

Egypt: Food Insecurity in a Time of Water Scarcity

Egypt is a desert with one river, the Nile. The entirety of Egyptian socio-economic activity centers around this river. Regrettably, the ongoing collision between urban development and water scarcity perpetuates food insecurity. Avoiding a food crisis requires: 1) investing in water infrastructure efficiency, 2) prioritizing alternative drought-resistant crops, 3) penalizing polluters, 4) defending arable land, and 5) sourcing alternative water supplies. Without decisive policy action to combat water scarcity, food insecurity will intensify and likely bring severe hardship to Egyptians.

Background

Egypt's arid and inhospitable climate severely restricts agricultural cultivation. Located in northeastern Africa bordering the Mediterranean Sea, Egypt is principally a desert; only 3.4% of the country's total area is arable, leaving scant land available for agricultural production and urban development (World Bank, "Arable Land"). Because water sources are limited, virtually all rural, urban, and agricultural activity centers around the Nile River and Delta.

Despite a lack of arable land and water, agriculture represents a large percentage of Egypt's economic activity. According to USAID, agriculture contributes 11.3 percent of Egypt's GDP. Agriculture also represents 28 percent of all jobs and over 55 percent of employment in rural Upper Egypt (USAID). Most of Egypt's farms are small, averaging 2.5 feddans or 0.84ha (El-Sherif). These small-scale farms represent a significant amount of Egypt's crop production. Despite agriculture's prevalence in Egypt's economy, demand from a growing population has increasingly outstripped domestic production capabilities. Consequently, Egypt imports 40 percent of its food needs (FAO, "Glance").

Critically, Egypt's rapid population growth is accelerating urbanization and is threatening the country's already scarce agricultural land. Between 1960 and 2021, Egypt's population grew from 26.6 million to 104.2 million, a nearly four-fold increase (World Bank, "Population"). The aggressive growth of the past six decades is poised to continue; projections place Egypt's population at approximately 160 million in 2050 (Al-Youm). Significantly, the rapid population growth accompanied migration from rural to urban areas—66 percent of its citizens lived in rural areas in 1960 compared to 43 percent in 2021 (World Bank, "Rural Population").

Egypt is a developing nation with limited resources, where one-third of the population lives below the poverty line (Associated Press). The average household annual income is approximately 69,059 EGP or \$2,889 (CEIC). This income supports a typical 4-person family (ARCGIS). Although a substantial portion of the Egyptian population lives below the poverty line, citizens still have access to critical human health infrastructure. In 2015, 100 percent of the urban and 99 percent of the rural population used improved drinking water sources. In the same year, 94.7 percent of the population used improved sanitation facilities (FAO, "Country Profile"). Unfortunately, Egypt's education system is not as robust; the country consistently ranks below global educational standards. The Borgen Project indicates that, in 2017, the rural illiteracy rate was 32 percent, and the urban rate was 18 percent (Borgen Project).

Despite historical progress, Egypt's ability to support its current population and future development depends on reliable access to water. Egypt's water supplies are already strained and are impacting agricultural output. The UN threshold for water scarcity is 1,000 cubic meters per person annually. Egypt sits well below that minimum at 560 cubic meters of water per person annually (Farouk). But, the water scarcity crisis will worsen. Climate change has brought extreme heat and drought. Egypt's exploding population further heightens demand for existing water sources. Moreover, Egypt employs subpar, water-intensive farming practices that waste precious water. Finally, a new Ethiopian dam upstream of the Nile (the Grand Ethiopian Renaissance Dam) threatens to reduce water flows into Egypt drastically (Demerew). Together, these potentially catastrophic pressures on Egypt's water supply have created an existential threat to the food security of Egyptian families.

Solutions

To optimize agricultural productivity in a time of water scarcity, Egypt must immediately implement inward-looking policies to protect against water shortages. The policies proposed below are listed in order of priority. Domestically, Egypt should invest in water infrastructure efficiency to improve agricultural water use; prioritize alternative drought-resistant crops over its current more water-intensive agriculture; enforce pollution control laws; defend its precious existing arable land from unchecked urbanization; and reduce its dependence on the Nile by sourcing alternative water supplies.

Invest in Water Infrastructure Efficiency

Egypt has already made substantial commitments to improving agricultural water availability through investments in infrastructure. For example, Egypt has recently committed to building the world's largest agricultural wastewater treatment plant (Egypt Forward). Massive investments are essential, but significant gains can also be made by zeroing in on the water efficiency of smaller, rural food producers. Specifically, Egypt must ensure that all farms have access to improved irrigation systems and state-of-the-art monitoring technologies.

Egypt's farmers rely on a network of canals to access water for irrigation. Water is transported through a series of canals and ultimately to on-farm water distribution systems called marwas. Farmers then flood their fields to water their crops. Flood irrigation is prevalent yet highly inefficient. Water in the exposed canals is lost to ground seepage and evaporation in Egypt's arid climate. A more efficient way of transporting water requires burying irrigation pipes to prevent evaporation and lining canals with bricks to prevent seepage (State Information Service, "Canals"). Egypt should also require pressurized irrigation systems throughout the Nile Delta and Basin. These systems ensure that all available water is used to water crops more directly.

New technologies also offer particularly compelling opportunities for small farms. Some technology pilot programs pursuing "More Crop Per Drop" are equipping farmers with mobile monitoring devices that evaluate soil moisture to water crops with more precision (Farouk, "Technology"). Early technology-driven programs have shown tremendous promise but have run up against reluctance from finance-strapped farmers and their general wariness of new technologies. Adoption will likely require subsidizing investment in equipment, as well as education and training programs. Nimble groups accustomed to on-the-ground relationship building and implementation - perhaps NGOs focused on water infrastructure - should spearhead this effort.

