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Haiti, Water Scarcity

Haiti: Mangrove Restoration and Water Storage as Methods to Alleviate Water Scarcity

Haiti, previously named St. Dominique, was originally a French colony known for its sugar, coffee, and timber exports (Office of the Historian 2014). The Taino population, the indigenous people of Hispaniola island, was enslaved upon the Spanish arrival in 1492. Due to the Taino population decline from diseases, the Spanish imported African slaves to work in gold mines and sugar plantations (Concern Worldwide US 2024).

The class system, enforced by the French, separated Haiti's society into three groups: the Elites, free people of color, and enslaved people. The free people of color were labeled "semi-citizens" by the Elites. The white elites, which included the plantation owners, suppressed the lower two classes. The brutal conditions of plantations left the slave population seeking for emancipation. In 1791, following the French Revolution, the free people of color and slaves in St. Dominique revolted against France. A series of conflicts continued until its independence in 1804.

The Haitian Revolution resulted in civil unrest (Britannica 2024) and plantations and towns were left decimated. In order to receive French recognition, Haiti paid France an indemnity of an estimated value of 150 million gold francs which contemporary equates to billions of dollars (Alexander 2021). As a result, Haiti accumulated a large debt from taking out high-interest loans from French banks (Alexander 2021). Failed political institutions, foreign intervention, and natural disasters left Haiti undeveloped with poor infrastructure (Alexander 2021).

Around 58% of Haiti's 11.8 million population is urban, while 41% is rural (Statista 2022). Haiti has a humid tropical climate, with warm temperatures throughout the year. However, Haiti experiences a wet season between the months of February and May. Heavier rainfall occurs in the Southern peninsula, northern plains, and mountainous regions. The eastern central region receives a moderate amount of precipitation of 140-200 cm per year (Country Studies 2000). The areas in the western coast, from the northern peninsula to the capital, are relatively dry.

Around half of the country's population is employed in the agriculture sector. Although only 1/ 5th of Haiti's land is suitable for agriculture, more than 2/ 5ths of the land is under cultivation. Farmers focus on cassava, plantains, bananas, corn, yams and sweet potatoes, and rice for cultivation. Haiti's leading industries export beverages, butter, cement, detergent, edible oils, flour, refined sugar, soap, and textiles. The average farm size in Haiti is around a hectare, or 2.5 acres, per family. That is the equivalent of 1 and a half of a soccer field.

As of 2022, the typical family size is 4.3 per household. For rural households, Haitians typically live in two-room dwellings that have mud walls with floors and roofs thatched with local grasses or palm leaves. They may be constructed with plastic and other materials, with roofs of corrugated metal. No electricity

or piped water lies within the average house. Traditional kitchens are found outdoors, and meals are made over charcoal stoves. A typical family diet consists of starch staples such as rice, corn, millet, yams, and beans. Haitians typically eat two meals a day. They have a small breakfast with coffee and bread. Most families get their food from open-air street markets.

Typical families in Haiti suffer from poverty and insufficient lack of food security. The average family in Haiti does not have access to education and healthcare. Haitians cannot afford to send the children to school. Additionally, the average family does not have access to clean water, toilets, electricity, telephones, roads, and local markets. Haitians have restricted access to healthcare, and water and sanitation services. In Haiti, contaminated water is one of the leading causes of childhood illnesses and the 5.7% infant mortality rate (International Action 2018). Only 43% of Haiti's rural population has access to basic drinking water supplies (UNICEF 2021). Only half of the improved water sources facilities are operational (Integrated Drinking Water and Sanitation Information System 2022). The water scarcity is worsening, with only 50% of the rural population having access to basic drinking water supplies (The World Bank 2020). Local residents in urban areas store trickled water within tanks. They receive water from water truck deliveries. In poorer neighborhoods, they tend to lack tanks or water mains, so many residents line up to fill up their five-gallon jugs from the arriving tankers. Many Haitians cannot afford to spend money on water services since most residents live off of an average of less than three US dollars per day. Water supplied from rivers is highly contaminated, and water infrastructure, providing piped water to homes, becomes damaged from insufficient funding. Climate change causes shortages and droughts in some areas and floods in others. The inadequate sanitation systems lead to water contamination and outbreaks of waterborne illnesses, such as cholera.

Poverty is further worsened by natural disasters. The island Hispaniola exists on a major fault line named the Enriquillo-Plantain Garden fault line. Faults, or fractures, within the Earth's crust cause movement between two separate blocks of rock. Sudden movement along faults releases energy in the form of waves that lead to structural building collapses. Haitian civilians are left vulnerable to potential flooding, landslides, and geological hazards. In 2010, a magnitude 7.0 earthquake displaced more than 1.3 million people, killed 222,570 people, and destroyed 97,294 homes (NOAA 2021). Around 80% of the schools and more than 50% of hospitals were destroyed or damaged (GOH 2010).

Natural disasters, like earthquakes, may contaminate groundwater essential to the livelihood of Haitians. According to the U.S. Geological Survey, sediment and other contaminants can be released into water once earthquake shaking damages infrastructure like sewer or gas lines (USGS 2022).

