

Rohan Freedman
Cape Elizabeth High School
Cape Elizabeth, ME
Iran, Factor 2: Water Scarcity

Iran: Securing Water and Revitalizing the Agricultural Sector Through the Improvement of Irrigation Efficiency

With a long history of agriculture dating back to 10,000 BCE, the Islamic Republic of Iran was historically known as a primarily agricultural nation (“ĀBYĀRĪ”). However, the nation of Iran was transformed in the 20th century by the discovery of oil, resulting in rapid urbanization and sadly, losing its agricultural identity. Before the discovery of oil in 1955, 75% of Iran’s population lived in rural areas (Kent). After 1955, as foreign exchange revenues from oil boomed, subsidizing food, public education, health care, and water, investments in agriculture did not keep pace, causing a decline in agricultural production and contribution to the GDP (“Iran”). As a result, in a rapid reversal, 75% of Iran’s population now lives in urban areas (Kent). This national movement of people to towns and cities in search of employment opportunities has had negative ramifications on agriculture, such as: a significantly smaller agricultural workforce, a decrease in crop production, and a decrease in investment in agricultural technologies. Iran is losing its agricultural sector, and with it, its self-sufficiency in food production. This does not bode well in today’s changing world where oil consumption and prices are rapidly falling as the world moves toward greener energy sources. Iran has survived thus far, as a net importer of foods, providing for its people by subsidizing imported foods with oil revenues. However, climate change has made reliable imports from trading partners, Russia and India, unpredictable, as these countries suffer droughts and cut exports (“The Family”). The capital Iran generates from oil revenues is short-lived and not sustainable in the long term. It is imperative that Iran is cognizant of this and takes concrete steps to become self sufficient in agriculture, growing the food needed to feed its citizens. Iran must rebuild its agricultural sector and move towards being a net exporter. In the last few decades farming has become something of the past in Iran. The farming techniques that were historically passed down from fathers to sons in ancient farming families have dissipated. This had been compounded by harsh international sanctions since 1980 that have hindered foreign investment and expertise in Iran’s agricultural sector (“ĀBYĀRĪ”). The agricultural crisis has been further exacerbated by a severe water crisis sweeping the nation. This water crisis stems from both man-made and natural causes: excessive damming, inefficient irrigation practices, wasteful water consumption, climate change, drought, and desertification of land. All of these challenges have culminated in making farming in Iran a challenging, unreliable, and unattractive career for its citizens, the majority of whom are under 30 years of age (“Iran”). Iran must revive its once vast agricultural sector to achieve self sufficiency and food security through incentivizing citizens to de-urbanize and take up farming, educating farmers on modern techniques that are efficient and profitable, and addressing the water crisis through the use of drip irrigation systems. A thriving agricultural sector that comprehends a warmer planet and the need to conserve water with efficient irrigation techniques will bring prosperity and self-reliance to the Iranian citizens, thereby reducing their current reliance on subsidies from falling oil revenues.

Today, Iran is the second largest country in the Middle East, and has a population of 79 million people (“Iran Profile”). Efficiently feeding this population is problematic, however, as only 10% of Iran’s land is arable; 90% of the land is arid or semi-arid encompassing wasteland and mountains (“Iran”). The average rainfall is 240mm a year. 30% of the population works in the agricultural sector, however, the revenue generated is only 10% of the national GDP (“Iran Profile”). The agricultural sector produces wheat, rice, barley, dates, figs, walnuts, cotton, sugar cane, tea and potatoes. The majority of farms are less than 10 hectares, which is considerably small, and is the reason why the agricultural sector is unable to take advantage of the economies of scale (“The Family”). Additionally, most farms do not function on full capacity and water is wasted as the majority of irrigational practices consist of flooding fields and crops

despite this being unnecessary. Iran's recent history has also been turbulent and not conducive to growing the economy and consequently the agricultural sector. The 1979 revolution and ouster of the Shah of Iran, followed by the 1981-1988 war with Iraq, and finally the international sanctions imposed by the western countries have all led to lackluster development with little to no innovation and research in advancing irrigation systems ("Iran"). This kind of innovation is what Iran is so desperately in need of, because the agricultural sector consumes a total of 90% of Iran's total water supply and it can easily be made more efficient to save water for farmers, food, and most importantly the citizens of Iran (Bengali).

