

Emma Brimeyer

Clayton Ridge High School

Guttenberg, IA

Saudi Arabia, Factor 1: Water Scarcity

### **Saudi Arabia: The Water Factor**

Saudi Arabia is a country located in the Middle East, bordering the Persian Gulf and the Red Sea (CIA). The country's top exports include crude oil, plastic, petroleum, and metal ("Saudi Arabia," *The World*). The total population exceeded 28 million as of 2016, with immigrants and foreign workers making up over 30% of that population (CIA). Over 83% of the population lives in an urban area (Esposito). The main ethnicities of the country are Arab and Afro-Asian (CIA). The official language of the country is Arabic (CIA). Saudi Arabia is also the birthplace of one of the major world religions, Islam, housing two of the most sacred places in the religion, Mecca and Medina (CNN Library). There are other religions present in the country, such as Sikh, Hinduism, Christianity, and Judaism, though Islam is the most common (CNN Library). Women in the country are placed under a guardian system based on an interpretation of Islam (CNN Library). The guardian system states that women cannot go out alone, open bank accounts, drive, or travel without the guardian male's permission (CNN Library). This system is not law, though it is practiced throughout the country (CNN Library). Having an area of over two million acres, Saudi Arabia is approximately one-fifth the size of the United States (CNN Library). The country has a total area of approximately 2.15 million square kilometers (FAO).

As the vast majority of the country is covered in arid land unsuitable for farming (only approximately 2% of the country is able to support crops,) trade dominates the economy rather than any other agricultural activity (Esposito). The country's top exports include crude oil, plastic, petroleum, and metal ("Saudi Arabia" *The World*). It is the largest country in the world without a permanent river, as it is mostly covered in desert, and any riverbeds in the country are dried up for the majority of the season (CIA). Due to this factor, many fossil aquifers, defined as large, ancient pockets of water that have been replenishing themselves for millions of years, are being pulled from the ground and used up for irrigation and other urban uses (Giansiracusa). The process of reusing wastewater from industrial, municipal, and domestic wastewater treatment centers has become popular in some states in the United States as a means of conserving water (Haering). If such techniques and technologies are used correctly in Saudi Arabia, the water problem in the country may be quickly and efficiently solved.

The desert country's climate varies slightly based on the season, mild in the winter and much hotter during the summer months (Al-Hazmi). Any rainfall that occurs falls in the winter, though it never exceeding 100 millimeters (Al-Hazmi). Heavy rainfall that does occur falls so rapidly that it floods dry river beds, causing flash flooding (FAO). As the country's temperature rises during the summer, the land becomes more arid than during other seasons (Al-Hazmi). Strong, dry winds across the country can cause large dust storms (CIA). Combined with temperatures reaching up to 122 degrees Fahrenheit, the summer seasons in Saudi Arabia are unbearably hot and dry (FAO). These winds and extreme temperatures can cause multiple health problems within the population. Between the months of May and September, heat

exhaustion is common, especially to those who are not originally from the country, such as tourists and foreign workers (ExpatArrivals). Frequent sand storms are bad for the respiratory system, especially for those with existing lung and breathing problems (Expat Arrivals). During the colder winter months, temperatures can reach close to freezing, causing it to snow in the mountainous region of the country (FAO). Climate in Saudi Arabia is a huge factor in determining plant and animal production, along with the amount of water present in the area. Because there is little land available for agricultural uses, the main source of income for the country is trade (Esposito.) The country's top traded items largely include oils and oil byproducts, as there are large oil and natural gas reserves in the country (“Saudi Arabia” *The World*). In fact, over 22% of the world’s oil reserves are located in Saudi Arabia and the country is the largest exporter of liquid petroleum in the world (CNN Library). The country wishes to lower its dependence on the export of oil and rather try to expand agriculture in the country, thus producing a high standard of living and an easier access to food (Al-Hazmi). The climate significantly affects what little land there is available for agriculture. Only 1.5% of agricultural land is used to grow crops (“Saudi Arabia” *The World*). The other land that is used for agriculture is mainly used as grazing lands for livestock (CIA).

