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## **Impacts of Water Shortages on Farmers in Rural Jordan**

Jordan is home to richly vegetated mountains, the mineral rich Dead Sea, and the arid Arabian Desert. Jordan is roughly the size of Indiana. Jordan is divided into four main land areas; desert, also known as the Badia, the Jordan River valley, the highlands, and the plains. The Badia is the largest land area of the four, being roughly 85% of the total land mass. This area receives less than four inches of rain a year. Poor use of irrigation, and lack of capital has created inescapable poverty in east and south Jordan. Securing enough drinking water, let alone water for crops, is a problem for those living in rural poverty. Many people in these areas have improperly irrigated, depleted the natural wells, have few conservation practices in place and have been removed by urban sprawl. Preventing improper irrigation, urban sprawl, and other water-depleting practices are the keys to escaping poverty and feeding the people Jordan.

The United States Agency for International Development, USAID, has a large project in Jordan to help with the deficiency of water that currently defines many rural Jordanians. USAID labeled Jordan “The most water-poor country in a region already characterized by extreme water scarcity.” Jordan can implement conservation practices and improve irrigation to reduce imports. Jordan imports an extensive amount wheat, barley, and corn which totaled over 1,731,740 tons in 2009 (“Jordan, Food Security”). Jordan should begin to implement practices to decrease imports, increase exports, and support their small famers. Jordan can successfully work within the water scarcity by addressing and changing the types of crops grown. For example, tomatoes have been in the top two highest grossing exports for Jordan since 1961 (“Jordan, Food Security”). Tomatoes require one inch of rain per week which does not naturally occur in many places in Jordan. These require lots of water from irrigation and are impractical. Growing plants that require less water and implementing conservation projects would greatly reduce the need for water in agriculture. The Permaculture Research Institute of Australia has designed a project in the Jordan River Valley using swales. Swales are grassy ditches used to collect and infiltrate rainwater. Swales conserve water and sustainably grow crops and trees.

Jordan has similar levels of poverty compared to its Arab neighbors, however poverty is still prevalent. Jordan’s current population at or below the poverty line is 13.3% (Mansur). Jordan’s rural population has a higher level poverty at 19% (“Rural Poverty in Jordan”). In 2011, Jordan’s population is 6,508,887 (“Jordan”). About 6% currently live in poverty. The typical poor rural family includes six children, a mother, and father. These families are typically headed by the father. Access to health care requires money most poor farmers currently lack. Health care is generally considered in good shape in Jordan with a less than 1% HIV/AIDS rate among adults and an average life span of around 70 years (“Jordan”). Most poor rural families are illiterate or have no formal education. Schooling is another expense that poor rural people cannot afford.

The average poor rural family eats a mix of cheese and yogurt from goats and sheep milk, pita bread, humus, legumes, lamb, chicken, and many fruits and vegetables. Almost all of the produce and meat consumed is grown on their farm that averages about 10 acres. The remaining food is purchased with income from their farms. The absence of community gardens has put an even great pressure on the farmer to have a successful garden and source of income. These farms raise sheep, goats and grow wheat, barley, fruit trees, and various summer vegetables such as tomatoes, chickpeas, and onions. In order to grow these various plants, irrigation and other water conservation methods are used to keep water in the ground and in their plants.

Many things are keeping and creating poverty in Jordan. Factors making life difficult for the farmer in rural Jordan include; a lack of education on conservation, low water supply, lack of capital and available loans, environmental conditions, and desertification. Life in rural Jordan is hard due to lack of general education, landscape, insufficient rainfall, and the near void of personal income. Without education and income, life stays difficult. The lack of rainfall and rough landscape create challenges for even the most successful farmers. The poor rural farmers have the impossible task of keeping themselves afloat and maintaining the environment in which they live.

Water shortages are becoming more prevalent and concerning in Jordan. Agriculture accounts for about 68% of Jordan's total water use ("Environmental Threats and the Jordanian"). The demand for water has been growing. Jordan requires about 1.150 billion cubic meters each year while Jordan can only provide 850 million cubic liters each year ("Environment and Water"). Water trends are measured based on average water consumption per person, uses of water, how much water is pumped out of the ground, and how much water is brought into the country. Water is currently at 200 cubic meters per person, per year, in 2025; water is expected to be 91 cubic meters per person, per year ("Environmental Threats and the Jordanian"). Jordan currently ranks fourth in water scarcity in the world (Tokanel). The population of Jordan is expected to increase; subsequently, the demand for water will increase. Jordan has huge water shortages issues already that every Jordanian face and the Jordan government must adopt strict water policies.