With the collapse of the agricultural sector as well as the urbanization of the population, the average Iranian diet has also changed. Before, the Iranian diet was healthier and more crop-based, consisting of wheat, rice, fruits, and vegetables. Now, the most popular food is cereal and due to the population shift from rural to urban areas, the average diet increasingly consists of cheap fast food that is not crop based leading to higher rates of obesity and malnutrition, putting a greater stress on the healthcare system ("The Family"). High unemployment and inflation combined with the restrictive sanctions have caused food prices to skyrocket, forcing people to buy cheap food. Fortunately, Iran has a robust health care system with more than 80% of the population being covered by a heavily subsidised primary health care system ("Iran's Excellent"). At the national level, the average energy and protein intakes are higher than the respective recommended dietary allowances (RDAs). In addition, 20% of the citizens have low food intake, 40% overeat and are at risk of chronic nutritional diseases, the remaining 20% having an ideal recommended diet (Heslot). The average proportions of dietary intake in Iran is as follows: 11% comes from protein, 22% consumed is fat and 67% is from carbohydrates (Heslot). Iranian society is patriarchal, emphasizing strong familial bonds, and shariah law governs family and state affairs. In Iranian society, family is the most important bond in one's life, and the average family size is 4-5 people with 71% of all households consisting of parents with children ("Iran Profile"). Iran has a highly educated population with the majority of citizens having easy access to education as all public schools are free and mandatory up until 9th grade, leading Iran to have one of the highest literacy rates amongst developing nations. Iran's adult literacy rate is 84.6%, compared to worldwide which is 85%, and neighboring Arab states standing at 78% ("Education"). Even more amazing, the literacy rate amongst citizens between the age of 15-24 is 98% ("Education")! An educated population is a great asset that Iran can leverage to raise awareness about the dearth of water and to encourage the population to research new technologies and solutions that could alleviate the water crisis and revive agricultural production.

Shockingly, the water necessary to feed livestock and produce crops has largely contributed to the shortage of water, because it takes a gargantuan amount of water to sustain an efficient farm. As explained by English environmentalist Fred Pearce, in *When The Rivers Run Dry*, some farms can use nearly 265 gallons of water everyday (Pearce 23). This is because the amount of water needed for the production of food is so great. "It takes 250-650 gallons of water to grow one pound of rice, 130 gallons for wheat, and 65 for potatoes" (Pearce 22). Thus with a finite amount of water in Iran, it is crucial water is consumed diligently and not used to support crops that are water intensive. The problem is, though, Iran cannot achieve food security if it limits the amount of water used by farmers. Farmers also cannot use rainwater, as rain patterns don't occur frequently enough (Ames). It is truly evident how many different factors are driving this water crisis, and with much research, it seems that all factors boil down to one: the inefficient use of water in the agricultural sector. Plants are flooded, irrigation systems and sprinklers spray to areas that don't need water, and subsidized water has lead many farmers to believe there is an infinite amount of water because it is cheap (Moghtader). Water is being wasted and it is the key problem that has manifested as this acute water shortage.

The ramifications of this water crisis are causing citizens experiencing agricultural loss to be unable to produce significant food for both consumption and profit (Madani). Lakes and rivers are drying up, water resources are becoming scarce, and water sources are increasingly contaminated. For example, Iran's largest lake, Lake Urmia, has decreased to 10% of it's original size due to drought (Pearce 30). This is

becoming a ubiquitous problem as bodies of waters are drying up throughout the nation (“People”). At this rate, the water scarcity is projected to destroy farmland and crop production to a point that will trigger another crisis: the inability to achieve food security. Even more alarming, in the words of British researcher, Fred Pearce, “...nearly 5 million farmers and families have lost their livelihoods and have fled their land in search of a life with sustainable vital resources such as, water” (Pearce 33). This truly illustrates the severity of this problem, and highlights the sheer number of people losing their homelands. Innocent farmers and their families are losing the lives they have worked so hard to create, in the pursuit of survival.

