Sara Stoakes, Student Participant
North Tama County Community High School
Traer, Iowa

A Rich Country Where the People are Poor: Reaching Morocco's Potential

The stereotypical desert picture the public has when they think of Morocco may soon become reality. During a 1967 visit to the United States to request food aid, Morroco's King Hassan described his country as "a rich country where the people are poor" (New York Times February 10,1967) His call for food aid was precipitated by a drought which destroyed half of the growing season's grain crop. Hassan's aides alleged in simple words "Everything in Morocco depends on the King except the weather." The request for aid prompted the United States to send nearly 170,000 tons of wheat with an approximate value of $12 million (Payne 153). According to the World Factbook in a 2007 estimate, the labor force of Morocco consisted of 11.05 million people. Women are virtually the heads of the families, doing most of the work on subsistence farms. A 2008 estimate from the World Factbook showed approximately 2.57 children are born per woman. Only 52.3% of the total population is literate. Of the males in Morocco, 65.7% are literate compared to the 39.6% of females, according to a 2004 census (World Factbook 3, 4). The GDP per capita, measured in purchasing power parity, was $4,100. Agriculture makes up the majority of the economy, employing 40% of the labor force in Morocco (ArabNet 2). To the eyes of an economist, Morocco was once a country gaining stability with growth over the past fifty years. The growth rate of GDP in Morocco, however, declined 2.1% in 2007 due to a drought reducing agricultural production and caused the country to require wheat imports (World Factbook 7). A positive correlation can be drawn showing Morocco's economy relies heavily on rain. Irregular rain makes growing seasons unpredictable and difficult to manage. The abnormality of rain and weather patterns, however, does not match up with the constant patterns of malnutrition and poverty in Morocco. The problem with Moroccan agriculture is not the fact of declining food production, but a lack of advancement in technology and efficient farming practices concerning water scarcity, coupled with a growing population and food demand. Water conservation and land degradation/desertification are a huge problem for the region, and affect crop growth. Morocco's agricultural sector can be assisted by the help of knowledge and skill from outside organizations. The problem of desertification has the potential to be solved by instituting proper use of land resources and advancing technology of water conservation in the region.

A relative of mine who took a trip to Morocco through Iowa Farm Bureau wrote in her journal: "Miles away, we witnessed a woman gathering a bundle of grass in a barren area and loading it on her donkey. A young lad might be watching a flock of sheep while the men were sitting in the open front coffee shops" (Kruger). In Moroccan culture, the family is an extremely significant unit and plays an important role in society. A family consists of both the immediate and multi-generational extended members. The elderly are respected greatly by their families. It is considered a duty to give financial help to other members of the extended family, and adult children are expected to care for their parents when they are too old to be independent (CultureGrams 3). Children are important to the family structure, especially in small subsistent farm families, because they are an essential source of labor. Generally, children go to school a few hours a day, but spend most of their time in long days of labor, times of slim nutrition, and periods of confronting diseases such as tuberculosis, malaria, and aids (Rockefeller Foundation 5). Children, therefore, often do not get the schooling they need to pursue a career in a larger urban area, and they must instead turn to subsistence farming for their lifestyle. School life expectancy for an average Moroccan is 10 years, 11 years is average for male children and 9 is average for female (World Factbook 4). Morocco does not have a full national healthcare system. Each province has at least one hospital and a few clinics, but medical facilities are not suitable to serve the entire population. In rural areas especially, facilities are limited. Water supplies in urban areas are drinkable, however, rural water supplies are not as sanitary. Rural families are mainly subsistence farmers. A small sector of modern farmers produces enough food to account for 30% of all export income (CultureGrams 4).

