

Ezgi Ustundag
Ames High School
Ames, IA
Turkey, Factor 2

Implementing Sustainable Irrigation and Water Management Practices to Benefit Subsistence and Large-Scale Farmers in Turkey

Turkey is a country in transition. With a young and growing population that has already reached over 73 million, Turkey's food and energy demands have skyrocketed in the past decades ("Rural Poverty in Turkey"). In addition, Turkey applied for membership in the European Union in 1999, and has reassessed its agricultural and energy policies extensively in accordance with the European Union's Instrument for Pre-Accession Assistance ("Rural Poverty in Turkey"). Consequently, Turkey recently implemented several agricultural reforms in its most remote and impoverished areas to increase yields and raise the standard of living for the inhabitants of these areas.

Agriculture is a major sector for employment in Turkey. Despite growth in agricultural production, subsistence farming is significant, primarily due to outdated inheritance laws and a rapidly growing population. Around 85% of farms are smaller than 9 hectares, even though 60% of the total arable land area is cultivated by the remaining 15% of farms (Kaygusuz).

Much of the agricultural labor force consists of unpaid family laborers, primarily women, who have little to no access to public services and education. The typical subsistence farm family is large in size, even though the land it farms for sustenance is small. Prevailing inheritance practices, especially in remote areas in eastern and southeastern Turkey, confine families to these tiny plots of land. In addition to staple crops like wheat and lentils, subsistence farmers also raise tomatoes, eggplants, herbs, and peppers (Harris). Families that do not own a cow or a goat must purchase milk and yogurt, and this may lead to protein deficiencies in the members of the household, especially in women and children.

Eastern and southeastern Turkey, the most remote and impoverished regions of the country, are characterized by high plateaus with little rainfall. This water scarcity exacerbates the low crop yields and reliance on subsistence farming practices. In the case of larger farming operations, farmers have to compete with the urban and environmental users of the same water (Gürlük and Ward).

Fortunately, the Turkish government has begun to address this barrier to greater agricultural productivity by implementing several regional development projects, such as the Southeastern Anatolian Project (GAP). The government is also involved in the progressive transfer of the operation and maintenance of irrigation networks from the General Directorate of State Hydraulic Works to local water user associations ("Turkey Country Section"). Nevertheless, Turkey has a long way to go before it fully implements sustainable water management practices.

Agricultural water use grew by 65% between 1990 and 2004. Agriculture accounted for nearly 80% of water use by 2001, according to data gathered by the OECD. Nearly 5 million hectares were being irrigated by 2005, and up to 26 million more hectares of land are suitable for irrigation. Larger farms are generally irrigated from dams and reservoirs with help from the government, while smaller farms are irrigated from wells constructed at the farmers' own expense.

Southeastern Turkey is a remote and relatively impoverished region. In response to the poverty of this region, the Turkish government has taken significant steps in recent years to improve access to water in this region for use in agricultural and domestic spheres (Harris).

The Southeastern Anatolian Project (GAP) is the largest regional development project in Turkey at an estimated cost of 50 billion Turkish liras, or 32 billion U.S. dollars. GAP's primary objective is to expand agricultural production in the region by building twenty-two dams and providing irrigation infrastructure for 1.7 million hectares of land by 2015 (Kaygusuz).

Although GAP has raised the standard of living in many parts of southeastern Turkey, the appearance of previously absent irrigation systems in these remote plateaus has presented many challenges for subsistence farmers and their families. One of the first areas to receive irrigation waters as part of the GAP project was the Harran Plain, located to the southeast of the city of Şanlıurfa. In the first year of irrigation delivery alone, the average income of a farmer on the Harran Plain increased from about \$1,000 to nearly \$4,000 (Harris). Unfortunately, with this increase in income came an unexpected increase in expenses and the emergence of new barriers to reducing poverty in the region.

Leila M. Harris highlights the difficulties faced by the inhabitants of this region in "Water Rich, Resource Poor." The people of the Harran Plain relied on subsistence farming for food and money prior to the availability of irrigation waters. Animal husbandry was also an important source of income for those without an official title to a plot of land. With the introduction of large-scale irrigation systems in the Harran Plain, most subsistence farmers turned to raising cash crops, primarily cotton. Because cotton is a crop that is labor- and land-intensive, women and children and families with livestock suffer greatly from this shift in agricultural focus. Women and children are often the unpaid laborers that work long hours in the fields to plant and harvest the cotton. Children, especially young girls, are unable to attend school because they have to help with the fall harvest. Those engaged in animal husbandry are also suffering because of the shift from subsistence farming to cotton growing. Because cotton demands a large growing area in order to produce a viable yield, there is little land available for these semi-nomadic pastoralists to graze their herds.

