stop sending water to places like Yazd and Kerman," he says, "and start getting more water from Khuzestan." Of course, such a policy is bound to alter the ecosystem of that province, but as Bassiri notes, "Khuzestan has 32 billion cubic meters of water flowing down from the Zagros Mountains, whereas in Esfahan we have only 1.5 million" (private conversation, 26 July 2001). Even so, Bassiri admits, "I have calculated that even after completing two additional tunnels, we will still have water shortages."

Ahmad Budkhubi, an engineer with the Department of Environment main office in Tehran, disagrees that the present shortages are insurmountable. "There is a lot of water in the Zagros mountains," he explains, but most of it flows [down the western side] into Iraq. "If we kept that water for ourselves we would have no crisis" (private conversation, 7 August 2001). Budkhubi declined to remark on the effect that withholding water from Iraq – against whom Iran fought a bitter eight-year war during the 1980s – might have on regional stability.

In any event, there have been numerous problems associated with digging the Kuhrang tunnels. In fact, the idea of bringing water from that mountain range to Esfahan originated with the Safavid ruler Shah Abbas I in the early seventeenth century and has yet to be completed. More recently, a Japanese firm was hired to dig the additional tunnels. Pressure from Iranian contractors caused the Japanese to be removed from the project, but as it turned out, the Iranian companies lacked the capacity to complete the task, which remains suspended indefinitely.

Bassiri cites an additional problem at Kuhrang, namely that "the head spring is very high up in the mountains, and will be cut open by this digging. The water pressure is very high and it will shoot into the air and can't be controlled" (private conversation, 26 July 2001). One proposed solution is to first freeze the water underground, inside the mountain, but this is both difficult and expensive. "Personally, I believe that any human interference with natural systems will destroy them," Bassiri concludes. "But hopefully, with proper scientific understanding and attention, the damage will be less." Bassiri believes that water-intensive rice cultivation

is another major issue that needs to be addressed. "We should import rice," he says, "instead of growing it in dry regions."

Ahmad Khatoonabadi suggests that the first stage to be implemented is better watershed management in the higher elevations, including a moratorium on livestock grazing (which exacerbates erosion and pollutes watercourses) for at least five to ten years so that the mountain ecosystems can begin to recover.

Another problem Khatoonabadi cites is the dependence of subsistence-level peoples on local resources as a means for making profits (in other words, using resources as a means of getting into the cash economy, rather than merely for subsistence). He suggests that this practice could be reduced by increasing alternative sources for income, such as tourism or the development of small-scale industries.

Finally, Khatoonabadi argues that the Iranian government's dam-building policy needs to be re-assessed. "We need an alternative development strategy," he says, "but so far we have been imitating Western models. We have adequate cultural patterns and principles of our own to serve as a basis for such an alternative model, but so far we have not reached a consensus about how to do this" (private conversation, 24 July, 2001).

Khatoonabadi and Bassiri agree that public participation and consensus, especially at the local level, are crucial. "Local involvement in decision-making is important," says Bassiri, "not only centralized government policy-making." Khatoonabadi, for his part, has devoted considerable energy to mobilizing local communities for environmental activism. In particular, he has initiated a program of "participatory drama," where members of village communities play out issues of local environmental concern as a way of identifying issues and establishing dialogue (Khatoonabadi, 1999, forthcoming).

CONCLUSIONS

This paper has indicated three major sources of value systems that have been available to inform water policy decisions in Iran. These systems are not entirely distinct from each other, and often overlap considerably; yet they frequently set forth conflicting principles and directives. Two of these value systems – the Iranian and the Islamic – can be considered indigenous, if by "Iranian" one understands the ancient cultural heritage of the peoples of the Iranian plateau (including Zoroastrianism), and by "Islamic" the values that were shaped to a significant extent by Iranian Muslim jurists and theologians from the eighth century onward.