According to the Encyclopedia of the Nations 2007, 9,895,000 hectares or 22.1% of total land area in Morocco is arable, excluding Western Sahara. Cereals make up 43% of the arable land, 7% grow plantation crops such as olives, almonds, citrus fruits, grapes, and dates. 3% of the arable land is devoted to pulse crops, 2% to forage, 2% to vegetables, and 2% to industrial crops such as sugar beets, sugar cane, cotton, and oilseeds. Within this arable land, 42% is fallow. According to author Rhys Payne, the agriculture economy of Morocco can be divided into two distinct sectors, often known as the "modern" and "traditional" sectors. Modern sectors of Moroccan agriculture are more mechanized, occupying the best lands, using irrigation, and producing fruits, vegetables, and other more "cash crops" for export to Europe and other countries. On the other hand, the more "traditional" sector involves dry land farming of cereal grains to meet food needs of the family alone. Subsistence farming is most open to drought and most devastated by the effects. During years of drought, such as 1967-1968, the "traditional" sector lost half of the grain harvest while the "modern" sector experienced a higher yield of cash crops to export (Payne 154, 155). Unusual inconsistency of the sectors and season has been studied since 1968, and the need to bring the "traditional" sector up to the standards of the "modern" sector has been established. Currently, in the sub-Saharan population, the average earnings per day is 65 cents (Rockefeller Foundation 5). Three-fifths of all farms are quite small and run mainly for subsistence, or to feed the family alone. A typical Moroccan farm carries on a traditional subsistence type operation on plots less than five hectares or 12 acres. Large farms with more mechanization make up 10,000 km², or around a one-eighth portion of the land suitable for agriculture, while 55% of all Moroccan farmers operate on three hectares or less (Voll 585). An additional 15% are only somewhat bigger with three to five hectares. Farm size generally does signify household wealth, and small farmers are apt to be poor. Farm households operating more than 20 hectares represent around 4% of the total, but they cultivate around one third of the land available for agriculture (Arndt 5). In the late 1960s and early 1970s around 500,000 hectares of land previously owned by European settlers was redistributed to Moroccan farmers. The Agricultural Investment Code of 1969 requires farmers in irrigated areas meet a minimum standard of efficiency dictated by the government, or their land is taken away from them. The standards apply to all farms greater than 5 hectares (Encyclopedia of the Nations 1). There is, however, a wide range of climate and soil in Morocco, leading to different crops in different areas. In the north, Morocco generally produces fruit, olives, and wheat due to the more plentiful rainfall found in the southern portion of the country. Tangier, near the Strait of Gibraltar, receives approximately 890 mm of rain annually, whereas Agadir along the southern Atlantic coast, obtains only 230 mm (Voll 584). To the west, oranges, vegetables, and wheat are common. Dates are an important crop to the south. The friend also wrote in her journal of her trip to Morocco: "We learned about irrigation…Another Moroccan, who studied in California...showed us his flourishing greenhouses of banana and avocado and papaya trees. He also grew watermelons, peppers, tomatoes, and sweet corn. He had just been in California to learn a way to prevent frost damage. All this knowledge tucked in the back roads of poverty looking dwellings. One even saw mule-pulled equipment but hearty waves from the people. Although the olive tree does not require much water, they are concerned their water table is dropping 3 meters a year" (Kruger).

Degradation of land in the arid areas of Morocco presents a large problem to the escalating demands of a growing population. Desertification is a common problem in Africa. According to United Nations Univeristy's Institute for Natural Resources in Africa, based in Ghana, if recent trends of soil degradation continue, Africa may be able to feed only 25% of its population by 2025 (UNU). Currently, Sub-Saharan Africa contains 16 of the 18 most undernourished countries in the world. It is the only region remaining in which per-capita food production continues to worsen every year (Rockefeller Foundation 1). Desertification is due to a changing climate and lack of technology and poor management practices by uneducated farmers. Overgrazing, over cultivation, and over usage of ground water contribute to desertification. It is often thought droughts cause desertification. As people begin to analyze the problem of desertification further, solutions point more toward proper farm management and reversing the overexploitation of the environment. Appropriate management has more promise to

