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ISSUE BRIEF

Environmental and Wildlife Degradation in Iran

JUNE 2018 DAVID LAYLIN

Environmental degradation has become a major issue in Iran. It is a source of economic hardship, ill health, social disruption, and recent political protests. Climate change has been a factor in this deterioration, but so has mismanagement of the country's once-ample natural resources. It is essential for the government to effectively address these issues, for the sake of Iranians' well-being and the government's own lagging legitimacy.

Before the twentieth century, when Iran's population was less than ten million people, biodiverse ecology was not threatened. Water was plentiful. Diesel- and gasoline-powered water pumps for extracting groundwater had not yet been introduced. Air and water pollution were not yet an issue, nor were dust storms. Agricultural cultivation and livestock-grazing practices had not yet caused significant erosion and desertification.

In 1845, a French colonel named Ferrier, who had served as an adviser to the Iranian army, described wildlife in Khorasan Province as follows: "It is almost impossible to imagine the immense quantities of game we saw…Every variety of partridge is met with on these plains and also the Houbara bustard. The royal tiger is sometimes seen, but the panther [leopard], hyena, wolf, jackal and fox are common. I never before saw such an immense number of deer [gazelle]. The plain was covered with them, each herd consisting of several thousand head."[1]

Even into the twentieth century, the mountains of Iran abounded with wild sheep and goats, the plains with gazelle, and the forested northern slopes of the Alborz Mountains with tigers, red deer, roe deer, bears, boars, leopards, and wolves. The Zagros Mountains were covered with oak trees, and had large populations of wild sheep, wild goats, bears, boars, leopards, and fallow deer. Persian lions also existed on Iran's southern borders through the nineteenth century, and, when migrating, waterfowl darkened

1 Eskandar Firouz, *The Complete Fauna of Iran* (New York: I.B. Tauris, 2005).

the sky from Siberia to Africa and back. In different areas, pheasants, partridges, sand grouses, quail, and bustards abounded.

No organized governmental wildlife-conservation effort existed in Iran until the 1950s. Conservation efforts were sparked by World War II, which brought occupying forces with modern rifles and Jeeps to chase gazelle in the plains, as well as spotlights with which to shoot game at night. Dynamite was introduced to harvest fish. Some Iranian sportsmen became seriously concerned, and persuaded Shah Mohammad Reza Pahlavi to introduce modern concepts of conservation and management for game and fish.

The first effort resulted in the 1957 creation of the Game Council of Iran. This was largely the result of efforts by Manuchehr Riahi, a wealthy businessman, assisted by Prince Abdol Reza, a half-brother of the shah. The public resisted the program, because game, birds, and fish were considered God-given, like air and water, and, thus, not subject to regulation. However, the concept was fully supported by the shah and approved by the parliament.

Initially, the government did not support the Game Council financially; Riahi provided most of the budget, and provincial directors served on a volunteer basis. Riahi, assisted by Eskandar Firouz, managed the council's activities until 1967, when parliament approved the creation of the Game and Fish Department of Iran. At that time, Riahi resigned and Firouz became the director of the new department.

Along with creating a basic administrative structure and promulgating national game and fish regulations, the council established sixteen of Iran's most important wildlife parks and protected areas, which now number more than two hundred. Enforcement of the laws and regulations was strict. As a result, the wildlife populations in these areas increased quickly.

In 1971, the Game and Fish Department was incorporated into the Environmental Conservation Department, which became the Department of the Environment (DOE) in 1974. Its responsibilities basically included all those of the US Fish and Wildlife Service, Environmental Protection Agency, and National Park Service.

During the 1970s, the DOE worked with Colorado State University (CSU) on a variety of conservation issues, including some that had US advisers assisting Iranian personnel in management duties. Aerial census techniques were developed to monitor large animals in the protected areas, and to determine which populations would benefit from culling.

"In the late 1970s, Iran was reputed to have the best wildlife and natural-areas management in Asia, and a program that rivaled European ones."

Hunting Contributed to Conservation

In the late 1960s and 1970s, the DOE—with assistance from the CSU scientists—established quotas for culling excessive game-animal populations in wildlife parks and protected areas. These quotas were divided between local hunters and an outfitting company, Iran Safaris (which later became Iran Shekar), which had an exclusive license to outfit and guide foreign hunters. The hunting programs were of high quality, and Iran developed an excellent reputation among international wildlife conservationists and sport hunters. The company also organized fishing and ecotourism programs.

Foreign sportsmen brought money that helped defray the country's conservation expenses. The meat of harvested animals was given to local villagers, some of whom were also employed by the hunting and other programs. Local Iranian hunters also paid for licenses and per-diem fees to use the protected areas. A game guard accompanied each hunting party. In the late 1970s, Iran was reputed to have the best wildlife and natural-areas management in Asia, and a program that rivaled European ones.

Firouz, the director of DOE, also focused on issues like erosion from uncontrolled rangeland grazing by domestic herds, as well as poor agricultural-cultivation practices. Desertification around the northern (Dasht Kavir) and southern (Dasht Lut) deserts was also a