As stated previously, nearly all of the farmers who switched from growing basic crops to cotton observed a dramatic increase in income. This increase in income was accompanied by a long list of new expenses. Because cotton requires a lot of land and water to grow in marketable quantities, families are left with little to no resources to address their own basic needs. GAP helped to make clean water more accessible to rural villagers, but the inhabitants of the Harran Plain are forced to purchase the food they once grew on their own land. Produce and flour have to be purchased from stores or larger farms, and most cotton growers cannot afford to buy meat and dairy products, leaving their families malnourished. Former grazers are heavily in debt because they can no longer feed their herds and sell the milk and wool that once sustained their livelihood.

Problems exist in other parts of Turkey as well. The Nilüfer River basin in northwestern Turkey is the province of Bursa's most important source of water. The basin itself covers an area of 1539 square kilometers, including the city of Bursa and surrounding agricultural areas (Gürlük and Ward). The river provides water to 428,000 households in Bursa, while the upper part of the river is used for agriculture. Following industrial growth in the region in the 1970s, much of the river is also used by privately owned factories and enterprises, leading to water pollution. The water used by the city of Bursa also contains a high amount of domestic waste that is discharged directly back into the Nilüfer River, unprotected by water treatment facilities (Gürlük and Ward). The contamination of the river has led to much contention between urban and agricultural users for the basin's limited resources.

Many of these problems can be traced to the transfer of infrastructure operation and maintenance from the government-run General Directorate of State Hydraulic Works (DSI) to self-financing local water user associations. This transfer of control allows farmers to support a higher share of the costs of maintaining irrigation systems. Unfortunately, the price of water is significantly lower than what it needs to be in

order to effectively maintain these irrigation systems. According to an estimate by the DSI, the water charges to cover operation and maintenance costs for cotton irrigation systems should be six times higher than what producers are currently paying (“Turkey Country Section”). In the past few years, however, some areas under the control of local water user associations have seen an increase in water charges. An OECD study of cotton and grape production in such an area showed that areas with higher water charges led to significant gains in irrigation water productivity.

The prevailing pricing practice is per hectare charge differentiated by crop (Cakmak). This policy is in place largely because it serves to increase the income of the farmers and boost the crop yield in the area. Although this practice has its disadvantages, as mentioned previously, the opposite practice, or volume independent pricing, is equally harmful if undertaken by uneducated farmers. Volume independent pricing leads to the overuse of the irrigated water with a negative impact on crop yields (Cakmak). According to the OECD’s “Turkey Country Section,” there has been a slight improvement in irrigation management practices, but the tendency to inefficiently flood irrigated fields remains.

With the current water pricing policies and infrastructure projects in place, urbanization and population growth, if they continue at the same rate, will strain the irrigation systems significantly. A greater population requires a greater amount of food, and farmers will need more water. If farmers continue to flood their fields, and if water treatment plants are not built throughout Turkey, much of the water supply will be contaminated and rendered unusable by the fertilizers and pesticides used extensively by growers. This will lead to a decrease in crop yields and availability of drinking water in urban areas. Urbanization is another trend in Turkey’s population that could lead to a strained agricultural sector. If families continue to move into cities and leave their farms behind, especially in Turkey’s remote areas, the cities will struggle to meet the greater demand for clean water and for an increased amount of food. Because Turkey’s population is relatively young, this trend of urbanization and population growth is likely to continue for the next several decades (“Rural Poverty in Turkey”).

