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Israel, Factor 2: Water Scarcity

Israel: Water depletion and planning for the future

In December of 2008, I walked into a restaurant with my parents and siblings to have dinner with my uncle. I had no idea I would meet Mazi, a darker skinned, black-haired, woman who would later marry my uncle and become part of my family. Mazi moved from Israel to America in 2002. She left her family and friends behind to move to the United States and have a life here. It started out as a trip to visit her friend, but she stayed in order to experience America fully. I first met my Aunt Mazi when I was seven; as I grew and got to know her, I learned about what an amazing person she really is. Growing up, my aunt lived in a very small apartment with her family in the southern part of Israel. She remembers the country always being in a state of stress, with war and revolts breaking out often. At eighteen, Mazi left home to work in the Air Force. Although she was nervous at first, she said it was an amazing experience that let her be independent for the first time, and she loved the time she spent there.

Recently, Mazi and my two cousins went back to Israel to visit family. The two week long trip extended to five because of missile attacks during Tzuk Eitan, the Israeli-Gazan conflict in 2014. They were forced to retreat to their safe room with iron doors many times over the weeks in order to stay safe from the missiles flying above their heads. My family's stories of real danger brought this conflict to my attention in a way that news reports and articles just never had before.

Israel is a relatively new country, gaining its independence in 1948 (CIA World Factbook). It is located in the Middle East and is found between Egypt and Lebanon, bordering the Mediterranean Sea. The small country has 20,770 square kilometers, yet it houses the 99th biggest population in the world at 8.049 million people (CIA World Factbook). The north is mountainous. Central Israel is home to Jerusalem, the capital, and has many other big cities, while southern Israel is mostly desert and is most sparsely populated. The climate is temperate, hot, and dry, and the annual rainfall is 18.4 inches (Country Watch). 60% of Israel is the Negev desert, which has not been developed and only 8% of the county's population lives there (Humphries). Sandstorms are common in the warmer months with droughts occurring often and periodic earthquakes (CIA World Factbook).

The average Israeli family has five members with three children, and most extended families do not live together (Culturegrams). Despite this fact, family is very important to Israelis and they see it as a basic unit (The Jewish Agency For Israel). Many families live in apartments because real estate is expensive. The life expectancy for Israelis is above average at 82 years, and the median age is 30 years (Culturegrams). The country's population is growing at an annual rate of 1.56% due to the 18.48-births/1000 population and 5.15-deaths/1000 population (CIA World Factbook). The education expenditure is 5.6% of GDP and the literacy rate of Israel is 97.8%. Most Israelis have on average thirteen years of education. When they are eighteen, all Israelis must serve in the military. Woman must serve two years, and men three (CIA World Factbook).

The average Israeli diet includes many vegetables and fruits. They also use chickpeas, and eggplant in many recipes. Pita bread is considered the national bread of Israel (Israel Food Guide). 75% of Israelis are Jewish, and for them, food is very important (CIA World Factbook). That majority is guided by a strict diet called *Kashrut*, which restricts the consumption of shellfish and pork. Also the consumption of milk products and meat products in the same meal is not allowed (EveryCulture). On holidays and the Sabbath Day special meals and desserts are made. The night before the Sabbath, a special egg bread called *challah* is eaten, and to bring in the new year, honey and apples are eaten as a tradition.

The health expenditures are 7.2% of GDP. For every 1,000 people in Israel there are 3.34 physicians. The infant mortality rate of Israel is 3.55 deaths for every 1,000 live births (CIA World Factbook). 100% of the Israeli population, both rural and urban, has access to a drinking water source and access to sanitation facilities (CIA World Factbook). However, water pollution is a major problem in Israel. Chemicals threaten the already depleting water supply, which leads to waterborne diseases (Encyclopedia).

The Global Food Security Index Rates countries based on affordability, availability, and quality and safety. Israel is rated 19th out of 109 countries with a total score of 78.9 in the Global Food Security Index. This is the highest score out of the 12 Middle Eastern and North African countries. Israel's strengths include food safety, nutrition standards, sufficiency of supply and agricultural infrastructure. Israel's biggest challenge according to Global Food Security Index is public expenditure on agricultural R&D (Global Food Security Index).

60% of Israel is desert, holding less than 10% of the population. The remaining 40% is semi-arid and holds the rest of the population. Only 20% is arable land for farming (Agricultural Development in Israel). Therefore, farming in Israel is of high importance (Jewish Virtual Library). Despite the lack of fertile soil, Israel has been able to move from a traditional way of farming to a much more technological system. This technology means that farms have moved from small family farms to large industrial size plantations, with only 2.5 percent of the population working in agriculture (Agricultural Development in Israel). Although Israel's farming is highly technological, the country is not looking into the future; the public expenditure on agricultural R&D is 2.3% lower than the world average (Global Food Security Index).

