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### **Tuvalu: Creating Sustainable Agriculture while Involving Local Populations**

Tuvalu is an obscure, yet fascinating island nation located in the South Pacific Ocean. Spanning over a miniscule ten square miles, the nation is composed of nine coral atolls on which its approximate population of 11,000, second smallest in the world after the Vatican City, reside (CIA World Fact book). The lone airstrip of Tuvalu, a remnant of World War II, is located on Funafuti, the main island, along with Tuvalu's tallest building, its three story headquarters, built with financial aid from Taiwan (BBC). After its independence from Great Britain in 1978, it has established a stable government, but struggles to form a self-sustaining economy due to geographical challenges. Although projects are already being implemented to help rural Tuvaluans combat with the challenges of poor soil, climate change, and pollution, these projects need to focus on integrating the native people in order to ensure long term success.

The population of Tuvalu is approximately 96% Polynesian (CIA World Fact Book). During WWII, U.S. forces were stationed in present day Tuvalu and built air bases on three of the islands. Prior to its independence, it had split from the British owned Gilbert Islands in 1974 to form the Ellice Islands due to ethnic differences. In 1978, Tuvalu gained complete independence; however, the United Kingdom still keeps a strong presence in the affairs of the island through a constitutional monarchy with a parliamentary democracy. Queen Elizabeth II is the head of state and is represented in the islands by the appointed governor general. A prime minister is also elected by parliament. The House of Assembly contains fifteen seats and its members are determined through elections held every four years. Tuvalu's judiciary system is composed of courts on eight islands with an overall High Court. Democracy is held in high importance in Tuvalu and there is universal adult suffrage. In the islands, especially the outer ones, chiefs and island councils play significant roles in the governance of the island (Department of State). These councils and chiefs would need to be the link between the local people and the central government through any new agricultural policy implementation.

For a population of 11,000, Tuvalu is experiencing rapid urbanization. Approximately 50% of the population lives within an urbanized setting, on the main atoll of Funafuti, with an annual urbanization rate of 1.4% per year. The average GDP per capita is \$3,400 as of 2010, putting Tuvalu in the lowest 16% of the world's averages. Its national GDP is around \$32 million, with only 17% of it stemming from agriculture, due to poor soil and unpredictable rainfall. Tuvalu relies largely on foreign aid to sustain its infrastructure, with a majority of it coming from the Tuvalu Trust Fund (TTF), an international trust fund established in 1987 by the United Kingdom, New Zealand, and Australia. This fund contributed nearly \$9 million towards the national budget in 2006 (CIA World Fact Book). Tuvalu has also created treaties and pacts with other nations, allowing them to fish in the areas surrounding Tuvalu in exchange for payment. Proving its ingenuity, the government of Tuvalu also earns more than \$2 million a year from the lease of its internet domain, ".tv" (CIA World Fact Book).

Around 75% of the population works primarily in rural, subsistence farming. Similar to the way families have subsisted in Oceania for centuries prior, the people of rural Tuvalu live within kinship groups and island communities. There is a strong sense of volunteerism within Tuvaluan communities, leading to the pooling of resources; each community thus manages its own social welfare and services. New agricultural practices that are implemented would need to be supported by entire communities in order to succeed.

There is relative gender equality, although men and women are expected to fulfill different roles in society, such as fishing as opposed to child rearing. Due to strong Christian values leading back to the time of colonialism under the British and the significance of continuing or expanding kinship groups, marriage is a highly valued rite in Tuvalu that symbolizes a child's entrance into adulthood. Marriage leads to the creation of nuclear families that usually live with the parents of the male spouse. Inheritance and property ownership are decided based on the kinship ties of a person, with a preference for the eldest male children (Every Culture).