Two key environmental issues could also play a significant role in adversely affecting the present irrigation infrastructure. The pollution of rivers by pesticides, fertilizers, and domestic waste produced by farmers and urban populations will eventually render these important sources of renewable water unusable. Contaminated water is detrimental both to the health of crops and rural and urban populations. Without water treatment facilities in river basins, such as the Nilüfer Basin in northwest Turkey, Turkey’s water resources will soon be depleted (Gürlük and Ward). Soil erosion is another key environmental problem caused by the improper irrigation of farmlands. Erosion may stem from many sources, including natural conditions due to the climate and steep topography of the Anatolian Plateau and poor tillage and irrigation management practices (Kaygusuz). Off-farm sediment flows have reduced the efficiency of dams and have had adverse effects on aquatic ecosystems (“Turkey Country Section”). Increased soil salinity, although less prevalent than other forms of soil degradation, was shown to reduce crop yield by over 30%. Soil salinity is caused by inappropriate fertilizer and irrigation management practices and over-extraction of water, especially in the GAP region.

There is no empirical solution to all of the problems facing Turkey’s current irrigation infrastructure, but a good starting point is education, especially in the areas affected by the GAP. Classes in water management and farmer training can easily be made available at the women’s centers in the GAP region that the government has already built (Harris). These centers could be used to link women of all ages to the broader issues in southeastern Turkey and empower them with the education they need to more efficiently manage their family’s plot. The World Bank, which is already helping fund the GAP, can play an important role in the upstart of these education programs. Farmers in other parts of Turkey, such as the Nilüfer Basin, should also have access to similar water management education programs, although they would have to be revised to meet the needs of larger-scale farm operations.

In their study of integrated basin management, Gürlük and Ward constructed four basin-scale models illustrating the hydrologic, agronomic, and economic consequences of a variety of scenarios. Such models are invaluable tools for policy makers to understand the full implications of their decisions. If policy makers are able to view the scope of their decisions, Turkey can achieve greater financial autonomy in additional agricultural projects because wiser and more cost-effective solutions will be pursued by the government. The Turkish government must be willing to provide its large-scale farmers with more efficient irrigation tools, such as low pressure sprinklers and drip emitters manufactured by Turkish companies, to discourage the wasteful practice of flooding (Kaygusuz). Water treatment facilities must be built throughout river basins to reduce the contention between urban and agricultural water users. Such facilities will also ensure that Turkey will have dependable sources of water for years to come. The government should also carefully follow the EU Water Framework Directive and implement management practices in river basins accordingly, and seek the expertise of international research agencies and the faculty of Turkish and international universities in building these basin usage models.

In accordance with the transfer of operation and maintenance from the DSI to the local water user associations (WUA), the government must provide WUA personnel with education and extension activities in managing local irrigation systems that benefit multiple farms. A better organization of the WUA's will greatly increase the farmers' satisfaction with their WUA and lead to improved user participation and more careful use of the irrigation channels, ultimately lowering maintenance costs (Uysal). The Ministry of Agriculture, the DSI, and the WUA's must work in careful cooperation for the next several years in order to effectively introduce these enriching water management extension activities. In addition, the DSI should act as the governing body of the WUA's and advise personnel should local crises arise.

Turkey's agricultural sector, despite its growth in the past two decades, has a long way to go before it can fully meet the needs of its growing and urbanizing population. The government has made remarkable strides in the right direction and has facilitated several large-scale infrastructural projects to improve access to irrigated waters, most notably the GAP. These massive building projects must be accompanied by equally comprehensive farmer education and water management classes for the rural subsistence farmers who have little experience with growing cash crops. The women of the GAP region also require access to courses in agriculture. These classes and extension activities can easily be taught in the women's centers already built by the Turkish government as part of the GAP.

Farmers in larger-scale agricultural operations should have access to water management courses tailored to their specific operation's needs. These enrichment activities can easily be sponsored by the local water user associations, but greater cooperation between the DSI, the Ministry of Agriculture, and the WUA's must first manifest itself. WUA personnel themselves should receive training in irrigation system management from the DSI before they are allowed to govern their region independently. The water pricing policy most appropriate for each irrigated region should be decided by the local WUA in accordance with the DSI, which should act as an advisory body. Finally, policy makers within the Turkish government should take full advantage of emerging irrigation technologies such as basin scale modeling. By allowing key individuals within the Ministry of Agriculture to view the full implications of their decisions, basin scale models can help the Turkish government implement sounder and more cost-effective irrigation systems.

Su akar, yolunu bulur is an adage frequently cited by the Turks—"water will always find its way." Despite the daunting challenges its subsistence farmers and its entire agricultural sector face today, Turkey is armed with the tools it needs to find its way in the years to come.

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