Large population growth into urban areas from rural has exacerbated the effects of this crisis, as it has offset the supply and demand of water. For example, Middle Eastern health analyst Alexandra Barton explains that, “Eight Iranian cities have a population of greater than 1 million while the population in the metropolitan Tehran has surpassed 14 million (18% of the country’s population), despite its limited access to water resources” (Barton). Amazingly enough, since 1979, Iran's population has doubled (Pearce 11). This rising population raises demand putting stress on the supply of necessities such as water. The primary reason why people are transitioning from rural farmland to urban cities is because they are in search of a stable income which they cannot find as farmers in rural areas because of the impact of limited water on agricultural production. Most of the urban dwellers are farmers whose land was destroyed by the water crisis. Al Jazeera estimates that the total water consumption in Iran is annually increasing at a rate of 7% (“People”). At these rates the demand for water will reach dangerous levels that will be almost impossible to meet with the current supply of water. The farmers who move from rural to urban areas need access to basic necessities such as water, and are creating yet another problem in that they are messing with the distribution of water in urban areas. Without a doubt recent population growth and movement of people has put a burden on the entire supply of water for the nation of Iran. Despite these facts, there has not been much improvement or even effective implementation. That is why this statement from the Vice President of Iran, Eshaq Jahangiri, could not be more pertinent to the current situation, expressing simply but so correctly that, “it is crucial we must change the water consumption patterns in order to fix this crisis (Pearce 40).”

In addition, desertification is sweeping the nation, driving farmers to move to cities and other urban areas because of drought, poor agricultural planning, and a warming planet drying out their farmland. Much of the land that is used for producing food is increasingly becoming arid desert. If this continues we will be in the midst of not only a water crisis but also a food crisis (Barton). Many farmers are even turning to the resources that groundwater tapping has to offer (where fresh water is often held in soil or in pores of rock.) However, as British scientist, Peter Schwartzstein explains it, “groundwater will run out within 13 years, as salt seeps into the soil and the water table tumbles (Ames).” The statistics are harrowing. Farms need water, and there simply is an insufficient amount in this region. In Iran, only one third of the farms receive sufficient water supplies needed for irrigation. This is the most crucial problem, because without land available for cultivation, there will be no farms, without farms there will be no food, thus, without diligent quick planning both long-term and short-term wise, the effects of this crisis could be egregious.

The agricultural economy of Iran is failing and will continue to depreciate significantly, because the dearth of water and progressive arid transformation in this region. For example, already, “Iran has lost its once billion dollar pistachio industry due to the lack of water needed for adequately farming these nuts in this region (“People”).” The destruction of farmland will follow with the inability to produce a sufficient amount of crops for people of this region, this trend indicates that the production of crops will decrease significantly. All these contribute to a depressed agricultural economy. This problem that Iran faces is best explained by Kaveh Madani, renowned Iranian scientist and environmental activist, stating that “without water a farmer cannot do very much.” Farmers also cannot use rainwater, as the rain patterns don’t occur frequent enough (Madani). The future does not look very bright, with the United Nations

believing that , “...without immediate implementation, we are looking at many crop industries disappearing from regions like these (Pearce 38).”

There has been much talk about desalination plants as a solution to increase the nation’s supply of freshwater through the desalination of salt water. However, while the implementation of desalination plants can be extremely effective in boosting a country’s supply of fresh water, it is not an adequate solution because it is too expensive, especially for a region such as the Iran, where resources and funds for infrastructure are limited due to international sanctions. Desalination plants and water treatment facilities range anywhere from \$100 million dollars to \$1 billion dollars just to build, not to mention the numerous additional costs of maintaining a facility like this (Fagan). Furthermore, Desalination plants are known to be “energy hogs”, consuming an immense amount of energy which would also be problematic taking into account exporting energy sources is their primary income, and this would significantly take from the capital they have invested in subsidies for their citizens (Bienkowski). Thus, because of the many inconveniences of a facility like this brings, the implementation of water treatment plants is not a viable solution for solving the water crisis in Iran.