Obviously, over the past thirteen hundred years the first two systems have co-evolved to a large degree and are profoundly interconnected. The qanat system, for example, which originated long before the Islamic period, was incorporated into the developing Islamic legal code in conjunction with Arabian-derived norms reflected in the traditions of the prophet Muhammad.

The third value system at work in contemporary Iranian water management, and the one that has dominated water policy both prior to and since the Islamic revolution of 1979, derives from industrial modernism. Despite the incompatibility of modern industrial values of the European variety with both the ecological realities of Iranian ecosystems and the precedents of traditional Iranian society, Iran's policy-makers have thus far been unwilling to abandon the basic assumptions on which the present global economy is based: that industrialization and economic growth must be pursued at all costs, that the interests of industrialists and the government supersede those of the general population (or that benefits to the former will somehow trickle down to the latter), and that the interests of the present generation supersede those of future generations.

This is all the more remarkable in light of the post-revolutionary regime's ongoing rhetoric of Islamic social justice by which it seeks to legitimize itself. Iran's constitution of 1980 makes a strong connection between sustainable development and social justice, as in Article 50, which reads:

In the Islamic Republic protection of the natural environment, in which the present and future generations must lead an ever-improving community life, is a public obligation. Therefore all activities, economic or otherwise, which may cause irreversible damage to the environment are forbidden.

Twenty years later, Iran has yet to bring its development and resource management policies in line with this basic directive.

Given the experience of many developing nations who have been forced to undertake massive dam building projects and other environmentally-destructive schemes in order to secure foreign aid through the IMF, the World Bank, and other agencies, it is significant to note that since the 1979 revolution, Iran has remained largely outside the paradigm of Western-directed development. Although some Iranians blame the lack of foreign aid and investment for their country's ongoing economic problems, it is at least true that Iran has maintained its independence in the realm of policy making more successfully than most nations in the developing world.⁹ This is a source of both pride and shame for Iranians, since as one

⁹ In October, 2001, the US again vetoed Iran's application for membership in the World Trade Organization. A strong sentiment exists in Iran today, echoed almost daily in the

Iranian academic succinctly puts it, “our bad water management policies are the result not of foreign pressure, but simply our own stupidity” (private communication, name withheld).

Environmental changes brought about as a result of unsustainable exploitation of Iran’s water resources now threaten entire communities with extinction. According to geographer Paul English, “On the Iranian plateau . . . [the] change in water technology is draining aquifers, altering the distribution of towns and villages, and transforming the lifeworlds of Iranian villagers” (English, 1998, p. 187). As English sums up the current situation, “evidence suggests that deep wells have made many small farmers dependent on well owners, have failed to increase agricultural production significantly, and bode poorly for the long term survival of many long-established settlements. The desire for short term benefits has prevailed; the long term costs remain to be seen” (English, 1998, p. 187).

It is sometimes argued that unsustainable growth and short-term values are not unique to modernity, but existed as well in pre-modern times. As Danish historian Peter Christensen claims, “it remains indisputable that the Middle East as a whole suffered marked, cumulative decline in pre-industrial times” (Christensen, 1998, p. 16). Christensen notes that the pre-Islamic Sasanian rulers constructed great irrigation and flood control works such as the well-known Nahrawan complex east of Tigris, as well as five large dams with canal systems in nearby Khuzestan; further east, in Seistan, they constructed a major dam on the Helmand river (Christensen, 1998, pp. 18, 21). Problems of salinization and silting were as prevalent then as they are today. Observing that the Nahrawan had definitively broken down by the mid-twelfth century, in part as “a result of coercing a fragile environment,” Christensen states that “expansion under Persian rule had created an irrigation system that was, if not self-destructive, then at least extremely vulnerable to even small disturbances” (Christensen, 1998, pp. 19–20).