Lack of sufficient water in agriculture has caused many problems within rural families in Jordan. Farms require water to grow plants and animals. Plants and animals provide essential nutrition and income to these farmers. The water deficiency in Jordan has caused many farmers to go without basic medical care, schooling, and nutrition. The water crisis has causes many farmers to use non-environmentally friendly agriculture practices and irrigation methods. When water crises occurred, water is used in a number of ways before the water is used for watering gardens. Many farmers collect water used in the house and use the gray water to nourish their gardens. This seems like a good idea to the farmers who have little water to begin with. These practices put harmful chemicals and other substances in the soil causing even more damage.

The environment, mainly the soil and the aquifers, have been thoroughly depleted and abused. Farmers have been unintentionally causing massive desertification. Desertification occurs when the natural resources of a place have been overused and run down. Desertification has been occurring in Jordan for a long time due to a number of factors. "The years 1908-17 were one of the most destructive periods for Jordanian forests" ("Environmental Threats and the Jordanian"). This period of time was so destructive to the Jordanian forest due to the construction of the railway from Damascus to Madina. This major disturbance in the land does not stand-alone. There have been countless environmental disasters, both large and small. These disasters continue to occur and little is being to help bring those areas affected back to life.

Poor and rich Jordanians alike must learn how to irrigate efficiently and implement conservations methods. Water scarcity and farming go hand in hand in Jordan. Average rainfall across Jordan is about one inch per month. Every single drop of rain is vital to Jordan and their poor farmers. Another collection technique used by these farmers is collecting and storing rainwater in rain barrels. These barrels can hold up to 80 gallons of rainwater on their roofs.

Sewage has been an issue that nearly all-rural communities face. Only 6% of the rural population has access to the sewer system (*Improved Drinking Water*). Most rural communities do not have a sewer network or sewer treatment. The sewage waste is commonly placed in cesspits. These cesspits add pollutants including nitrates to the ground water and surrounding wells. The ground water is also contaminated with excess chemicals used in farming. The Water Efficiency and Public Information for Action and USAID have teamed up to provide small loans to those in poverty in need of water assistance.

These loans have been used to provide families with cisterns and the ability to connect sewage to a sewer network. When water becomes contaminated, agriculture productivity and incomes plummet.

Less than two percent of foreign aid in Jordan is given to the environment in 2011. That is a mere five million dollars out of a 359.4 million dollar budget. The funding allotted to the environment has been steady shrinking. In 2009, nearly 10 million dollars was spent on the environment in Jordan ("Jordan Spent Stage"). This trend spells out more bad news if the Jordan government doesn't step in soon. The government could easily regulate what crops could be grown. These crops would be much more water efficient than current crops such as tomatoes and wheat.

Rural farmers are the hardest hit when it comes to water shortages. Women headed families in poverty are especially at risk of falling under the radar and disappearing because of the water shortage. Families that have women at the head typically hold less land, livestock, and are less likely to receive grants and loans. Conditions in rural Jordan are headed in a downward trend. The lifestyle of these people will continue to decline if major changes do not occur soon.

Climate change will have a detrimental effect on irrigation and water use. If climate change causes the Arabian Desert to receive less rainfall than it currently receives, many poor farmers could no longer continue to farm and would most likely move to an urban center.

Urban areas have begun to spread into ideal farmland in Jordan. Urban areas take up space and water that the poor rural farmers desperately need to survive. Urbanization rates of change are estimated at 1.6% for 2010-2015 ("Jordan"). That means that urban areas will begin to spread even more and take up land those farmers currently live on. This trend spells out more bad news for the rural farmer. Urbanization will eventually cost them their lives, their community, their farm, and way of life. If the water in Jordan were to become moderately or severely polluted, there may be massive death due to starvation and malnutrition. Water is the difference between a good education, health care, and survival, or death; Jordan cannot afford to lose any water to pollution or waste.