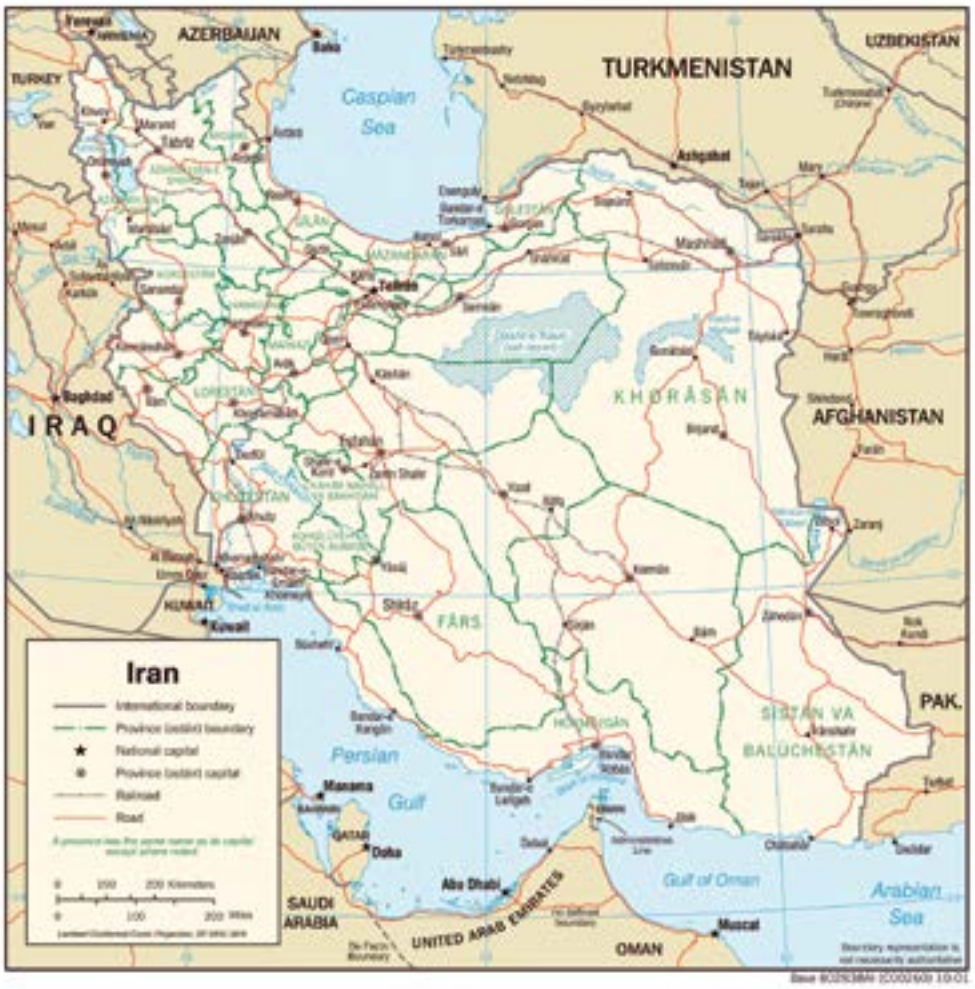


Photo credit: © 2016 Maps of the World | Maps of all regions, countries and territories of the World

source of concern. The increased use of diesel-powered water pumps after World War II depleted underground aquifers at a rate faster than they could be replenished. Many qanats—the famous underground irrigation tunnels that had supported Iranian life for thousands of years—were no longer maintained, and water sources were lost as underground water levels subsided.

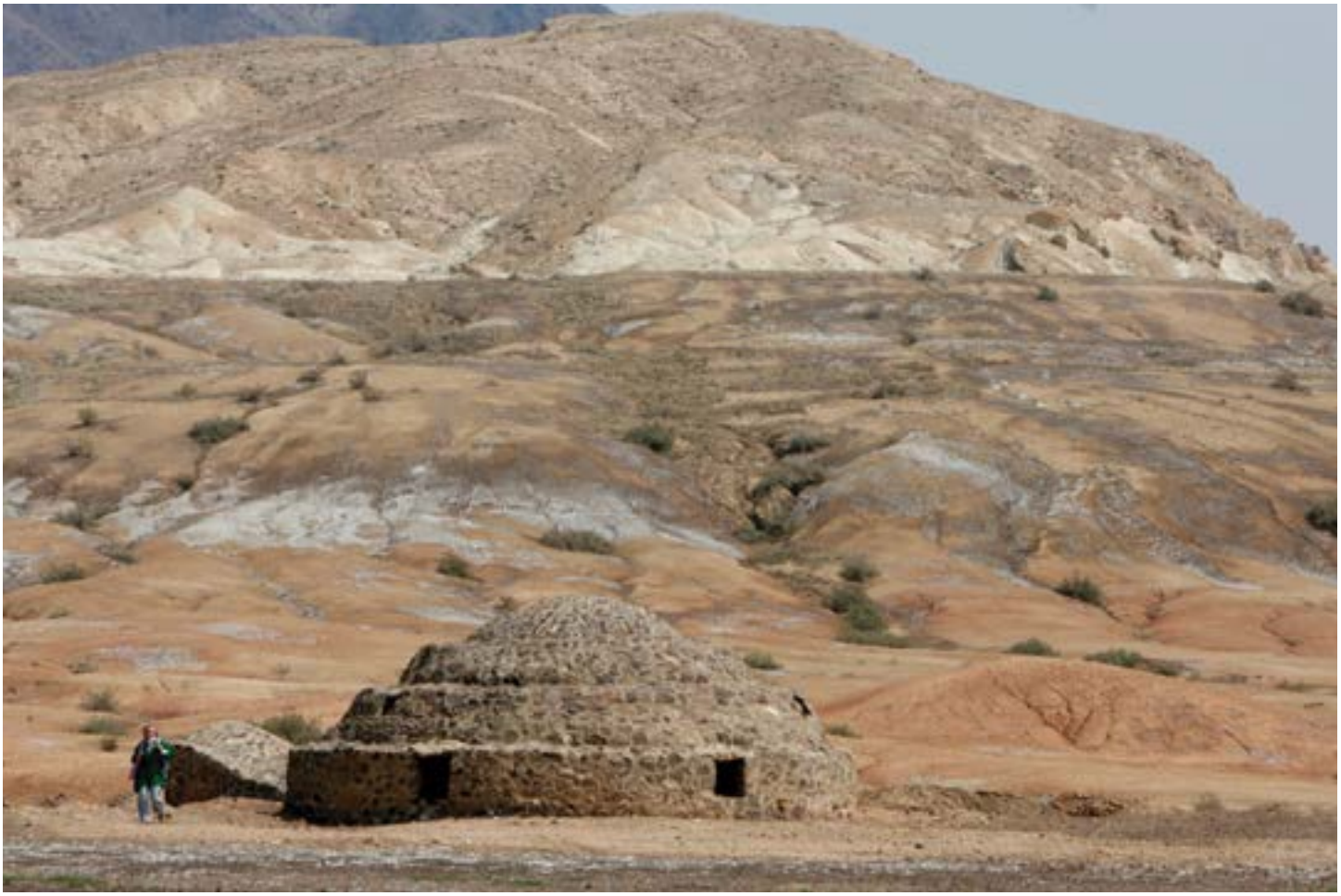
In the industrial sector, factories were built without regard to air and water pollution. Military maneuvers were launched without respect for the integrity of parks and other protected areas. Automobile traffic in Iran's cities increased rapidly, without consideration for air pollution.

Under the direction of Firouz, and with the support of the shah, the DOE attempted to rectify many of these problems. However, there was little public support, and the government's focus was on economic development.

Management Deteriorated after the 1979 Revolution

Following the 1979 Revolution, the competence of the DOE deteriorated. Given Iran's other pressing domestic and regional challenges, the DOE suffered greatly from minimal budgets—and from incompetent, and sometimes corrupt, management.