Prioritize Alternative Drought Resistant Crops

Egypt must shift agricultural production away from water-intensive crops to more new drought-tolerant crops. In 2021, Egypt cultivated 750,000 acres of water-intensive crops, according to the Egyptian Agricultural Minister (Emam). By instituting and enforcing tighter crop-planning regulations, the Egyptian government can dramatically increase the agricultural yield per unit of water. Such new regulations should reduce the acreage allowed to cultivate water-intensive crops such as rice and bananas. This water-protection effort would benefit those who comply with new laws through government subsidies and tax credits and punish those who violate these policies with major fines. Moreover, Egypt should further its development and acquisition of drought-tolerant crop varieties much as it did when it announced a new drought-tolerant rice species in 2021 (Emam).

Penalize Polluters

Polluted water is a problem for agricultural production because it significantly reduces crop yields. Despite 1982 discharge laws, 300 million cubic meters per year of industrial sewage spill into the Nile from 34 large industrial facilities (Egyptian Streets). High concentrations of heavy metals, bacteria, pesticides, and fertilizer from municipal and industrial waste negatively impact human consumption and adversely affect crop production. While all polluters should be cited, Egypt ought to prioritize reprimanding larger offenders as they have a greater negative impact on the health of the Nile. Egypt should consider financial penalties, remediation requirements, a reevaluation of business licenses, and jail time for repeat offenders.

Defend the Arable Land

As Egypt's population grows, there is increasing pressure to develop arable land near the Nile. To improve food security, it is paramount that Egypt preserves existing farmland and, if necessary, reclaim farmland from illegal urban development.

Protection begins by aggressively enforcing existing laws. Specifically, Egypt penalizes building on agricultural land (Masri and Abdelaty). However, enforcement of those laws is spotty, at best. According to Egypt's president, illegal construction represents a staggering 37.5 percent of Egypt's buildings (Egypt Independent, "Illegal Buildings"). Egypt must tear down illegal developments and punish developers with financial penalties and possible jail time. More radically, Egypt might incentivize migration from the arable land abutting the Nile to urban centers closer to the Mediterranean coast. Enticing tax incentives for relocation are an option—perhaps income tax cuts of 25% for five years. Prioritizing population density over sprawl will free up substantial farmland and water resources along the Nile.

While it is important to move population density away from farmland and into urban centers, successful farms require successful farmers. Farmers have been leaving their farms to work as taxi drivers in urban areas (Farouk, "Bailing"). Egypt must encourage existing farmers to stay and entice new people into the profession. Importantly, in 2019, Egypt began an ambitious program called "Decent Life" to improve the wages and standard of living for people living in rural regions (Daily News Egypt). The project established classrooms, youth centers, critical healthcare infrastructure, and other quality-of-life projects. However, the program is running up against significant cost hurdles. What was once expected to cost EGP 700 billion will now likely cost close to EGP 1 trillion (State Information Service, "Decent Life"). In the

face of these cost overruns, the Egyptian government must prioritize funding to tackle the most urgent, high-value issues. Noting the lack of education in these rural, illiterate communities, funding for education infrastructure should top the list. These programs will keep farmers from abandoning their land and, in turn, improve agricultural productivity.

Source Alternative Water Supplies

Egypt relies almost exclusively on the Nile to satisfy its freshwater agricultural needs; the agriculture industry consumes 85% of Egypt's share of the river (Farouk, "Scarce Water"). Any sustained reduction in river flow would have a catastrophic effect on agriculture. However, many other upstream nations also rely on the Nile and its tributaries. Most notably, in Ethiopia, the Grand Ethiopian Renaissance Dam (GERD), located on the Blue Nile tributary, aims "to address critical energy gaps in Ethiopia and also generate export revenue from neighboring partners" (Demerew). Understandably, this dam has proved to be a major point of conflict between Egypt and Ethiopia. While Egypt is surviving the filling of the GERD, it points to the need for highly negotiated water rights for all countries along the river.

Yet, dependence on water treaties is imprudent. Egypt should further sustainably develop its vast renewable and nonrenewable water aquifer resources. Presently, only 8 percent of Egypt's water production comes from aquifers, a shockingly low amount (Fanack). Egypt currently underutilizes this potentially significant source of water. Experts estimate Egypt's underground water reserves at 40,000 billion cubic meters, with the Nile Aquifer representing 87% of Egyptian groundwater (Fanack). These reserves represent a one-hundred-year water supply that is largely untapped (MENA). Egypt ought to focus on funding and maintaining pumps to access critical underground aquifers and develop treatment plants to create potable water.

Egypt must also continue developing new desalination plants beyond its existing 82 plants. Population growth and migration to major urban areas near the Mediterranean will concentrate on increases in freshwater demands. Due to proximity to the sea, this need should be met through the expansion of desalination beyond the country's current 917,000 cubic meters per day capacity. This past summer, 14 new plants that would increase capacity to 1.4 million cubic meters per day were proposed (Gomaa). Egypt should complete these projects and be prepared to build more as future population growth necessitates.

Conclusion

Absent extreme measures, agricultural instability in Egypt will intensify in the coming years. Egyptians must make choices—some likely to be highly unpalatable. However, ignoring the issues will not make them disappear. Fortunately, investing in agricultural water infrastructure and technologies, planting drought-tolerant crops, penalizing polluters, defending arable land, and sourcing alternative water supplies are inward-looking and can be accomplished independently of other nations. Through the proposals discussed above, Egypt can lay the necessary groundwork to mitigate food insecurity for its people.

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