In Saudi Arabia, crops that are grown must be sustainable in hot desert climates. Cereal grains, along with some vegetables, fruits, and foliages, are major crops in the country (Al-Hazmi.) Wheat, barley, tomatoes, watermelons, dates, eggplants, and alfalfa are all growable in Saudi Arabia with irrigation (Al-Hazmi). The country’s ability to grow crops that would not normally be able to survive the harsh, dry climate has increased since 1990 as new technology and methods of growing crops were introduced (Al-Hazmi). Dams and tube-well irrigation provide a way to transport water to crops and recharge aquifers that have been used for irrigation (Al-Hazmi). Because of new technological advances, the country has become self-sufficient in this area, and has been able to export crops that it normally would not be able to, such as dates, wheat, and watermelon (Al-Hazmi). As the majority of agricultural land in the country is used for pasture rather than crops, Saudi Arabia exports many goods related to animal production, such as eggs, poultry, and milk (Al-Hazmi). Cattle, chickens, goats, and sheep are among the main animals raised in the country (Esposito). In fact, through many recent technological advances, Saudi Arabia has been able to become self-sustaining in raising dairy cattle, regardless of the small amount of water they receive a year (Shadbolt). The variety of food produced in the country gives a wide range of options for a sustainable nutrients system. In Saudi Arabia, a common diet is available and consumed throughout the country. The diets of many in the population consist of many of the same foods, most of which has been grown and raised directly in the country. Beans, rice, dates, and chicken are common in the Saudi Arabian diet (“Saudi Arabia” *Food*). Camel milk and flatbread are also prevalent in the Saudi Arabian diet (“Saudi Arabia” *Food*). Because Islam is the prevailing religion in the country, alcohol is not consumed, as drinking alcohol is prohibited in the Islamic culture (“Saudi Arabia” *Food*). Islam also prohibits consuming pork since it is considered dirty and inedible (“Saudi Arabia” *Food*). For special occasions, lamb is often served (“Saudi Arabia” *Food*). The crops and animals that are grown and raised reflects these religious guidelines, limiting the number of certain animals that can be raised, plants that can be grown, and food that can be cooked or consumed.

Saudi Arabia has always been very active in the agricultural aspect of its economy, and it is working toward being completely self-sustaining in the agricultural department and producing more crops and products to export (FAO). The country is trying to decrease its dependence on oil and petroleum as its main source of income and strengthen its production of crops and livestock to increase its food security, while also expanding its trading capabilities (FAO). New technology in Saudi Arabia has led to the growth of the agricultural industry, helping to complete the task of raising the country’s food security. New plants are being grown that could not be grown otherwise, giving Saudi Arabia new export

opportunities. Though these technological innovations are providing Saudi Arabia new ways to become sustainable, they are also causing problems. All of these agricultural advancements need one thing: water. Because Saudi Arabia is vastly dry and arid, water used for agricultural and industrial purposes is either drawn up from underwater aquifers or sea water that has been purified and prepared for agricultural usage (FAO). In fact, Saudi Arabia is the largest desalinated water producer in the world (FAO). There are 28 plants located on the coasts of the country, producing 1,645 million cubic meters of water according to the 2014 annual report done by the Ministry of Water and Electricity (Kharis). It has been reported that desalinated water makes up approximately 60% of the water used in Saudi Arabia (Al-Sughair). Though these methods are adequate for the situation, problems still arise concerning how these methods affect the environment and the future of the country's water problems. Underground aquifers are located in the central and eastern part of the country and are carried through the country via tube-wells (FAO). Though these methods are effective at this point and time, they will no longer be effective when the aquifers in the country run out of water. These aquifers are poorly recharged because of the lack of rain the country receives, therefore limiting what the country will be able to do in the future after these aquifers run out of water (FAO). These ancient aquifers have taken millions of years to fill and it would take many more millions of years to once again refill these aquifers (Giansiracusa). Al-Ghamdi states after finding there has been a drop in water levels in agricultural areas, "This is a dangerous situation for all future crops that depend on these aquifers" (Sheffield). Though the process of purifying sea water is highly effective, it also brings up more problems. Power plants that purify the sea water are conveniently located on the coasts of the country, so they can draw water directly from the sea and then ship it all over the country (FAO). However, oil is used to power these plants, and the oil is known to spill, polluting the sea around the plant (FAO). Open drainage canals carry used water away from where it was previously used (FAO). This drainage system works poorly, and the canals often leak, polluting the soil by making it salty (FAO). Saudi Arabia has also decided that the decision to grow wheat in 1983 has led to the water crisis in the country and has, in turn, banned the growth of wheat, as wheat is very water dependent (Sheffield). A new, different way of irrigation and drainage must be found and implemented to prevent overusing, polluting, and possibly depleting the water sources in Saudi Arabia.