In general, the government has failed to cooperate sufficiently with the private sector and academia. Iranian universities with wildlife-biology programs teach conservation theory, without regard to conservation management. Thus, wildlife parks and other protected areas, once internationally admired, have deteriorated.



Ancient Ab Anbar (water storage cistern), Dasht-e-Kavir desert. Spring, 2007. Photo credit: David Laylin

Game-animal and bird populations have been decimated. Domestic sheep herds encroach and overgraze, leading to erosion and desertification, decreased soil productivity, and invasion of harmful plant species. Cheetahs, lacking food in the protected areas, are forced to travel long distances, and are killed by trucks and shepherds. Due to the severely diminished herds of game animals, hunting has been banned in protected areas. The result has been to increase poaching. Game guards are paid poorly and late; thus, they are tempted to collude with poachers. The guards also lack insurance given to other law-enforcement officers. So, if one shoots a poacher in self-defense, he will often end up in jail, or may even be executed for not being able to pay compensation—so-called "blood money"—to the victim's relatives.

War Games in "Protected" Areas

Roads have been built throughout the protected areas, sometimes for access to industrial mines, damaging the integrity of once-pristine places. The DOE is unable to block the activities of powerful ministries or the military, which enters and occupies protected areas to conduct war games. One example is the Dasht Kavir Desert National Park, near Varamin, where well-regulated ecotourism to the Qasr Bahram Caravanserai was allowed before the revolution. The cheetahs, goitered gazelles, and onagers that once lived there are now long gone.

Unregulated popular access is also allowed in many protected areas, leading to uncontrolled public interface with wild animals and the dumping of trash. The once-pristine pre-1979 thorn bushes in the Dasht Kavir Park are now covered with plastic bags. Under new management, the DOE has launched a major, and popular, effort to reverse the willful dumping of trash. However, it's a daunting task.

After 1979, the DOE suffered from a series of poorly qualified directors. The government of President Hassan Rouhani, however, has recently appointed more suitable individuals. For some years, Dr. Isa Kalantari, the new

director and a former minister of agriculture, has warned about the existential need to confront poor water-management practices. Masoud Tajrishy and Kaveh Madani, new deputy directors, are experienced and dedicated scientists. (Unfortunately, Madani's ties to Iran's environmentalist movement, and public warnings about Iran's dire water challenges, led to his arrest and coercion by the Islamic Revolutionary Guard Corps (IRGC) security establishment. He left the country in April 2018.) The DOE's budget has recently increased; however, the present focus is less on conservation and wildlife management, and more on ameliorating Iran's severe water shortages, and the challenges from sand and dust storms.

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Water and Air Pollution

Overfishing, oil spills, lack of sewage treatment, pesticide runoff, and accumulated trash and plastics contaminate the once-pristine waters of the Caspian Sea and Persian Gulf.

Throughout Iran, untreated industrial and municipal wastewater and sewage (especially from hospitals) are also polluting land, rivers, and groundwater. Less than 40 percent of the population has access to functional wastewater treatment plants, and the use of bottled water is prevalent. According to recent research, Iran is among the countries that most uses untreated sewage to irrigate agricultural land, thus threatening the health of millions of citizens.[2] This wastewater contains pathogens that may lead to the outbreak of contagious diseases, such as cholera. Although many wastewater plants are planned or under construction, there is a lack of sufficient funding. The unregulated discharge of farming fertilizers and pesticides is an additional source of contamination for surface and groundwater.

Air pollution is also a major challenge for Iran. In 2016, according to the World Bank, the Iranian cities of Zabol, Bushehr, and Ahvaz were among the most polluted in the world.[3] The cost, in terms of human health and economic losses, was then estimated at $13-30 billion per year.

In Tehran, 70–80 percent of air pollution is caused by the transportation sector, with old buses, mini-buses, and trucks accounting for half of it. Iran does not require annual safety and emissions tests.

After the revolution, due in part to US-led sanctions, Iran stopped importing quality gasoline, and instead manufactured its own. Although the national standard for benzene, a known human carcinogen, was supposed to be less than 1 percent by volume, and the sulfur content below twenty parts per million (ppm), in 2013, the Tehran annual Air Quality Report indicated that the benzene content was as high as 2.89 percent, and the sulfur content was two hundred ppm. Fortunately, sanctions were relieved under the Iran nuclear deal; the quality of fuel has improved, and is now closer to European standards.

Accurate macro information regarding Iran's sand and dust storms is not available. However, a March 2017 letter to United Nations (UN) Secretary General Antonio Guterres—co-written by Iranian Foreign Minister Mohammad Javad Zarif and Masoumeh Ebtekar, vice president for Women and Family Affairs and a former head of the DOE—stated, "Estimates indicate that approximately 2.5 million hectares of [sand and dust storm] hotspots are located within Iran, while Iraq alone has an estimated hotspots of about 8 million hectares,

2 "Iran is One of the Five Main Consumers of Untreated Sewage for Irrigation of Farms," *Radio Zamaneh*, March 2018, www.radiozamaneh.com/387824.

3 Amin Mohseni-Cheraghlou, "Clearing the air pollution in Iran," *World Bank* (blog), February 26, 2018, http://blogs.worldbank.org/arabvoices/clearing-air-pollution-iran.

topped with similar order of magnitude from other states in and around the Persian Gulf region."[4]

Sand and dust storms (SDS) in the Middle East originate in the Sahara Desert. Westerly winds pick up more sand and dust in Syria and Iraq, before reaching Iran. Iran itself is 90 percent arid or semi-arid, which abets SDS. The mostly dried-out Lake Urumieh—once the biggest lake in the Middle East—and many now-dry wetlands have also contributed to SDS. The storms are often composed of fine particulate matter that causes cardiopulmonary disease. Currently, more than 50 percent of yearly deaths in Iran are caused by some kind of cardiovascular disease.[5]

Throughout Iran, extensive overgrazing by livestock and inefficient farming have led to erosion, desertification, and SDS. Soil erosion in Iran is reported to be 2.5 times the world average.[6]

In eastern Sistan-Balochistan Province, winds of 60–100 kilometers per hour blow for up to five months a year, carrying dust and sand to the provincial capital, Zabol, as well as southwest Afghanistan and western Pakistan. In 2017, these dust storms—following the transfer of Helmand River water from the original Hamoun wetlands to four man-made reservoirs—caused Zabol to be named the most polluted city in the world.[7] In May 2016, the World Health Organization released a report that Zabol had the world's worst air pollution (measured by particulate matter under 2.5 micrograms; in Zabol, it was 217 micrograms per cubic meter). According to a local authority, some 650,000 people have migrated out of the area since 2000.[8]

The southwestern province of Khuzestan is especially prone to SDS. The *Tehran Times*, covering a strong storm that hit the province in February 2018, noted that, "the concentration of the fine particles astonishingly went beyond dangerous level of 9,000 micrograms per cubic meter while according to the United States Environmental Protection Agency, the short-term [daily] standard is 35 micrograms per cubic meter of air."[9] According to the World Health Organization, the provincial capital of Ahvaz is one of the world's most polluted cities. For much of the year, yellow smog covers the city, sending residents to hospitals with cardiopulmonary issues.