In addition, the common ideal of encouraging Iranian citizens to become “water conscious”, will not fix the problem because domestic water use makes up a miniscule, almost negligible, amount of the total water consumption. Typically, when people try to be cognizant of water consumption, they think to take baths rather than showers, not leave any faucets running and maybe hand wash dishes and clothes. However, these changes in a person’s daily routine would only save a small amount of water, accounting for only 7% of Iran’s total water consumption (Hazony). The real problem lies in the water usage of farmers for watering crops and raising livestock, this accounts for a whopping 92.1% of the total consumption (Hazony). Clearly, juxtaposed against the agricultural consumption of water, domestic use of water is not consuming all that much water.

The best and most plausible solution to solve the water crisis in Iran is the improvement of irrigation practices, because the agricultural sector -- notorious for inefficient irrigation practices -- consumes 92.1% of Iran’s freshwater (Bengali). Farmers need water for their crops, as well as for their livestock to drink. This is where the crisis resonates, “.....to produce one pound of beef it requires nearly 1,800 gallons of water..... to produce a pound of pork it takes 576 gallons of water (Small).” Furthermore, some single plants can use up to 265 gallons of water a day, a pound of rice requiring up to 650 gallons (“Water”)! This is enough to sustain an entire household for a week (Perlman)! In addition, farms that use irrigation systems waste an incredible amount of water, because sometimes the automated water systems spray water to areas where there are not even any plants. The solution that will significantly increase the efficiency of water in Iran, create more total water for citizens, revitalize farms and their crop production is inspired from a 1930s water engineer named Simcha Blass. His once noticed in a line of trees that one was immensely bigger than the others, leading him to ponder. He curiously “walked over to the base of the tall tree and found that a metal water pipe had sprung a tiny leak, and was dripping into the soil near the tree’s roots (Hazony).” This led him to formulate his ideas that a

“...tiny amount of water in the right place could make a plant grow a lot bigger and faster than a large amount thrown at it by rain or floods or sprinklers. So the question became: How do you deliver it to each and every plant in a way that is cost-effective (Hazony)?”

That is the solution: drip irrigation. “Drip irrigation is a form of irrigation that saves water allowing water to drip slowly to the roots of many different plants, specifically targeting areas and controlling the consumption of water (“How”).” This is the best way to end the water crisis in Iran, as explained by researcher and water expert David Hazony,

“...estimates suggest that you can save at least 40 percent of your water on a per-acre basis. But that’s before you take into account how much more productive the plants become. Just like the tree that grew much taller, crop yields are double or more when using drippers. In fact, researchers in the Netherlands have found ways to get yields of over 550 percent above traditional irrigation. So assuming that the most conservative numbers are correct, water efficiency and crop yields combine to save you more than 70 percent of the water required for any given crop. In a world getting thirstier and thirstier, that’s revolutionary.... (Hazony).”

Clearly, this solution is the most plausible for a region such as Iran where agriculture consumes so much water. Drip irrigation has the potential to tremendously ease the stress on the water supply and possibly to end the crisis. Not to mention, this has the ability to reinvigorate the agricultural sector of Iran, make farming a more attractive and profitable career, and achieve both water and food security. Drip irrigation systems are estimated at \$3 a square foot which is a very reasonable price for the benefits it can potentially bring (“Cost”). But the cost is significantly less than the implementation of a desalination plant per se. An easy solution to produce the needed funding is to persuade the Iranian government to stop subsidizing water with oil revenue, and fund instead the implementation of drip irrigation systems with oil revenue. This could boost the supply of water and ideally reduce the price to a point where subsidies are not even needed. This is also important as oil prices are dropping and Iran must become less reliant on oil revenue to subsidize commodities and support its citizens. In addition, if water became more expensive, farmers may realize how valuable water really is and possibly use it more efficiently. Furthermore, one other possible resource where funds could also be allocated from are NGOs such as the Middle East Desalination Research Centre (MEDRC), which currently has 169 water projects and 12 million dollars of funding, focusing on developing solutions to this crisis (“Overview”). If NGO’s similar to the MEDRC could direct even a small fraction of its budget towards manufacturing drip irrigation systems, purchasing transportation vehicles and operators, along with educating experts who can install and teach farmers how to operate these irrigation mechanisms, implementation of this solution would be easy and done in a timely fashion that could prevent the crisis from evolving into a more critical phase. In addition, the water conserved in the agricultural sector would allow more water to flow to urban areas, thus easing the stress for water in cities. Looking forward, if every Iranian farm has a drip irrigation system that yields successes even close to as was found by the aforementioned researchers from the Netherlands, there would be no more crisis. With more water, comes more farms, with more farms comes more food, and this is what the Islamic Republic of Iran needs most.