Education is highly valued, although children of non-elite families usually lack the time to properly study. As of 2001, children, on average, attend school up until they are eleven years old. The study of English is a major obstacle for students who want to continue their education, especially those of the outer islands, because it is a requirement for pursuing higher education. Few people are able to attend tertiary institutions because that involves travelling abroad, often with donor assistance. Those that do are guaranteed positions in the national bureaucracy (Every Culture). Many rural families, especially those of the outer atolls, are dependent upon the salaries of relatives that work elsewhere, such as for the government or the other few commercial groups. Apart from public service which employs 37% of the population, there few job opportunities. Despite government attempts, unemployment is on the rise, especially amongst younger generations. Because of this, approximately 15% of the adult male population works abroad, and contributed a total of about \$2 million in income in 2007 (CIA World Fact Book).

Western medicine is most commonly practiced, although reliable health care cannot be found on all of the islands and the only formal hospital exists on Funafuti. Where western medicine leaves off, traditional methods of curing take over. A syncretic blend of Christianity, science, and ethnic beliefs promote the use of herbs, divination, prayer, magic, special foods, etc. to heal illnesses (Every Culture).

The common crops grown and consumed in Tuvalu include taro, coconut, and breadfruit. However, Tuvaluan soil lacks in plant nutrients, particularly potassium, nitrogen, calcium, and phosphorus (FAO Pacific). Due to this obstacle, farmers have devised new ways of planting, most notably the trench method. Trenches that are about 3-6 meters wide and 2-4 meters deep are dug and filled with leaves and other natural fertilizers to provide nutrients for the plants (Encyclopedia of the Nations). However, the thin soil is highly susceptible to increased salinity from the ocean due to rising sea levels and contamination through waste from intensive livestock production. Another problem Tuvaluan farmers face is the lack of a reliable source of usable water. Having no natural bodies of fresh water, the native Tuvaluans rely on rainfall for their water and often drink coconut milk as a substitute for drinking water (Every Culture). Fishing also exists as mainly a subsistence activity, providing much of the dietary protein for the natives (New York Times).

The lack of land hinders the mass cultivation of crops. In 2009, Tuvalu's imports grossly outweighed its exports, with \$1 million worth of products being exported and \$12.91 million being imported (CIA World Fact book). Copra, the dried shell of a coconut, and fish are its only major exports. About 80% of the food consumed is imported, brought in on monthly cargo ships with sky-high prices attached (Guardian UK). Tuvaluans are finding it increasingly more and more difficult to pay for the imported food which provides a majority of necessary nutrients. As a result, malnutrition is the main problem at hand. A large component of Tuvaluan diet consists of imported rice, flour, and canned or frozen meats. Families are being forced to spend less money on buying food and more on growing food. However, the traditional crops they grow are mostly only rich in starch (New York Times). It is vital to introduce new crops to the Tuvaluan diet in order to provide the native people with a more nutritious diet.

Women and children, the ones needing the both nutrition, are suffering the most from the lack of diet variety. Eighty percent of families living in vulnerable areas do not have enough money for food, as reported by the United Nations Children's Fund, otherwise known as UNICEF, in 2010 (Radio

Australia). Malnutrition in children can cause conditions such as dwarfism or developmental delays, especially in the brain, impacting performance in school and later on in life. Pregnant mothers who are not properly nourished tend to give birth to underweight, unhealthy babies that have a higher chance of mortality and deformities. Increasing unemployment rate and rising food prices are main reasons for the spread of malnutrition. As employment opportunities decrease, families suffer from the loss of incomes and economic contractions, and thus do not have enough money for food (Radio Australia). New ways of planting more nutritious foods, possibly in surplus, would alleviate concerns of malnutrition and give families a new way to earn extra income.