DOE Director Kalantari has stated that Khuzestan's SDS problems could be dealt with over a period of three years. However, government programs don't sufficiently address the challenge of internal causes, nor SDS coming from west of Iran. Some mitigation efforts have been made, such as the planting of soil-stabilizing mesquite forests west of the Karkheh River and some restoration of the huge Hour al Azim wetland area shared with Iraq. However, the local population doubts that the government has the political will and resources to deal with this problem.

> "Forests covered some nineteen million hectares of Iran in 1900, according to the Statistical Center of Iran, but shrank to 14.4 million by 2012."

4 "Iran Asks UN for Regional Forum on Particulates," *Press TV*, March 5, 2017, http://www.presstv.com/Detail/2017/03/05/513075/Iran-UN-Guterres-Turkey-Iraq-Syria.

5 "Main Causes of Mortality in Tehran," *Financial Tribune*, May 3, 2017, https://financialtribune.com/articles/people/63560/main-causes-of-mortality-in-tehran.

6 "Soil Erosion in Iran 2.5 Times the World Average," *Tehran Times*, November 11, 2017, http://www.tehrantimes.com/news/418381/Soil-erosion-in-Iran-2-5-times-the-world-average.

7 Ada Carr, "World's Most Polluted City Is No Longer in India or China," Weather Channel, October 24, 2017, https://weather.com/science/environment/news/2017-10-23-pollution-zabol-iran-most-polluted-ambient-air-diseases-deaths.

8 "How Iran's Khuzestan Went from Wetland to Wasteland," *Guardian*, April 16, 2015, www.theguardian.com/world/iran-blog/2015/apr/16/iran-khuzestan-environment-wetlands-dust-pollution.

9 "Soil Erosion in Iran 2.5 Times the World Average," *Tehran Times.*

Foraging after a dust/sand storm, near Zabol, Sistan. Spring 2013. Photo credit: David Laylin

Deforestation

Forests covered some nineteen million hectares of Iran in 1900, according to the Statistical Center of Iran, but shrank to 14.4 million by 2012. By 2015, the total forested area of Iran was reduced to 10.7 million hectares, according to the Trading Economics Company, an estimated loss of 43 percent since 1900.[10] Most of the remaining forested area is in the Alborz Mountains near the Caspian Sea, and in the Zagros Mountains.

Present-day Iran has hardly any virgin forests left. The millennia-old human impact on the natural environment—population growth, appropriation of land for agriculture, exploitation of forests by nomads, and increasing demand for wood as construction material or as firewood—has destroyed or depleted the country's forest resources.

During the Pahlavi era (1925–1979), the development of agriculture was especially harmful to forest cover. In Khuzestan Province, much forested land was cleared to grow tobacco, opium, and sugar cane. In Gilan, forests were cut down to allow for production of tea, rice, and tobacco. The similar exploitation of forested lands in Mazanderan destroyed the habitat of the Iranian tiger, last seen in the 1950s.

Since the revolution, Iran's forests have been the victims of increased depredation. About one million hectares of the ecologically rich Zagros forests have been lost to climate change, according to the deputy head of Iran's Forests, Range and Watershed Management Organization.[11]

Government agencies responsible for enforcing laws and regulations regarding forested areas are weak and

10 Trading Economics, "Iran—Forest Area (% of Land Area)," tradingeconomics.com/iran/forest-area-percent-of-land-area-wb-data.html.

11 "1m Hectares of Zagros Forests Lost in 10 Years," *Financial Tribune*, May 2, 2017, https://financialtribune.com/articles/environment/63473/1m-hectares-of-zagros-forests-lost-in-10-years.

Dried out Lake Bakhtegan 160 Km. east of Shiraz. With former surface area of 3,500 square kilometers, it was Iran's second largest lake. Spring, 2008. Photo credit: David Laylin

underfunded. Individuals cut trees at will, and sometimes start forest fires to create more cultivable land. According to the Center for International Forestry Research, "Excessive clearing or thinning of forests can destabilize the world's climate by releasing into the atmosphere millions of tons of greenhouse gasses normally stored in wood in the form of carbon. This can damage the atmosphere and lead to global warming and eventually climate change. By storing carbon, forests provide a major environmental benefit by reducing global warming."[12]

Wetlands

Iran possesses more than one thousand wetlands, twenty-four of which are Ramsar Convention-designated sites, and approximately ninety of which are considered important enough to have some kind of national or international protection. Wetlands are a critical component of any ecosystem, providing very important environmental, social, and economic services. Efforts are being made to address wetland degradation, notably regarding Lake Urmieh, but Deputy DOE Chief Tajrishy said, "some 18 wetlands in Iran are completely dried up and some 24 are in critical condition."[13]

Water Resource Issues

According to the UN's Food and Agriculture Organization, Iran's total long-term renewable water resources are estimated at 137.5 cubic kilometers.[14] Over thirty-five years before 2016, rainfall in Iran has shown a slight negative trend, according to the satellite-assisted historical measurements of the University of California–

12 Center for International Forestry Research Factsheet, "Deforestation and Degradation," http://www.cifor.org/Publications/Corporate/FactSheet/degradation.htm.

13 "18 Wetlands Totally Drained in Iran: Deputy Environment Chief," *Tehran Times*, April 21, 2018, www.tehrantimes.com/news/422839/18-wetlands-totally-drained-in-Iran-deputy-environment-chief.

14 AQUASTAT, "Irrigation in the Middle East Region in Figures," 2008, http://www.fao.org/nr/water/aquastat/countries_regions/IRN/IRN-CP_eng.pdf.

Irvine, but nothing statistically significant. The reasons for perceived water shortages in Iran have more to do with a growing population, poor agricultural practices, and incompetent water-resource management.