Mostly, Israel grows winter vegetables, mainly in greenhouses with saline water. Due to the climate, Israelis try to raise their cattle with reduced heat stress. In the north, there is more ability for growth in crops due to change in climate. There, they are able to grow a variety of fruits and vegetables, along with cotton and wheat. One third of the agricultural production is exported, while the rest is for domestic markets. A few of Israel's main fruits grown include citrus, avocados, mangos, grapes, apples, peaches, and bananas (Agricultural Development in Israel).

Over the past two decades, farms in Israel have become larger and more efficient, with farmers better equipped (Israel's Agriculture). Because Israel's agriculture is now technology based, family based farms suffer. While the country becomes more advanced, the number of self-employed farmers and family farms has dramatically decreased (Israel's agriculture). Unaffiliated farmers simply cannot keep up with the large-scale farms and their technology. In the past, there were agricultural communities. The kibbutz is a community based on communal ownership of property, the means of production and consumption. Alternatively, a moshav (moshav ovdim) is an agricultural village combining elements of individual ownership with elements of a cooperative such as mutual aid and communal purchases and marketing. However, these communities are disappearing, making it hard on family farms (Population of Israel).

For all Israeli agriculture, water is a limiting factor. Most of their water for crops is either recycled sewage water or saline water (Agricultural Development in Israel). This can lead to bad harvest and unsafe food (Global Food Security Index). The total renewable water sources in Israel are approximately 1.78 cubic kilometers, while the annual freshwater withdrawal is 1.95 cubic kilometers. Limited fertile land and freshwater pose serious constraints, along with groundwater and air pollution (CIA World Factbook).

92.1% of the population is urbanized, and citizens continue to migrate into cities at an annual rate of 1.37% (CIA World Factbook). Because the country is mostly desert, most Israelis live in the four main cities: Jerusalem, Tel Aviv, Haifa, Rishon le-Tsion (Israel's Agriculture). Minimum wage is at an all-

time high right now in Israel at 4650 ILS/month (Israel Minimum Monthly Wages). However, 21% of the Israeli population is still below the poverty line (CIA World Factbook). For the unemployed, The National Insurance Institute provides the unemployed person with a source of subsistence for the duration of his unemployment, until he manages to find work. In nearly every major Israeli city, there is one or more fresh food market for people to buy their food. It gives people a way to get fresh produce, and also a place to gather (My Jewish Learning). For those who are not able to afford the food in the main markets, however, street food is very popular in urban areas, and gives people an affordable, easy way to get the food they need (Israeli Street Food).

Water scarcity is one of the biggest issues facing Israel today. The problem of water depletion is of utmost importance, since water is necessary to the well-being of citizens and the food security of the country. Israel has suffered from shortage of water for a while; in the past few years, it has become a crisis. This problem is caused by both continuous years of drought and the growing population and its increased demand for water (Israel's Chronic Water Problem).

Israel is located on the Mediterranean Sea and is mostly desert. This means that the country has trouble with freshwater, and must promote its conservation. Israel's total renewable water resources are 1.78 cubic kilometers per year. However, Israel is taking more water than they should, with an annual withdraw of 1.95 cubic kilometers. By doing this Israel is making their water depletion problem worse (CIA World Factbook). Israel's main freshwater sources are the Coastal Aquifer, the mountain Aquifer and Lake Kinneret. And after drawing all the water they safely can, Israel is starting to draw water from unconventional sources: reclaimed wastewater effluents, intercepted runoff and artificial recharge, artificially induced rainfall (CIA World Factbook).

The water issue, of course affects the citizens. If the current trend continues, 65% of the fresh water used in agriculture now, will be gone. 85% of Israel's food is grown there and only 25% imported. Therefore, Israel's food security could be threatened (Israel's Need for Desert Agricultural Innovations). Because of water depletion, and the fact that much of Israel's water is also unsafe to drink, clean drinking water prices have been increasing. This makes it difficult for poor families to get safe water to drink (Uriel Heilman).

The water scarcity issue in Israel is very severe. Because of this, all water use and the Israeli Water Authority meters consumption. Due to water scarcity, natural water sources have been monitored for decades. Regulating the use of water is very expensive, costing around \$7,532,550 annually. Also, because of water scarcity, the state of Israel plans on making improvements to their natural water sources, which will likely cost quite a lot (The State of Israel: National Water Efficiency Report). Because Israel is taking up more groundwater than what is renewable, they are depleting the land (CIA World Factbook). This will increasingly become a larger problem, especially since most of Israel's food is grown in the country.