As of right now, the World Food Programme works with over 150 Organisations de Producteurs Agricoles, or OPAs, to source food from smallholder farmers. WFP funds an average of \$1 million dollars, in U.S. currency, into the local economy each month, through buying Haitian-grown products. Despite receiving funding from foreign aid agencies and private companies, water accessibility is worsening. The research conducted within Haiti addresses short-term problems rather than form long-term solutions. For example, equipment left, for short-term research from aid agencies, becomes dilapidated (Piasecki 2023). To protect Haiti's water systems in the future, grass root organizations should dedicate more funding towards long-term research. Bodies of water, such as lakes and rivers should be monitored to identify trends and changes in water supply quantity. Data taken should be used to determine appropriate water distribution plans. Local communities would then determine how to allocate their water supplies.

To restore and regulate Haiti's groundwater resources, agroforestation and implementation of integrated water policies are needed. Agroforestation is the cultivation of trees, shrubs, and crops into farming systems. Agroforestation allows farmers to expand their agricultural production and source of income (Jacquet 2016). The cultivated land provides ecological benefits including wind shelter, increasing biodiversity, carbon sequestration, and flood control (Jacquet 2016). Agroforestry practices continue to spread across Haiti as government agencies and organizations subsidize costs for farmers (Jacquet 2016).

Mangrove ecosystems are important for regulating natural processes and maintaining the biological diversity of coastal areas. Mangroves are tropical plants, such as shrubs or trees, adapted to live within a saltwater environment. Mangroves grow in loose, wet soils, brackish water, and are periodically submerged by tides. Mangroves promote biodiversity through nutrient and pollutant removal from groundwater. Integrating mangroves into farming systems reduces the impact of natural disasters. Mangroves restoration protects soil, home, and animals from extreme weather. Mangroves reduce flooding from heavy rain and storm surges.

Mangroves, and other native Haitian plants, reduce soil erosion and prevent rainwater from being deposited into the ocean. Mangroves desalinate water, improving water quality through filtration of runoff and polluted waters. Improving water quality results in the restoration of previous groundwater levels. Groundwater serves as an essential source for daily applications such as bathing, drinking, cooking, and cleaning. In addition, mangroves improve food security through the diversification of agricultural landscapes.

Less than 1% of Haiti's primary forest remains (Food and Agriculture Organization of the United Nations 2016). The cultivation of native, woody and herbaceous plants can be used to slow down soil erosion and reduce natural disaster impacts. Vegetation, such as common snake bark or white indigo berry tree, promote biodiversity along the coastlines of Haiti.

In the Fiscal Year 2023, the U.S. Agency for International Development provided over \$110 million dollars in humanitarian aid (USAID 2023). According to the USAID, they "promote environmentally friendly activities that focus on resilience, community-based solutions, and market-based financial development" (USAID 2020). Through the USAID Reforestation Project, they address deforestation and environmental degradation. They plan to plant more than 5 million trees and preserve 15,000 hectares of forest (USAID 2020).

An issue pertaining to mangrove reforestation is a formation of a salt layer on soil. The salt crust left on the surface needs to be removed to begin restoration. This can be accomplished by leaching, or draining, the soil to remove the surface layer of salt. Leaching salts from the surface layer should be done with adequate drainage and clean, available sources of irrigation water. Further improvement to soil conservation practices will be managed by local farmers and habitants.

Installation of water storage tanks can preserve the water otherwise lost. Water storage tanks hold rainwater from the reverse osmosis system or other filter systems for future use. Reverse osmosis system removes sediment and other contaminants from the water by passing the water molecules through a semipermeable membrane. The filtered water sits within the storage tank until its usage. Water storage

tanks lessens the demand for a centralized water supply.

Benefits to water storage tanks include reduction of property and infrastructure damage, replenishment of water aquifers, and minimizing energy consumption for pumping and treating water. Stormwater runoff, collected by storage tanks, often carry debris, chemicals, and other contaminants. Filtering the water reduces the risk of spreading waterborne illnesses. Additionally, the usage of water storage tanks allows water aquifers to replenish the groundwater exploited from excessive use. Aquifers are natural storages of water. They naturally filter water, removing substances from the water. The groundwater level can be maintained to improve the ecosystem. Since water tanks do not require municipal water systems, they will rely on less energy-intensive processes.

International Action is a grassroots, non-profit organization whose mission is to prevent the spread of waterborne illnesses through the access to clean, safe-drinking water. International Actions installs affordable and effective chlorine water treatments devices in community water tanks, schools, and clinics (International Action 2018). Their water tank installation program restores or replaces damaged water tanks throughout Port-au-Prince. International Action establishes connections within the local communities in Haiti to create self-sustainable water systems (International Action 2018). To do so, they create local water boards to train alongside teachers and school directors to maintain the water systems (International Action 2018). Haitians take an initiative within their community to improve previous infrastructure, develop and implement new policies to allocate water supplies.

Water scarcity is a significant issue impacting the daily lives of Haitians. Mangrove and vegetation restoration and installation of water storage tanks can be used to mitigate the effects of water scarcity. Mangrove restoration acts as a lasting solution to reduce environmental devastation, while water tanks prevent the further spread of ecological hazards. Both solutions require the collaboration between the local community and international aid to maximize their lasting impacts.

Mangrove restoration promotes biodiversity lost on coastal areas. Mangroves mitigates structural damages caused by natural disasters. Installation of water storage tanks holds collected rainwater for communities. This allows easier accessibility to water. Water storage tanks reduce water pollution, reducing the risk of spreading waterborne pathogens. Local, grass-root organizations should dedicate more funding to furthering the education of local community members. Furthering the education of Haitians allows them to take initiative in their lives. Education prevents future generations from being exploited by the cycles of poverty.

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