Families in Saudi Arabia are affected greatly by the lack of water in the country. Because of increased population and standards of living in the country, the consumption of water has continually increased over the past 30 years (Al-Sughair). It is reported that the average Saudi Arabian citizen uses anywhere from 100-350 liters of water per day in urban areas and 15-20 liters of water per day (FDI Team). These numbers give Saudi Arabia one of the highest water usage numbers in the world per person (FDI Team). Saudi Arabia has recently placed a tax on water used residentially to try and make up for the lowering cost of oil (Sheffield). Specialists do not believe that placing tariffs on water will help, as desalinated water will have to be produced and manufactured in double the amount that is currently being produced (Al-Sughair). Fortunately, there is a way that Saudi Arabia may be able to solve its problem.

Researchers have been studying and trying to produce a new way to reuse agricultural, industrial, and municipal water (Haering). They have found that one way to do this is to reuse water (Haering). Reused water is defined as water that has been recycled and can now be used for a beneficial purpose (Haering). This practice has been put into practice in multiple states in the United States, because it is seen as a practical way to conserve water (Haering). Reclaimed water can be used for many purposes, except for human consumption (Haering). If Saudi Arabia turns to using reclaimed water, there will be many benefits. The country will no longer have to divert as much groundwater to use for municipal and industrial purposes; instead, they will be able to continue to reuse water by purifying it and putting it back into the system to be once again used for municipal, industrial, and domestic uses (Haering). The usage of

recycled water will also help decrease the amount of drinkable water that would have been used for industrial and municipal purposes, thus giving reason to remove the water tax in Saudi Arabia (Haering).

How does the process of recycling water take place? The process takes place in at least two stages: primary treatment, secondary treatment, and possibly advanced treatment (Haering). During primary treatment, water is transported to a wastewater treatment plant, where solids are screened and settled out (Haering). Secondary treatment involves further settling out of solids and decomposition of materials (Haering). If a wastewater treatment plant is not able to complete the advanced step at its facility, then the water is decontaminated and released into bodies of water (Haering). The advanced step consists of further sanitation and settling; water that goes through this advanced stage will come in closer contact with humans, because it is much safer for human use than water that has not been through the advanced step (Haering).

Saudi Arabia will be able to benefit from these processes in more ways than one. Through this process of reusing and recycling water, Saudi Arabia can reduce its consumption of groundwater and water taken from aquifers. It will also be able to lessen its use of purified sea water, reducing the chances of spilling oil into the water, while also cutting down on the amount of oil that will have to be used in order to power the plants. The statistic that states Saudi Arabia will run out of groundwater in 13 years will no longer be true if new ways of reusing and saving water are implemented (Sheffield). This can allow time for aquifers to properly recharge and for the aquifer water to be put directly toward human use, instead of industrial uses. Besides industrial and municipal uses, there are many other ways for recycled water to be used in society, such as in urban centers (for toilets, decorative water sources in golf courses and decorative ponds, and fire protection), along with industrial uses (cooling water) (Haering). The recycled water can also be put toward agricultural uses, allowing for the expansion of the Saudi Arabian economy through new agricultural growth and production. Families will be able to produce more food as a result of the increased water. Oil will be used in smaller quantities because it will no longer be used in desalination plants, thus making larger amounts available for export, allowing for the economy to gain more money and grow. The amounts of water in circulation will increase, thus opening the doors to the possibility of growing new plants who would not have been able to grow because of the lack of water. The amount of water in circulation will also lead to new technology that will be used to store water to be used later. Water will be able to go towards Saudi Arabia's dairy farms, where water is vital to the production of quality milk for exports. Families will no longer be required to buy taxed water, and will then be able to put the saved money toward buying new foods or growing their own. Saudi Arabia will be able to become self-sustaining in a newer, wider range of activities, whether agriculturally or industrially, and the country will be able to grow both nationally and globally.