Since 1979, Iran's population has doubled, to more than eighty million people. This population also enjoys a better diet than before the revolution, including increased consumption of water-intensive meat and dairy products.

Due, in part, to economic sanctions imposed on the country, the Iranian government has pushed for greater self-sufficiency in food supply. Farmers have been encouraged to maximize production, and have been supplied with inexpensive water and electricity. In arid areas, no serious government effort has been made to stop farmers from growing water-intensive crops, such as rice and corn.

"An estimated 70 percent of the groundwater has been extracted, and what remains is often brackish, or worse."

According to official statistics, some 750,000 deep wells are now operational in Iran, 330,000 of which are illegal.[15] An estimated 70 percent of the groundwater has been extracted, and what remains is often brackish, or worse. For example, significant areas in Kerman Province that once produced substantial numbers of pistachios and dates can no longer grow those crops.

According to the *Iran Student News Agency*, Iran is using 92 percent of its total renewable freshwater resources, far above the upper limit of 40 percent recommended by international norms. More than 90 percent is used by the agricultural sector, at an efficiency rate of 30–35 percent, compared to a global efficiency rate of 75 percent.[16] Also, most farmers still use flood irrigation during the day, when evaporation is greatest.

Qanats, the underground water canals that have existed in Iran since the first millennium BC, are very efficient in minimizing evaporation. In the mid-twentieth century, an estimated fifty thousand were in use in Iran; as of 2015, only thirty-seven thousand remained.[17]

Iran is also suffering the consequences of having overconstructed dams, some of which have wrongly redirected rivers and contributed to significant environmental damage. For example, the Gotvand dam in Khuzestan was built in salt hills. As a result, the water that now flows from it into the Karun—Iran's longest river—is saline, and has damaged much habitat.

Before the revolution, the country had seven ancient dams and fourteen modern ones. Since 1979, Iran has built about six hundred dams of various kinds and sizes. Many more were planned when Rouhani became president in 2013 and called a halt to all dam-construction projects. Despite that, since his inauguration, different government officials have announced plans to inaugurate thirteen new dams.[18] Environmentalists have called for some five hundred dams to be decommissioned, as dams have contributed to significant environmental damage.

Floods are also a serious problem in Iran. Deterioration of forest cover and overgrazing of rangelands have deprived vast areas of stabilizing vegetation that would otherwise have absorbed moisture and allowed replenishment of groundwater. In addition, climate warming has led to heavier downfalls, delivering more concentrated rainfall.

Given the arid nature of much of their country, and their love of traditional Persian gardens, Iranians are extremely fond of aesthetic uses of water in municipal

15 National Groundwater Association, *Facts About Global SM Groundwater Usage* (Westerville, Ohio: NGWA, 2016), www.ngwa.org/Fundamentals/Documents/global-groundwater-use-fact-sheet.pdf.

16 "FAO Calls for Urgent Action to Prevent Irreversible Groundwater Depletion," *Iran Student News Agency,* April 20, 2015, https://en.isna.ir/news/94013112731/FAO-calls-for-urgent-action-to-prevent-irreversible-groundwater.

17 "37,000 Qanats Still in Use Across Iran," *Tehran Times*, November 4, 2017, http://www.tehrantimes.com/news/418198/37-000-qanats-still-in-use-across-Iran.

18 "Proposals of the Minister of Energy for the New Year," ISNA News Agency, March 30, 2018.

parks and personal gardens. Ornamental water use varies per city, but a short visit to any of the cities south of the Alborz Mountains will reveal the extravagant use of water. In Isfahan, for example, the Zayanderud River is dry, but expansive gardens and parks along both sides of the river are perennially lush.

Because water for personal use is very inexpensive in urban areas, Iranians are profligate in its use. For example, the average Tehran resident uses three hundred and twenty-five liters of water (eighty-six gallons) per day. Tap water consumption in the country is 70 percent above the global average.[19]

More than 14 percent of water is wasted due to old, eroded pipelines, according to Deputy Minister of Energy Alireza Daemi.[20] He added that Iran has already used or committed 90 percent of its natural water resources, and that "unconventional means" (such as recycled waste and desalinated water) must be found to supply ever-increasing water demand.

Evaporation is also a major problem. Some 68 percent of Iran's average annual rainfall volume evaporates before reaching rivers.[21] More is lost from wetlands, lakes, rivers, and reservoirs, and from poor irrigation practices.

In general, as in the western United States during the nineteenth and twentieth centuries, groundwater in Iran has been willfully and abusively depleted. Also, surface water has been diverted to go where people want it, rather than allowed to flow as directed by millions of years of natural evolution.

Dislocation of Rural Populations

Drought and abysmal resource management have caused a disastrous situation for much of Iran. Rural farmers and smallholders can no longer make a living from the land due to lack of water, and have migrated to cities in the hope of a better life.

Rural populations are closely bound by religion, intermarriage, and common local interests. However, once this social "glue" governing behavior and interaction is dissolved by migration to the periphery of big cities, one ends up with a homeless, unemployed, highly dependent population. Ethical and moral standards tend to decline, developing a dog-eat-dog culture that fosters crime, disease, and prostitution.

According to the chairman of the parliament's social commission, about 35 percent of the population lives in impromptu settlements.[22] Around Tehran, more than sixty rural areas have become towns/cities and some, including Qarchak and Varamin, may soon become provinces. Many of these areas lack basic urban services, as well as employment opportunities. One consequence will be the further marginalization of these populations, exacerbating existing social problems with no ready solutions.

"Over time—given proper conservation and management programs—the flora and fauna of the parks and other protected areas, including rivers and wetlands, can rejuvenate."

What Can be Done to Address These Challenges?