A solution to the water depletion issue does not seem to be in sight, years of droughts and taking more water that is renewable shows this (Israel's Need for Desert Agricultural Innovations). However, Israel is finding ways around the problem. Israel is mostly desert, however they mainly farm in the north, where the land is more fertile and water is more available (Agricultural Development in Israel). Israel uses water with low amounts of salt for traditional agriculture. Brackish water is more abundant, however this water is not safe for traditional agriculture or consumption. Although, it is used to grow other plants, including several kinds of cedar trees (Recent Advances in Energy & Environment). There are uses for the saline water, with Israel's new technology they are able to now grow plants safer than before with salt water (Israel's Need for Desert Agricultural Innovations). Israel is using it to grow plants, such as switchgrass and elephant grass, which produce biofuel, which can replace fossil fuels and gasoline (Eshel et al.).

Because there is much more saltwater than freshwater, a lot of money is put into desalination facilities. By spending money on these facilities, water can be cleaned for citizen use and to grow safer food (Recent Advances in Energy & Environment). This is an expensive process; however, it would solve the water depletion problem. Solving this issue would mean more food for Israel's ever growing population. It would also lower the high prices of water, making it easier for poor urban families to get clean water (Uriel Heilman). By solving the water scarcity problem, Israel would not have to take up as much groundwater as the currently do. This will help keep Israel already small amount of fertile land, fertile (CIA World Factbook).

Israel's growing population is causing issues as well. The rate of population increase is 1.56% placing it as the 78th largest growth in the world. Israel's growing population requires more freshwater, not more water depletion. Israel has already taken up more freshwater than is renewable; the country's water supply cannot sustain the citizens (CIA World Factbook). Demand leads to prices rising, and Israel is no exception. Because of the lack of fresh water, prices are rising, and will continue to rise as the population grows (Uriel Heilman). With the growing population and urbanization, pollution in cities is inevitable. Urban Israeli cities are filled with garbage and debris (Haaretz). Also, all the waste the cities create shows up in Israel's already limited freshwater sources. Rivers and lakes are sewage-laden, making the previously freshwater, undrinkable (Uriel Heilman).

Israel is trying to clean up their freshwater sources. The country has spent of \$1.5 billion on rehabilitating their waterways, and building wastewater treatment plants and channels. The rivers are improving; however, it is a big task solving a problem that has been growing for decades. And while the waterways are being cleaned, they need to be replenished by rainfall, which is hard to come by (Uriel Heilman). January gets the most rain with 74.7 mm. June until September get the least rainfall with .4 – .5 mm due to the hot, dry climate (Climate Change Knowledge Portal). Israel's climate is not going to improve in the near future. The already hot weather is expected to rise .3° C – .5° C every decade. Also, a reduction of annual rainfall of 1.1%–3.7%. The probability and intensity of heatwaves and extreme events like forest fires and droughts throughout the Mediterranean Sea area will grow in the next 50 years (Adaption to Climate Change in Israel).

Both population growth and climatic change contribute to energy demand in Israel. Population growth means more energy is needed. Climate change causes more energy use, for heating and cooling in homes. Since summers in Israel are very hot, at an average temperature in high 80s daily, lots of energy is used in both urban and rural areas (Temperatures in Israel– Weather in Israel). Israel produces 64.44 billion kWh of energy every year. They consume 59.83 billion kWh per year, export 4.938 billion kWh but do not import any energy (CIA World Factbook). This gives Israel very little leeway in case of emergency, especially since, in Israel, energy is needed for growth and activity in homes and economic sectors (Ministry of National Infrastructures, Energy, and Water Resources).

The water depletion crisis in Israel is a colossal issue that needs a solution as soon as possible. With the growing population, everyone needs to do their part to help out. At a local level, the water scarcity problem is gaining awareness. Citizen's water use is monitored, and should continue to be, to make sure they are conserving the city's water supply (United Nations). Water conservation campaigns, along with technical and economic measures, are being applied to increase awareness and conservation (Israel Ministry of Foreign Affairs). Most Israelis follow the conservation rules, as they know prices will rise the more fresh water they use (United Nations).