overcome desertification, proving droughts are not the direct cause. Droughts seem to put small Moroccan subsistence farmers so deep in debt they have little to look forward to even when good rains fall. Shortage of once plentiful water is the main problem. Agriculture uses large amounts of water. In Africa, 88% of the continental water is used in agriculture, 7% for domestic use, and 5% for industrial use. The water comes from 144 total cubic km per year and 4,570 cubic km of total runoff per year (Millstone, Lang 22). The extreme shortage of water is a growing concern for the country of Morocco. Water availability is rapidly falling compared to the amount needed in the developing country. The need is predicted to rise 13.4% by 2025, while actual available water is estimated to rise only by 4.4% (Runge, Senauer, Pardey, Rosegrant 47). Irrigation is important to the economic yields of Morocco's crops. Worldwide, irrigated land gives more than 40% of total food. Yields from irrigated lands produce crops yielding 30 to 200% higher than non irrigated land. Irrigation raises wheat yields from 1.4 to 2.4 percent in North Africa (Millstone, Lang 18). The question then becomes "Will it be possible to continue increasing irrigation, especially in a country such as Morocco?" Obviously, irrigation would be an easy answer to the problems associated with drought and famine. Consequently, there are problems irrigation itself has presented. Expert Sandra Postel acknowledged agriculture cannot increase its irrigation usage much more beyond the current levels without damaging the environment. The statistic of total water runoff per year can be misleading because it does not include water in remote areas where it is not available for human use or runoff which occurs during floods and not available for irrigation during dry spells. Postel states, "The problem is that water use tripled between 1950 and 1990 as world population soared by some 2.7 billion…Worldwide demand for water cannot triple again without causing severe shortages for crop irrigation, industrial use, basic household needs, and critical life-supporting ecosystems" (Postel). Irrigation has also been shown to deplete valuable sources of ground water. Another big issue with the depletion of groundwater is saltwater intrusion. Irrigation leeches salts from soil and carries the salts into the valuable groundwater, thus making the water unusable for future irrigation. Irrigation can also carry other harmful residues, such as fertilizers and pesticides. Salinization is another problem facing water degradation. Salinization is the accumulation of salts in the soil which results in the degradation of soils and vegetation (ICE 2). When plants use the water from irrigation, the salts are left in the soil, making it difficult for new generations of plants to absorb moisture in the soil. Uneducated and poor farm management practices also increase the salinity of soils by the lack of knowledge of salts in irrigation waters. Farmers inadequately practice proper drainage and leeching of sodic and saline saturated soils. Over 20% of irrigated land worldwide has been affected by salinity. Irrigated land continues to grow, however by 2% a year; an additional 0.4% is being lost to salinity. As levels fall and water becomes scarce, the rate of irrigation expansion has slowed. For many countries, including small Moroccan subsistence farmers, irrigation equipment is too expensive, and the cost of input would not equal the cost of output. Irrigation, therefore, is clearly not the key to solving agricultural yield problems for the small subsistence farmers of Morocco. It only seems to cause more harm to the environment which, in the long run, seems to increasingly hurt the poor subsistence farmers.

The solution to the problem of water scarcity, soil salinization, and desertification is a more thorough understanding of agronomic technology. Knowledge of alternative methods, as well as crop and water management, can help the environment while gradually and eventually increasing crop yields throughout countries such as Morocco. One method which could possibly reduce the issue of salinization is to use legumes and more salt-tolerant crops with proper crop rotation. Leguminous plants would help the soil structure of Morocco because legumes fix their own nitrogen from the air and restore fertility in the ground. Suitable salt-tolerant cover crops include Tall Wheatgrass (Agropyron elongatum), Western Wheatgrass (Agropyron smithii), Saltgrass Distichlis, Beardless wildrye (Elymus triticoides), the legume Birdsfoot trefoil (Lotus corniculatus), alkaligrass (Puccinellia), and Alkali sacaton (Sporobolus airoides) (Swift). While many are not particularly cereal grains grown for food production, the crops can be used as hay type material crops and sold to local cattle ranches throughout Morocco. Some other common crops tolerant to saline soil conditions include barley, rye, sugar beets, and cotton (Mullen 143).

Another method to increase drought tolerance is to genetically modify and breed new crops resistant to drought. Drought tolerant crops can be created by hybridization, back crossing, and genetic engineering through research. The Rockefeller Foundation has already supported the development and release of over 100 new crop varieties, some of which are already in use. An example of genetic research is a new rice variety which stands up to weeds, drought, pests, and diseases which have affected African rice farms for a long period of time. A significant positive characteristic of the rice is its short growth cycle and resistance to weeds, which allows less intensive labor to produce the crop. Shorter growth seasons result in higher school attendance among children who can in turn develop their own knowledge to benefit their own society (Rockefeller Foundation 6). Higher education has the promise of producing new generations of trained African agriculturalists able to dedicate time and energy into the development of new soil and water management techniques, as well as the time to educate subsistence farm workers on conservation techniques.

Loss of tree cover, topsoil, and general foliage has all contributed to Africa's dry lands (Rodale 195). A significant way to reclaim moisture would be the additional plantings of trees and foliage. The trees and other greens would hold soil in place, shade the soil from evaporating valuable water to leech salts, and draw deep water closer to the surface. The more vegetation planted, the more moisture content there would be to condense, rise, and form into clouds able to produce rain. Actor Richard Dreyfuss, a member of the group Africa Tomorrow had an idea, unlike any other, to reduce the effects of desertification. His claim was to: "Restart [the] ecological cycle and let it run naturally, unhindered by…fixes…funding, or the need for alien experts" (Rodale 195, 196).

