

Fragile ecosystems under pressure

By Richard Stone

The rescue plan for Lake Urmia, a vast but dwindling salt lake, is Iran's most expensive and highest profile environmental project ever (see main story, p. 1044). But the country has many other hot spots where the needs of a burgeoning population are taking a toll on the fragile ecosystems of this vast, water-poor land. Risking the wrath of hardliners, Iranian scientists and nongovernmental organizations (NGOs) are speaking out about the crises—and in some cases making headway toward solving them.

A "RIVER OF LIFE" RUNS DRY

In a good year, Iran's semiarid heartland receives just enough precipitation to keep the rivers flowing and supply the needs of cities, farms, and ecosystems. "Water is our biggest resource constraint in Iran," says Gary Lewis of the United Nations Development Programme (UNDP) in

Iran, the top U.N. official in the country. But a drought stretching into its fifth year is having devastating consequences.

In Isfahan, the ancient Persian capital 450 kilometers south of Tehran, the Zayanderud, or "River of Life," meandering through the old city is mostly dry—a visible symptom of a critically stressed

watershed. "The river's ecosystem function has completely collapsed and many fish species have been lost," says Mahboobi Soofiani, a marine ecologist at the Isfahan University of Technology. Isfahan once had enough water to share with other desert cities such as Kashan and Yazd. "Now there's no way to spare water, because we don't have enough to drink ourselves," Soofiani says. So long as the drought persists, he says, "I don't see any immediate solution."

A CASPIAN REFUGE UNDER SIEGE

Last December, Iran President Hassan Rouhani revived a plan to transform Iran's only island in the Caspian Sea into a tourism hub. Environmentalists fought back. Ashuradeh Island is part of the Miankaleh Biosphere Reserve, a habitat for migratory birds, endangered sturgeons, and Caspian seals. Ashuradeh also "has a unique vegetation" assemblage dominated by sedges and wild pomegranate, says Hossein Akhani, a systematic botanist at the University of Tehran.

Overgrazing, wildfires, and illegal hunting have already degraded the Miankaleh ecosystem, including parts of Ashuradeh; hotels and marinas posed a further threat. The Ashuradeh Rescue Committee—a coalition of 191 NGOs in Iran—has whipped up opposition to the tourism plan in the Iranian press. The government appears to have shelved the project, but Akhani—who won the 2015 Iran environmental award, conferred by President Rouhani—is not letting his guard down. "There is no sign that the whole project is going to be canceled," he says.

RARE FORESTS GET RARER

Iran never had much forest, and over the past half-century, nearly half of it has vanished. The latest figures show forest cover down to about 11 million hectares,



A drought stretching into its fifth year has intermittently drained the Zayanderud River, seen here near Isfahan's Khaju Bridge. Efforts to prevent the Asiatic cheetah from going extinct appear to be paying off, with camera traps showing an increase in the number of cubs.

just 6% of the country. Chief culprits are forest conversion to cropland, logging, urbanization, and holiday villas. Wildfires have taken a heavy toll in recent years, especially in the Zagros Mountains and in Golestan National Park, Iran's first biosphere reserve and home to almost 20% of Iran's plant species. And a few years ago, Zagros oaks—which account for almost half of Iran's remaining forest cover—began succumbing to a fatal fungal pathogen, *Biscogniauxia mediterranea*, which causes a malady called charcoal disease. Meanwhile, Iran's Environment Department is attempting to block construction of two dams: Shafarud Dam in Gilan province, which would flood vast swathes of Hyrcanian relict forest, assemblages of tree species such as the Persian ironwood near the Caspian Sea; and Khersan-3 Dam in Chaharmahal and Bakhtiari province, which would submerge 2400 hectares of Zagros oaks.