Israeli cities are working on collecting runoff water and stormwater. Israel is a country that is able to reuse and treat wastewater. They have purification plants and a method of purifying water so it can be recycled for multiple uses. These plants are getting older, however, and will need to be updated and expanded to meet the requirements for the reuses of the water (United Nations). The Dan Reclamation

Project is one example of using new technologies to sustain the water sector. The project's purpose is to solve the problem of sewage disposal in towns in the Tel Aviv coastal area (Dan Region Sewage Reclamation Project). Mekorot is another project in Israel that treats wastewater for reuse. Their three main goals are: to divert more freshwater to households, increase the quality of water for agriculture, and protect the environment by reducing the ecological damage that untreated wastewater can cause (EMS Mekorot Projects).

Israel could also conserve water by using a Micro (or drip) irrigation. In 2012, Dr. Daniel Hillel more fully explored and wrote about the process of slowly and precisely dripping water and or nutrients into the roots of a plant (World Food Prize). This allows the plant to use less water, and because it drips water directly onto the roots of the crop, Micro Irrigation reduces the chance of weeds and disease in the plants (St. Johns River). However, not all of Israel's farms have this option. If all or most farms in Israel got the chance to use Micro Irrigation, Israel could save much more water for domestic or other uses.

Israel has only a few large freshwater sources, however the country is on the Mediterranean Sea and has plenty of salt water available. For this reason, Israel has a few desalination plants throughout the country. This technological advancement allows the brackish water to be cleaned for agricultural and domestic use. The five plants on the Mediterranean coast alone account for 35% of the expansion of natural water sources. If Israel continues to create and fund the desalination plants, that alone could help solve a sizable part of the water depletion problem in the State of Israel (United Nations). This process could harm sea life, however, which is something they must take into consideration.

Another thing that could help is an organization called Charity:Water. Charity:Water is a project run completely by donations to help countries with their water crises. The organization has helped 24 different countries, mostly in Africa. However, the organization could expand to help countries like Israel with water scarcity problems (Charity:Water). Another organization in Israel is the Jewish National Fund. The Jewish National Fund is a charity that funds projects about forestry and ecology, community and development, security, education, research and development, recreation, and water. With lots of projects, it is hard to make a huge impact in one area. If the Jewish National Fund could receive more funds, they could scale up their projects— water and all the others. With these extra funds, Israel could take a giant step forward to solving their problems (Water solutions).

Another important charity in Israel is the Israel Water Treaty. The Israel Water Treaty is a nonprofit organization that uses donations to work on making the water in Israel safer, cleaner and more abundant. The project started in 2010 and has been growing ever since. The Israel Water Treaty is working on educating people about the water issues in the country at a local and national level (Israel Gives). One of the issues in Israel is the amount of money spent on agricultural research and development, which greater impacts the water depletion. The Ein-Shemer Ecological Greenhouse organization is working to fix this. The Ein-Shemer Ecological Greenhouse creates projects to expand agricultural, environmental, and renewable energy research that can help to move Israel forward on their water depletion problem (Israel Gives).

Zalul Environmental Association is an organization committed to cleaning up Israel's water sources, like rivers, lakes and shorelines. The non-profit project was started in 1999 and is comprised of a team of professionals from various fields. Their goal is to clean up the water sources to keep citizens safe. These organizations all work together and complement each other to make Israel's water safer on a national level, but especially to the communities close to the shorelines and bodies of water (Israel Gives).

Israel is a very technologically advanced country. If they put all their efforts in, Israel will be able to solve their water scarcity problem. And other countries are taking notice. All of the Middle East is having the same issues as Israel: droughts, unsafe water and difficult farming due to climate (United Nations

Development Programme). Other countries can look towards Israel as a role model, to create organizations and put their efforts into solving their water scarcity problems as well.

Population and food security issues in Israel are directly proportional. As Israel's population has grown over the years, so has its water depletion and food security problems. More citizens require more water, however the State of Israel is using more water than is renewable, making its problems worse. Israel has access to better technology than many of the countries around it, yet still has issues they cannot seem to find ways to completely fix their water scarcity. With the changing climate and urbanization, Israel's problems will not solve themselves but get worse. The water scarcity problem not only leads to lack of water to citizens but lack of fresh and clean food. The country has made small steps over the years by cleaning up the rivers and shores and creating desalination plants. However, more drastic steps are needed. With Israel's technology they are able to create bigger and better desalination plants to clean water for agricultural and domestic use. Israel can also implement micro irrigation to conserve water. In the past, many organizations overlooked Israel because they have better technology than other Middle Eastern countries. However, without outside help, Israel cannot solve their food security problems, and people are taking notice. Multiple organizations have begun to lend a helping hand. All citizens need to do their part; all Israelis can conserve the water they use on a daily basis. Israel can also act as a leader for other countries, encouraging them to take steps forward. Although we cannot stop droughts and heat waves, with every country working to solve their food security issues and helping countries around them solve theirs, we can give everyone food security.

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