Works Cited

- "ĀBYĀRĪ." *Encyclopædia Iranica*. RSS, 3 March 2011. Web. 8 July 2017.
- "Afghanistan Accuse Iran of Using the Taliban to Undercut Water Projects." *Iran Focus*. VOA, 6 February 2015. Web. 27 January 2017.
- Ames, Nick. "Iranian Architects Design Roof to Conserve Water." *Construction Week Online*. ITP Digital Media, 5 January 2014. Web. 27 January. 2017.
- Barton, Alexandra. "Water in Crisis - Middle East." *The Water Project*. TWP, 20 November 2016. Web. 28 January 2017.
- Bengali, Shashank. "As Drought Grips Iran, Farmers Lament Loss of a Way of Life." *Los Angeles Times*. Tribune Publishing, 6 April 2015. Web. 12 July 2017.
- BienKowski, Brian. "Desalination, Expensive Energy Hog." *PRI*. OZY Media, 15 May 2015. Web. 24 April 2017.
- "Cost to Install Drip Irrigation System." *Homewyse*. ImproveNet, 22 June 2016. Web. 24 April 2017.
- "Education in Iran." *Education System Profiles*. The World Education Services, 7 February 2017. Web. 12 July 2017.
- Fagan, Kevin. "Desalination Costs." *SF Gate*. Hearsy, 14 February 2014. Web. 24 April 2017.
- Hazon, David. "How Israel Is Solving the Global Water Crisis." *The Tower*. City Media, 31 October 2015. Web. 24 April 2017.
- "How to Build a Drip Irrigation System." *Modern*. Farmer Media, 10 August 2016. Web. 24 April 2017.
- "Iran." *Countries and Their Cultures*. Advameg. 3 February 2008. Web. 12 July 2017.
- "Iran's Excellent Primary Health care System." *Media Centre*. UNICEF, 4 September 2008. Web. 12 July 2017.
- "Iran Profile Central Intelligence Agency." *Profiles*. Central Intelligence Agency, 23 June 2017. Web. 7 July 2017.
- Kent, Sarah. "A Brief History of the Iranian Oil Industry." *The Wall Street Journal*. Dow Jones & Company. 3 April 2015. Web. 08 July 2017.
- Madani, Kaveh. "Water Crisis in Iran: A Desperate Call for Action." *Tehran Times*. NewsBank, 7 May 2016. Web. 4 November 2016.
- Moghtader, Michelle. "Farming Reforms Offer Hope for Iran's Water Crisis." *Reuters*. Thomson Reuters, 3 August 2014. Web. 13 July 2017.
- "Overview." *MEDRC Water Research*. iMweb, 11 June 2012. Web. 08 May 2017.

Pearce, Fred. "*Water--The Defining Crisis of the Twenty-First Century.*" Boston. Beacon Press, 2006. Print.

"People and Power: Iran's Water Crisis." Iran Water Scarcity. *Aljazeera*, 13 November 2016. Online Film Clip. 29 November 2016.

Perlman, Howard. "Water Questions & Answers How Much Water Does the Average Person Use at Home per Day?" *Water Questions and Answers*. USGS, 2 December 2016. Web. 24 April 2017.

Small, Sarah. "Meat's Large Water Footprint." *Food Tank*. Country Studies, 3 October 2015. Web. 13 July 2017.

"Water Management in Iran: What Is Causing the Looming Crisis?" *Global Issues in Context*. London Media, 28 October 2016. Web. 23 February 2017.