Another option is to maximize efficiency in already existing irrigation systems. Increasing effectiveness would be much less costly than instituting new projects. Irrigating with seasonal runoff from adjacent highlands would be an excellent way to use already existing water sources, instead of using up and contaminating valuable ground water (Rogdale 194). Another opportunity would be the establishment of the drip or trickle system of irrigation. The trickle system would be especially helpful with the fruit and olive trees of Morocco. The drip irrigation system is found to be extremely efficient for vineyards and orchards where plants are spaced farther apart. Drip irrigation is also a great system to set up in permanent places. The drip system of irrigation trickles water to each specific plant, reducing water usage by an astounding amount. The water is also brought straight to the plant and placed where water absorption is maximized (Mullen 141). The high yield and value of return with crops such as olives, oranges, strawberries, grapes, and fruit trees offsets the high cost of installing the drip system. Also, stacking stones around the bases of trees would collect morning dew and help to preserve moisture within the soil (Rogdale 200). Grooves, or furrow irrigation could be dug in the surfaces to retain rainfall and trap seeds to grow more foliage. Maximizing efficiency of already instituted irrigation systems, as well as installing and instituting efficient drainage systems, can also prevent salt accumulation, allowing drainage water to leach salts from the soil.

Money and new irrigation projects only limit a country's advancement in technology. Knowledge, research, and education can last forever. Organizations such as the World Trade Organization, Food and Agriculture Organization and the World Food Program, have previously helped countries like Morocco. Large scale irrigation projects have been funded, but less than 2% of aid given to countries in Africa went to environmental restoration projects such as tree planting, water, and soil conservation (Lappe 18, 19). Knowledge and improvement of agricultural methods could be emphasized instead of the multimillion dollar new projects which have previously been instituted throughout developing countries. Billions of dollars have been spent researching irrigation, but little has been done about improving certain parts of the technology which show great flaws (Lappe, Collins 17, 18). Educational institutions such as Colorado State, Iowa State, Nebraska, and other top agricultural colleges in the United States need to consider the problems of irrigation and the environment. Colleges have the ability to research the long term effects of irrigation on the environment and formulate ways to apply

improvements to the many defects of irrigation. After researching, we can share our knowledge with countries such as Morocco to improve their systems and increase their yields in many simple ways. In addition, the cost-effectiveness of water conservation and technology should be investigated. There have only been a small number of research projects issued, and new projects of studying water conservation are needed. Successful alterations may prove to provide huge returns in crop yields of third world countries like Morocco. The economic rate of return with more efficient irrigation systems can help the small subsistence farmers of Morocco to produce higher yields to support their families and improve health. Technology and the trade-off between cost and environmental improvement needs to be recognized by everyone from research institutes in the United States to poor subsistence farming families in Morocco. Through research and education we can reverse the effects of desertification, salinization, and the reduced water tables Morocco experiences.

Perhaps at some point, Morocco will no longer be known as “a rich country where the people are poor,” but instead be known as a nation moving forward in the quest for environmental improvement, reversing the effects of desertification. Obviously, from observing statistics during the years of good rainfall, Morocco is capable of producing plenty of food. Increased production happens during good seasons with adequate rainfall. Through plentiful times, it seems Morocco can produce enough food to sustain itself while exporting valuable cash crops such as fruits, olives, and olive oils. The potential for great economic prosperity is attainable, hindered by the inefficiency of past technologies in desperate need of change. Instituting new knowledge and more efficient systems will increase the time allowed for children in Morocco to be educated, then they can institute their own technologies to improve agriculture. A vision of a future Morocco can be seen leaning towards the more “modern” sector of agriculture, while high yields begin to bring more prosperity. When new technologies take hold, farmers will not rely quite so much on the unpredictable weather and rains. As destruction of the environment remains an issue in many countries, foliage to Morocco can return, making the country a thriving center of lush agriculture and prosperity. The current problem with Moroccan agriculture is not the fact of declining food production but the decline in the advance of technology and efficient farming practices along with a growing population and food demand. The problem of desertification is one which can be solved by instituting proper use of land resources and advancing technology of water conservation in the region. With knowledge and technology instituted by helpful organizations such as the World Food Program, the Food and Agricultural Organization, the World Trade Organization, and top agricultural research institutions in the United States, Morocco can overcome its underdeveloped technology and strive to be a nation operating at full potential.