A CHEETAH RACES EXTINCTION

Asiatic cheetahs once ranged from the Arabian Peninsula to India. Today, the critically endangered subspecies is making its last stand on the arid plains of central Iran. Fewer than 100 are left, Lewis says. Over the past decade, Iran's Environment Department, UNDP, and others have been working together to try to save the predator through the Conservation of Asiatic Cheetah Project. The project aims to crack down on poaching while curbing livestock grazing to restore cheetah habitat and boost the numbers of its prey, including the Jebeer gazelle and wild sheep. Project leaders say they want to balance habitat preservation with the needs of local villagers.

The hope is that the cheetah won't go the way of another big cat, the Persian tiger. This close cousin of the Siberian tiger went extinct in Iran 40 years ago. "The decline in the number of these beautiful animals may have stopped," Lewis says. Camera traps show an increase of cubs, and a survey is underway to get a better handle on numbers. Although the animal's fate still hangs in the balance, Lewis says, "I strongly believe that it is not too late to save the Asiatic cheetah." ■



At the northern end of Lake Urmia, Sirous Ebrahimi and his team are watering sand dunes with a bacterial medium that is meant to both stimulate plant growth and form a crust that stabilizes the dunes.

"quadrupled, if not more, water consumption in the region," Sorooshian says.

As the lake receded, winds blew salt onto the surrounding agricultural lands, poisoning the soil. "With agriculture under threat, livelihoods come under threat," says Gary Lewis, who represents UNDP in Iran and is the top U.N. official in the country. "As the sea has dried out, people moved away in the hundreds of thousands." (The same scenario played out at the dying Aral Sea in nearby Central Asia.)

To avoid a human and ecological crisis, Iranians "have to go after low-hanging fruits," such as stemming the diversion of water flowing naturally to the lake, Sorooshian says. Improved irrigation practices could reduce water use by 45% nationwide, easing demands on the lake's tributaries, says Masoud Tajrishy, vice president of research at the Sharif University of Technology in Tehran, which is implementing some of the restoration effort. A tougher task, he says, will be weaning farmers off water-intensive crops.

Equally tough will be deciding what to do about a 15-kilometer-long causeway built 20 years ago across a narrowing in the middle of Lake Urmia. Today, the causeway separates mostly dry lakebed to the south from a relict lake that resembles the Arctic Ocean—cerulean water dotted with what look like ice floes but are in fact islands of salt. "Interrupting the natural circulation had to have an impact" on the lake's resilience, Sorooshian says.

Yet to prevent desertification from taking over the entire lake, engineers are contemplating further barriers to seal off its salvageable arms. Brine shrimp could be revived

inside the embayments, possibly attracting back waterfowl. The strategy has been in use for a century at the Great Salt Lake in Utah. Akhiani and other ecologists vehemently oppose partitioning, however. "We have experienced the impact of the causeway," he says. "We have a saying in Farsi: 'A wise man does not fall in a well twice.'"

At the northern end of Lake Urmia, a man in a straw hat is trying a smaller scale remedy. He is watering a sand dune with a garden hose. Sirous Ebrahimi, an environmental biotechnologist at the Sahand University of Technology in Tabriz, takes a break from this seemingly Sisyphean task to explain. He's spraying a bacterial medium that is meant to stimulate plant growth; it also forms a crust that stabilizes the dune.

Ebrahimi's effort is one of five pilot projects on dune stabilization that are vying for a sizable share of the Urmia restoration funds. Kiumars Pourjebeli, a horticulturist in Jebel village, plucks small purple berries from a bushy plant, *Nitraria schoberi*, clinging to a dune. He is planting the seeds near other, naked dunes. "I'm trying to accelerate the natural process," he says. He offers a berry: "Taste it." It's very salty.

In June, Sorooshian brought over a group of 10 Iranian scientists and water managers for a whirlwind tour of three saline California lakes—the Salton Sea, Mono Lake, and Owens Lake—and the Great Salt Lake. The purpose was to show them "what experiences we have gone through in the western United States. ... Not to say, 'Hey, this is what you have to do,'" says Sorooshian, who is an Iranian-American. He, for one, is not ready to write Urmia's epitaph. "I'm optimistic," he says. "But we don't have much time." ■