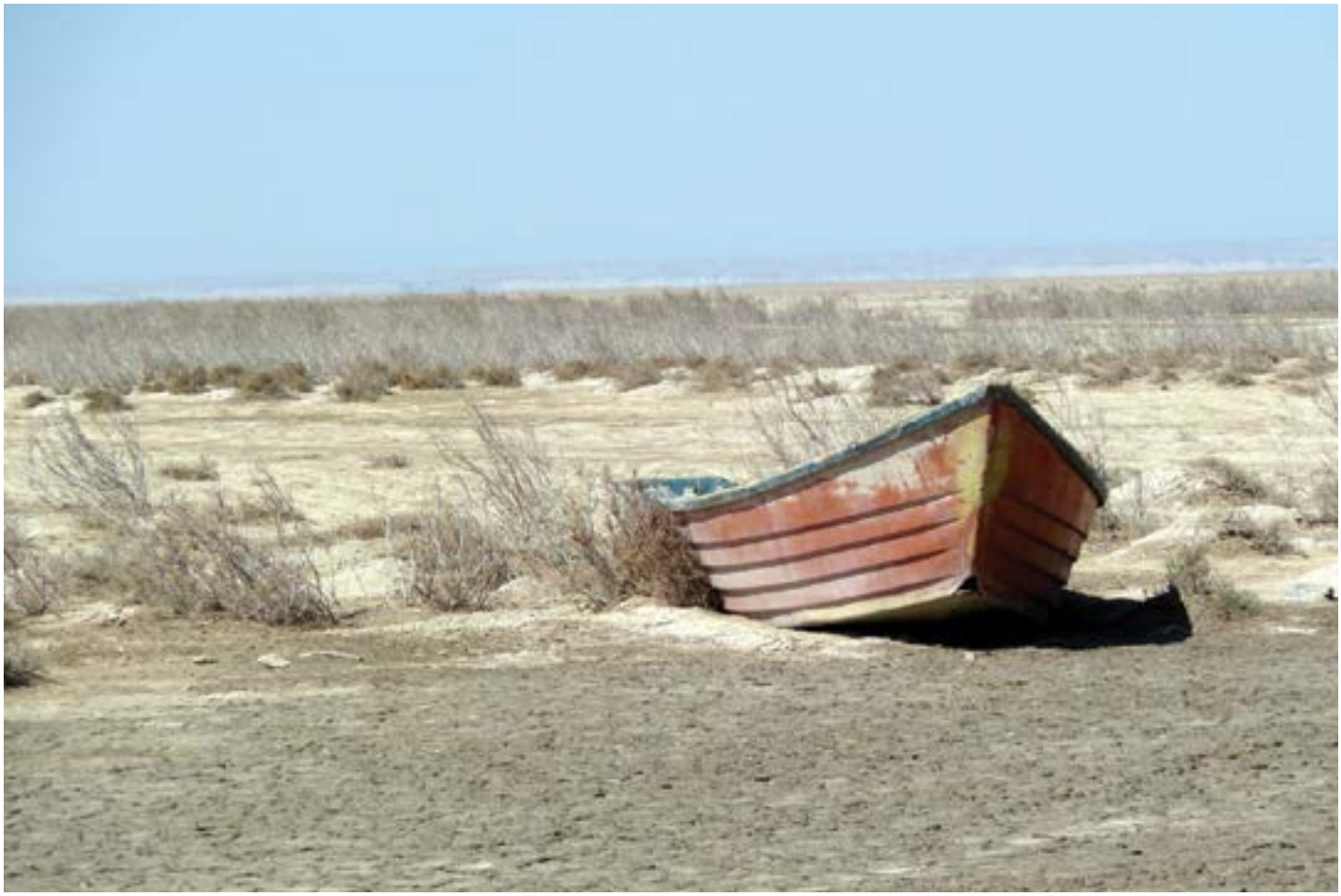
The environmental situation in Iran is dire, but not hopeless. Over time—given proper conservation and management programs—the flora and fauna of the parks and other protected areas, including rivers and

19 Bijan Rouhani and Fatema Soudavar Farmanfarmaian, "Iran's Imperiled Environment," *Payvand*, January 2014, www.payvand.com/news/14/mar/1025.html.

20 "Water Consumption Near Full Capacity," *Financial Tribune,* January 17, 2017, https://financialtribune.com/articles/environment/57556/water-consumption-near-full-capacity.

21 Fanack Water, "Water Resources and Quality in Iran," December 21, 2016, water.fanack.com/iran/water-resources-in-iran/.

22 "35% of the Population Marginalized," *IRIB News Agency*, October 28, 2017, www.iribnews.ir/fa/news/1581533/35.



The dried out Saberi Hamoun wetland, Sistani, Iran. Spring 2014. Photo credit: David Laylin

wetlands, can rejuvenate. As an immediate step, the DOE could reduce the number or size of protected areas that are no longer viable because of insufficient water or food. Domestic livestock should be removed, as overgrazing has damaged rangelands and led to floods and desertification. The government should also reduce the size of free-range herds, and import meat as required.

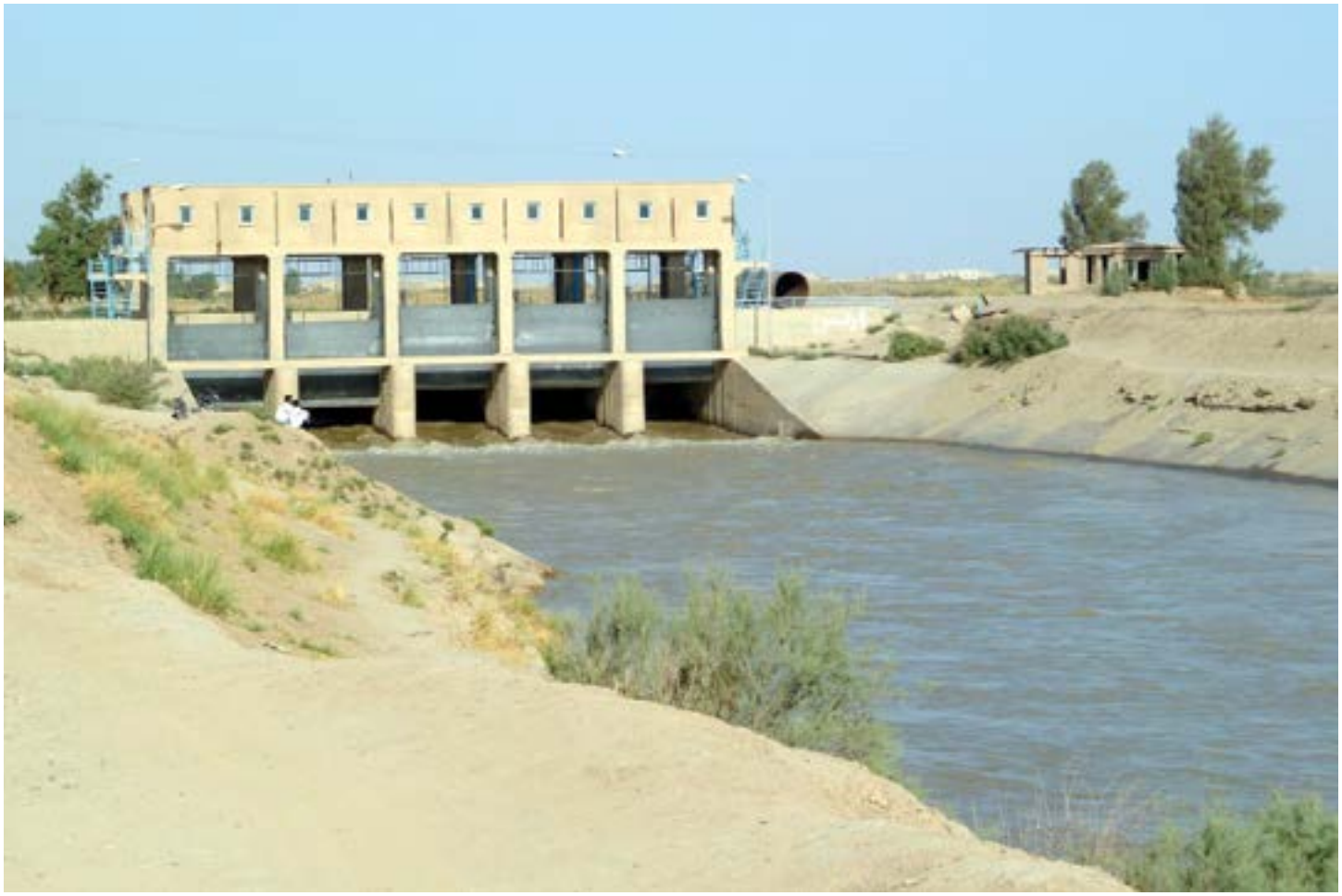
To deal with the dislocation of farming families, the government can work with village cooperatives to restore groundwater, reverse desertification, and develop sensible agricultural practices.