Works Cited

"Africa's Turn: A New Green Revolution for the 21st Century." Http://www.rockfound.org/library/africas_turn.pdf. July 2006. The Rockefeller Foundation. 9 Sept. 2008 <http://www.rockfound.org/library/africas_turn.pdf>.

Arndt, Channing. Policy and Progress in Moroccan Agriculture: A Retrospective and Perspective. 1997. Purdue University. 9 Sept. 2008 <www.luc.edu/orgs/meea/volume3/arndtrevised1.pdf>.

Commins, Stephen K., Michael F. Lofchie, and Rhys Payne, eds. Africa's Agrarian Crisis : The Roots of Famine. New York: Lynne Rienner, Incorporated, 1986.

CultureGrams. Kingdom of Morocco. Ann Arbor, MI: ProQuest Information and Learning Company, 2006.

De Nault, Kenneth J. "Gypsum." World Book. 2001st ed. 2001.

"Economy of Morocco." Wikipedia. 26 Aug. 2008. 04 Sept. 2008 <http://en.wikipedia.org/wiki/economy_of_morocco#agriculture>.

Evans, Charlotte. World Travel Guide. 21st ed. London: Columbus, 2002.

Foster, Phillips, and Howard D. Leathers. The World Food Problem : Tackling the Causes of Undernutrition in the Third World. New York: Lynne Rienner, Incorporated, 1998.

"Gypsum." Wikipedia. 30 July 2008. 9 Sept. 2008 <http://en.wikipedia.org/wiki/gypsum>.

Kruger, Deb. "County Board President Incentive Trip to Morocco." E-mail to the author. 20 Sept. 2007.

"Looming desertification could spawn millions of environmental refugees Africa may be able to feed only 25% of its population by 2025." Monga Bay. 14 Dec. 2006. United Nations University. 5 Sept. 2008 <http://news.mongabay.com/2006/1214-unu.html>.

Millstone, Erik, and Tim Lang. The Atlas of Food : Who Eats What, Where and Why. Detroit: Earthscan/James & James, 2003.

Moore Lappe, Frances, and Joseph Collins. World Hunger: Twelve Myths. New York, NY: Grove P, 1986.

"Morocco Agriculture." Arab.net. 2002. 04 Sept. 2008 <http://www.arab.net/morocco/mo_agriculture.htm>.

"Morocco." Encyclopedia of the Nations. 2007. 04 Sept. 2008 <http://www.nationsencyclopedia.com/africa/morocco.html>.

"Morocco: Language, Culture, Customs, and Doing Business." Kwintessential: Cross Cultural Solutions. 9 Sept. 2008 <http://www.kwintessential.co.uk/resources/global-etiquette/morocco-country-profile.html>.

Mullen, Russell E. Crop Science: Principles and Practice. 5th ed. Boston, MA: Pearson, 2005.

Phillips, Jon. "Effects of Desertification on Arab-Berber Relations." ICE Case Studies. 9 Mar. 2007. Inventory of Conflict and Environment. 4 Sept. 2008 <http://eagle1.american.edu/~jp3501a/berber.htm>.

Runge, C. Ford, Philip G. Pardey, and Mark W. Rosegrant. Ending Hunger in Our Lifetime : Food Security and Globalization. Detroit: International Food Policy Research Institute, 2003.

Sarre, Alastair. "Sodicity â€“ a dirty word in Australia." Nova: Science in the News. June 1999. CRC for Soil and Land Management. 9 Sept. 2008 <http://www.science.org.au/nova/035/035key.htm>.

Save Three Lives : A Plan for Famine Prevention. New York: Sierra Club Books.

"Soil Salinity." Wikipedia. 28 Aug. 2008. 04 Sept. 2008 <http://en.wikipedia.org/wiki/salinization>.

Swift, Curtis E. "Salt Tolerance of Various Temparate Zone Ornamental Plants." Colorado State University Extension. 13 Apr. 1997. 9 Sept. 2008 <http://www.coopext.colostate.edu/tra/plants/index.html#http://www.coopext.colostate.edu/tra/plants/stable.html>.

Voll, John. "Morocco." Academic American Encyclopedia. Vol. 13. Danbury, CT: Grolier Inc., 1985. 583-87.

Waterlow, J. C., D. G. Armstrong, and Leslie Fowden, eds. Feeding a World Population of More Than Eight Billion People : A Challenge to Science. New York: Oxford UP, 1998.

Wilson, Wesley M. Countries & Cultures of the World, Then & Now. Vol. 1. New York: Professional P, 1997. 65-69.