Social power relations were a factor influencing water management in pre-modern as in modern times. Qanat construction required a degree of capital investment only wealthy landowners could afford, giving them a considerable degree of control over the peasant population (English, 1966). According to K. S. McLachlan, “agricultural and social command structures were tight and unforgiving for the ordinary peasants: participation

country’s news media, that, if only Iran could gain membership in the WTO, then the nation’s economic crisis would be solved. When I noted in a public lecture in Tehran on 8 August 2001, that Iran’s economic and political independence was a rare achievement in today’s world, and suggested that the notion that a developing country could “beat the bank” was akin to a gambler’s belief on entering a casino, my remarks were met with overwhelming disapproval by the audience.

was demanded from above and not sought in any co-operative way, but at least the fate of the whole rural community living off qanat water was to a large extent indivisible" (McLachlan, 1988, pp. 90–91).

Health experts point out that problems associated with water pollution also predate the modern period. Amir Afkhami has noted that despite Zoroastrian and Islamic directives for maintaining water purity, the dumping of sewage, grave-digging, and other factors rendered much qanat water unsafe in pre-modern times, leading to repeated outbreaks of cholera among other things. Religious definitions of purity, furthermore, often obscured the reality of polluted water (Afkhami, 1998).

Such observations ought to caution against wholesale romanticizing of pre-modern practices. Even without industrialization, Iran's sevenfold population growth alone over the past century would have put a strain on the country's meager water resources. Alongside this dramatic population growth, there has been a corresponding depopulation of the countryside, as peasants displaced by mechanized agriculture have moved to the cities in search of work. Unfortunately, industrialization and land reforms have for the most part exacerbated, rather than alleviated, traditional social and economic disparities.

Geographers Eckart Ehlers and Abbas Saidi argue that while "the modernistic approach of agricultural policy under the shah not only changed, but finally destroyed traditional social structures and dependencies . . . it did not succeed in replacing the old by a new and acceptable modern order . . . It not only failed to improve the socioeconomic conditions of the majority of the local peasants and smallholders, but, on the contrary, it helped the *khans* [tribal chiefs] and the *malik-i buzurg* [large landowners] as well as certain urban capitalists to increase their grip over the land and to concentrate even more productive power in their own hands." In sum, Ehlers and Saidi conclude that "wells and pumps have not been able to establish a genuine alternative to the traditional qanat system" (Ehlers and Saidi, 1989, pp. 107, 110–111).

Traditional practices were sustainable only insofar as water demand remained in a steady state. If the history of water use in Iran provides a lesson, then, it may simply be that humans cannot survive indefinitely while ignoring basic laws of ecology. Water, like many other vital resources, cannot be created in ever-increasing amounts; it has to come from somewhere, and its future availability is dependent on its natural cycle remaining undisturbed. If periodic pre-modern mega-projects such as massive dam-building and channel-cutting proved unsustainable, Iran's ancient qanat system by contrast continued to function reliably over thousands of years because it operated within the natural laws of the water

cycle.¹⁰ As such, it must on some level at least serve as a model for sustainable water use in Iran's future development.

Abundant rains in the winter of 2001–2002 made it appear to many Iranians as if the water crisis had gone into remission. However, even if drought bears half the blame for the recent crisis, increased rainfall and replenished reservoirs cannot entirely compensate for bad water management practices.

With a growing population and continued industrial ambitions, the Iranian government is sooner or later going to have to make more realistic concessions to the ecological constraints posed by Iran's arid climate. For the time being, at least, Iran's independence in national policy and decision making could allow the country to choose a course of development that is not merely imported wholesale from elsewhere, but rather evolves in a way that is appropriate to Iran's own particular culture and climate. Iran is a dry country, and it is a Muslim country, and these two factors must surely play a basic role if Iran is to establish a sustainable program of water management in the future.

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¹⁰ English points out that the benefits of qanats – that they (1) are made of local materials, (2) use no energy, (3) transport water without evaporation or pollution, and (4) cannot drain aquifers – mean that they represent "a sustainable system that provides water to settlements indefinitely." Their major defect is simply that they "cannot increase production to meet modern demands" (English, 1998, p. 194).

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