Iran has a large number of highly qualified scientists in all the pertinent environmental disciplines. However, an insufficient percentage of top policy makers is committed to making the political and financial decisions required at the government level. Clearly, Iran's leaders need to reach a consensus regarding environmental redevelopment and must adopt and implement appropriate action plans.

Public information and motivational programs are also essential. After decades of uncontrolled water and energy consumption, the general population is not sufficiently educated, or motivated, to properly cooperate with environmental-restoration programs. In general practice, simple programs for recycling, or limiting energy and water use, do not currently exist.

One must understand that water occupies a special place in Islam. The word is mentioned sixty-three times in the *Quran*. Muslims believe that water is a "gift from God" and most Iranians feel that it should be free. That state of mind makes it difficult for municipal and rural governments to charge enough to cover the cost of supplying water. Charging for industrial and agricultural use is now better understood. This practice is being gradually introduced, but is not yet nearly enough to cover costs.

Despite the role of dams in causing environmental damage, it is politically difficult to reverse more than forty years of dam-building projects—such as those responsible for the tragedy of Lake Urmieh, and the dams that



Entry to Iran of Helmand/Hirmand river. Near Zabol. Spring 2013. Photo credit: David Laylin

have diverted Karun River water from Khuzestan to the Zayanderud for use by the homes, gardens, farms, and factories of Iran's central plateau.

As part of a nationwide redevelopment plan, Iran's government should decide which agricultural and other products are most economically imported, rather than homegrown. Current practices are inefficient and expensive.

International Cooperation

Much cooperation has occurred between Iranian ministries and UN agencies such as the UN Development Program (UNDP), the UN Environmental Program, and the Food and Agriculture Organization—and this cooperation should increase. Studies, conferences, and pilot projects can pave the way for more sustainable and pro-environment development and redevelopment programs.

The UNDP has helped create several nongovernmental organizations (NGOs) in Iran, including the Conservation of Asiatic Cheetah Program. Unfortunately, the UNDP has discontinued its financial assistance, and it does not appear that the project will succeed in safeguarding this endangered species.

A second joint venture between UNDP and the DOE is the Conservation of Iranian Wetlands Program, which was created to work with village cooperatives and train farmers in modern irrigation and crop-selection practices. It had a successful program with the farmers around Lake Parishan, southwest of Shiraz, and was awarded $3 million by the Japanese government to work with rural cooperatives around Lake Urmieh.

The Middle East and North Africa Regional Integrated Development program (MENARID) has worked with Iran's Agriculture Ministry's Forests, Rangeland and Watershed Organization (FRWO) to rehabilitate forty thousand hectares of land at four demonstration sites, and two hundred and sixty thousand hectares at two replication sites in northwest Iran. Qanats were revived, and modern irrigation practices were also introduced.

In June 2017, UNDP and FRWO signed a five-year memorandum of understanding to scale up and replicate these programs in other areas.

Until 2005, the World Bank Group was active in Iran, with commitments of more than $1.1 billion, including land- and water-management programs in the Alborz Mountains region. However, the bank has not been able to initiate new programs, due to US sanctions, which forbid US support for multinational lending to Iran.

"Starting in 2006, the United States and Iran have implemented thirty important scientific-exchange programs, including several that deal with water use."

Starting in 2006, the United States and Iran have implemented thirty important scientific-exchange programs, including several that deal with water use. Unfortunately, exchanges have dwindled recently, because of stringent new visa restrictions imposed by the Donald Trump administration and other political tensions between the two governments.

During the past decade, with some UN and other foreign support, the Iranian government has authorized the making of a number of documentary films that have been shown on national television. These films have educated Iran's population about the country's great and diverse natural beauty, and the threats to it from human activity. This has resulted in a surge of interest, indignation, and protests. Environmental-education classes have been introduced in schools, and should be expanded. Reaching the minds of young children is particularly important. The DOE's recently departed deputy director was very active in promoting such public education. One can hope that more such government activities will follow.