One project that could help with the water scarcity and irrigation issues in Jordan would be use and maintenance of swales in the driest parts of the desert area. Swales are made by digging a long ditch into the contours of the landscape. The swale would be two meters wide and a half meter deep. Then the soil used to make these ditches would be placed on the downside hill of the ditch. On the downhill side of the swale, fruit trees, crops, and supporting plants would be planted. These plants would receive the water from the swale through infiltration. On the uphill side of the swale, hardy desert trees would be planted. Swales reclaim and slow water runoff by spreading the water throughout the surrounding soil. The water would then infiltrate the soil, desalinate it and increase soil productivity. Swales are a form of irrigation that does not require a lot of maintenance or daily effort. Everyone in the community would benefit from the swale, especially the vulnerable families. Women headed house holds could easily implement the community swale into their lives and gain that extra leg up it takes to survive. Swales provide livestock with fresh and green plants to browse on, they also provide an area where high value crops can be grown such as figs, dates, mulberries, pomegranates, guavas, mushrooms, and citrus fruits. Swales desalinate areas and rejuvenate the soil, bringing the soil to productivity levels comparable to the areas in Jordan where the soil conditions are at their best.

There are projects already started to help solve the water crisis in Jordan. A project done by the Permaculture Research Institute of Australia called the "Greening the Desert" shows how swales can benefit an entire community. Plant matter was put in and around the ditch to create and maintain moisture and to prevent the burning of organic matter. This was contrary to the normal practice of burning everything including organic material. The swale covered ten acres of land. One million liters of water soaked into the landscape when the swale was full. The swales filled to capacity two or three times a winter. The uphill side contained hardy desert trees planted to stabilize the soil, add shade, reduce

evaporation, and nitrogen adds to the soil. On the lower side, various fruit trees were planted. Swales use significantly less water to desalinate an area than the tradition flush-out method of repeatedly dumping water onto the soils surface. Swales use about one fifth less water than the traditional flush out method.

If a swale was put in and maintained by a community, that community would begin to thrive and even prosper within a few years. Within four months, figs would bear fruit and begin making money for the community. Swales could be widespread throughout the whole country. Swales work in a huge variety of climates from rainforest, to desert, and to the average American backyard. The benefits that swales provide are not limited to crops. Swales provide food for animals, a place to compost while decreasing the amount of trash produced and burnt, and a cool, shaded place for people to congregate.

However, swales cannot solve all of Jordan's problems. In accordance with the Millennium Development Goals, abolishing traditional gender roles would benefit the rural population. The more people that can effectively and sustainably farm the land, the better Jordan will be. Better educated farmers would increase yields, soil quality, and the chance for a better future for the children of poor farmers. Sustainable environmental practices would improve Jordan in almost every statistic that measures the well-being of citizens. Their standard of living and water availability would increase and the poverty level would decrease, especially in poor rural areas. In order for swales to produce the maximum benefit, there must be a group of people to maintain the swale and the vegetation within it. These people could be from the community and be specially paid to keep the swale performing at its best. This would generate some much needed capital for the community. The money to pay these people could come from the Jordan government with assistance from the United Nations, UNICEF, and other similar organizations. The World Bank could prove micro loans or grants to small farmers. This loaned money could help pay for the initial startup cost of swale and some of the maintenance costs of the swales. These loans could also be used for other projects to increase water availability. People from the World Bank could be trained how to properly set up the swale and train the areas' people how the swale works. These people could make biannual visits to check up on the site for several years until the swale is being properly managed.

Jordan is home to a large desert, mountains and a sacred river. Poverty is spread through the country but mainly centered in the driest areas in the south and east. These areas receive very little rainfall, less than an inch per month. Jordan is one of the world most water-scarce countries. This presents many unique challenges when addressing rural poverty. Almost every farming, conservation, and environmental practice must be adapted to the arid climate. Misusing the land is common, especially in desert areas. Poor rural farmers try everything to stay alive and afloat in this country. Poverty cripples those with large families and takes away their access to proper health care and education. These families have no way to escape the cycle of poverty.

Jordan can overcome these hurdles through careful planning, education, and funds. Proper education, health care, and environmental protection can all be achieved for all of Jordan. Poor rural Jordanians can learn to farm sustainably, conserve water, and improve their quality of life. If no one teaches the rural Jordanians, they will continue to pollute their ground water with gray water used to irrigate their gardens and irresponsibly irrigate. If no one takes action to help these people, Jordan will have even less water to give to their growing population. Jordan could turn into a giant desert if the proper measures are not taken with some swiftness. Not all hope is lost for the rural people of Jordan. Assistance from institutes around the world, including the World Bank, USAID, and the United Nations can make a swift and long lasting green impression in the desert. Implementing projects such as swales can provide many benefits to communities in the desert.

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