Water is an essential part of life. Without water, humans and all other forms of life on earth would not be able to live. Water is needed in every aspect of life, whether for drinking, bathing, growing crops, watering livestock, and for recreational purposes. In countries such as Saudi Arabia, where vast deserts cover the landscape, water is scarce. Climate, seasons, and weather patterns affect the amount of water that a country receives. These factors in turn affect types of crops that can be grown and livestock that can be raised, along with the amount or byproducts of each that can be produced. Using million-year-old water from fossil aquifers, Saudi Arabia is depleting their underground water resources for agricultural, industrial, and other uses. Though taking water from the ocean and removing the salt is a way of using water, Saudi Arabia has been able to use salt water as a source of water for agricultural and industrial uses, though a lot of energy is needed to produce the water necessary for production. It also takes away from Saudi Arabia's main export--oil--which is burned up in the process of taking salt out of the water.

Oil that is currently being used to desalinate sea water could be sold and used to strengthen the country's economy, allowing it to support itself and propel itself forward through a growing new world. A new way of reusing water by recycling water that has previously been used for irrigation or household uses, will give the country water that can continue to be reused over and over again without depleting drinkable water or underground aquifers. Through purifying the water and taking out any toxins from the previous use, water can be reused over and over again for agricultural, industrial, and municipal uses. Water will no longer be wasted and carelessly "thrown out;" it would now be able to be used repeatedly for a multitude of uses. Through this method, Saudi Arabia can cut down on oil consumption and water waste. By using the water recycling system efficiently, the water crisis taking over the country can quickly and efficiently be solved, the country will be able to remove the water tax, and families will be able to grow their own food and become self-sustaining as a people and as a country.

## Works Cited

- Al-Hazmi, A.S. "Saudi Arabia." *FAO Corporate Document Repository*. N.p., n.d. Web. 20 Feb. 2017.
- Al-Sughair, Sultan. "KSA's water consumption surpasses global average." *Arab News*. Arabnews, 12 Feb. 2016. Web. 14 July 2017
- CIA. "The World Factbook: SAUDI ARABIA." *Central Intelligence Agency*. Central Intelligence Agency, 12 Jan. 2017. Web. 06 Mar. 2017.
- CNN Library. "Saudi Arabia Fast Facts." *CNN Library*. Cable News Network, 24 Jan. 2017. Web. 07 Mar. 2017.
- Esposito, John L. "Saudi Arabia, The Islamic World: Past and Present." 2004, *SIRS Issues Researcher*.
- FAO. "AQUASTAT - FAO's Information System on Water and Agriculture." *AQUASTAT - FAO's Information System on Water and Agriculture*. FAO, 2016. Web. 10 Mar. 2017.
- FDI Team. "Food and Water Security in the Kingdom of Saudi Arabia." *Future Directions International*. N.p., 27 Jan. 2016. Web. 20 July 2017.
- Giansiracusa, Adam. "Coping with Scarcity: Saudi Arabia and Water." *Stimson Center*. N.p., 9 Dec. 2010. Web. 16 Mar. 2017.
- Haering, Kathryn C. . "Water Reuse: Using Reclaimed Water for Irrigation." *Water Reuse: Using Reclaimed Water for Irrigation | Publications and Educational Resources | Virginia Tech*. N.p., 01 May 2009. Web. 11 Mar. 2017.
- "Healthcare in Saudi Arabia." *Expatriate Arrivals*. Globe Media Ltd., 19 Nov. 2013. Web. 16 Mar. 2017.
- Khrais, Rami. "What Saudi Arabia is doing to save water." *Al-Monitor*. N.p., 04 Apr. 2016. Web. 14 July 2017.
- "Saudi Arabia." *Food in Every Country Forum*. Advameg, Inc, 2017. Web. 16 Mar. 2017.

“Saudi Arabia.” *The World Almanac and Book of Facts* 2013, 2013, *SIRS Issues Researcher*.

Shadbolt, Peter. "Milking the desert: How mega-dairies thrive in Saudi sands." *CNN Library. Cable News Network*, 18 Dec. 2013. Web. 16 Mar. 2017.

Sheffield, Hazel. "Saudi Arabia is running out of water." *The Independent. Independent Digital News and Media*, 19 Feb. 2016. Web. 17 Mar. 2017.