Private-Sector and NGO Involvement

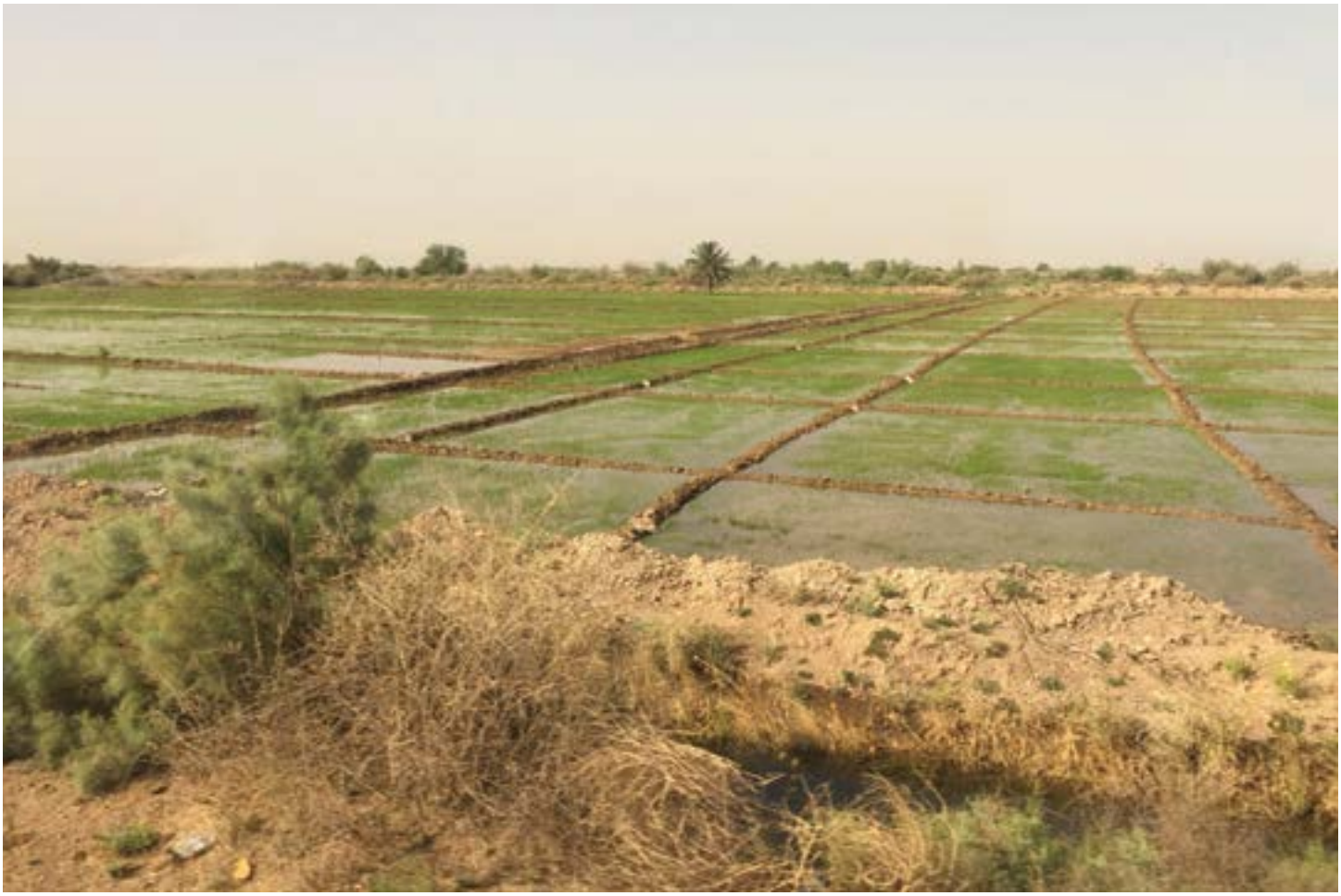
One result of the growing popular concern regarding Iran's environmental challenges has been the creation of new governmental agencies and institutes, private NGOs, and environmental-news entities. Earthdirectory.net/Iran lists some thirty national NGOs. In addition, many smaller ones exist, and are also very active. Government programs are often most successfully implemented by using the services of NGOs; contracts between government entities and NGOs result in less corruption and more efficiency.

The Persian Wildlife Heritage Foundation (PWHF) is among the most successful wildlife-conservation NGOs. Founded a decade ago by hunters-turned-conservationists, the PWHF focuses on wildlife conservation in the wildlife parks and other protected areas, in cooperation with the DOE. Its mission is to "protect endangered species of Iran by collaborating with all conservation groups and environmental organizations." The organization focuses on habitat as key to biodiversity, and conducts field research to determine the conditions of vulnerable species. It also seeks cooperation from commercial ventures and input from universities, research organizations, and the scientific community.[23]

PWHF's accomplishments have attracted considerable financial support, which has helped it better assist the work of the DOE. It has developed relationships with foreign conservation-oriented entities—such as the National Geographic Society, PANTHERA, and the Wildlife Conservation Society—and helps individual foreign wildlife experts interested in conducting studies in Iran.

Unfortunately, PWHF's success has attracted unwarranted attention from some individuals and entities that are ignorant of the excellence and importance of its work, and suspicious of its motives. In January 2018, the Intelligence Branch of Iran's Islamic Revolutionary Guard Corps arrested and jailed PWHF's principal officers and six employees. The former chief executive officer of the

23 Persian Wildlife Heritage Foundation, http://persianwildlife.org/en/how-we-work.



Traditional flood irrigation. (Exacerbates evaporation.) Near Ahwaz, Khuzestan, Spring, 2017. Photo credit: David Laylin

organization, Dr. Kavous Seyyed Emami, died in prison while under interrogation and, as of this writing, seven others remain in jail.[24] This is appalling on many levels. Aside from the fact that these individuals are innocent of wrongdoing, Iran badly needs the assistance of such competent and dedicated environmentalists. In addition, as long as Iran treats its own scientists in this manner, other countries and international institutions will be reluctant to cooperate with its government.

Conclusion

Iran was once home to a wide range of animal and plant life, and its wetlands played host to great numbers of birds migrating to and from Siberia, India, and Africa.

It is popular to say that it is never too late to reverse degradation and restore the natural bounty that once existed. That hoped-for outcome, however, is unlikely to apply to Iran.

Despite the pledges of the current government, international offers of assistance, and the deep dismay of the general population, Iran's decision makers are too focused on political and short-term economic issues to appreciate the unsustainability of the abuse to which the country's environment and ecology have been subjected. To paraphrase the US cowboy philosopher, Will Rogers, everybody is talking about the environment, but nobody is doing enough about it.

David Laylin is an ecologist with extensive personal ties and experience in rural Iran including both before and after the 1979 Revolution.

24 Thomas Erdbrink, "Iran Finally Let Her See Her Husband. He Was Dead," *New York Times,* February 22, 2018, https://www.nytimes.com/2018/02/22/world/middleeast/kavous-seyed-emami-iranian-environmentalist-evin-prison.html.

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1030 15th Street, NW, 12th Floor,
Washington, DC 20005

(202) 463-7226, www.AtlanticCouncil.org