Being extremely low-lying (its highest point of elevation is only 5 meters above sea level), Tuvalu is directly impacted by changing sea-levels due to climate change (CIA World Fact Book). Recent data has shown that sea levels around Tuvalu are increasing by approximately 4 millimeters a year (Atoll Fresh). Not only are the shores receding, reducing already limited land, climate change also brings new challenges to the natives, such as extreme weather, damages to the fisheries and the soil, and water borne diseases. Intensified ocean surges have swept through islands, creating flash floods and destroying shelter, leaving people homeless. Supplies of fish, a staple of traditional diet, are decreasing due to increasing water temperatures which damage coral reefs, the natural habitats of reef fish. Soil near the shores faces erosion, while soil farther inland is prone to increased salinity, both contributing to crop failures. Tuvaluans that live in areas prone to flooding are more at risk for water borne diseases, such as cholera and typhoid (New York Times).

Aside from climate change, pollution is another pressing issue for Tuvalu. Improper waste disposal and management is contributing to the effects of increased flooding and soil erosion. Climate change combined with pollution is damaging the coral reefs that surround Tuvalu's atolls. Sewage water is creating algal blooms that kill the small reef fish. The decrease of reef fish also affects the population of the larger fish that feed off of them. Fishermen have to travel farther away from shore and fish for longer to catch fish, and many times the fish are smaller (Guardian UK).

The Food and Agriculture Organization (FAO) of the United Nations has begun introducing new crops and methods of cultivation to Tuvalu to provide better nutrition for the islanders. Among the new crops introduced are tomatoes, papaya, eggplant, and cucumbers. The FAO is promoting the establishment of "home gardens" through demonstration and training courses for the islanders. There will be approximately four of these gardens on the outer islands and twelve on Funafuti, all being supervised and cultivated by the local populations (FAO Pacific). By involving local populations, the FAO is creating new job and leadership opportunities and giving Tuvaluans a sense of ownership over the project, which will motivate them to continue the project, even after the departure of FAO officials.

Another project, Atoll Fresh, is being developed around hydroponics technology to produce fresh fruit and vegetables for Tuvaluans year round (Atoll Fresh). The goal of the project is to put into use previously unusable land and to focus on training local populations in hydroponics. The project hopes to increase food supplies while also increasing job opportunities, training, and leadership experiences for the locals. The concept of hydroponics is growing plants in nutrient rich solutions, without soil. If it can be implemented on a large scale, this would be extremely beneficial to Tuvalu. It would allow for farmers to circumvent the poor soil conditions and plant crops year round. Year round planting would create surpluses of food that the farmers could then sell to earn extra income.

The locals are combatting the problem of rising sea levels by installing man made seawalls along the shore lines to block out water, trying salt resistant crops, and raising house and garden levels to prevent flooding. Mangroves are being planted near the shores to promote fish breeding and prevent soil erosion. Because it is a predominantly Christian country (98% of the population), the natives of Tuvalu also look

to religion to cope with the harsh realities of their daily life. In fact, the entire country shuts down on Sundays to attend church and worship (Atoll Fresh).

In order to develop sustainable agriculture that can combat climate change, pollution, and malnutrition, coordination between the local Tuvaluans, the Tuvaluan government, international bodies, such as the FAO, and NGOs, like Atoll Fresh, is mandatory. New crops need to be introduced to provide a more nutritious diet for the islanders, similar to the FAO's current program, while new agricultural methods, like hydroponics with Atoll Fresh, need to be implemented to increase the production of the new crops introduced. At the center of all of these projects must remain the rural farmers, as they will be the ones to carry out the project in the long term, thus they must be trained and educated. It is important to empower the islanders so that they feel like the projects are theirs and there to benefit them, not just merely outside intrusions. It is imperative also for the NGOs and international bodies that aid Tuvalu to interact directly with the islanders on each island, instead of only working with the government officials or elites. As the rural islanders are the ones who will directly benefit from the outcomes of improvements in agriculture, they should be the chief participants in any projects.

Measureable indicators of success would include increased domestic food production, increased family income through marketing agricultural surplus, and improved access to fresh fruits and vegetables. These projects will hopefully create new job and leadership opportunities, which, in the long run, could stimulate more domestic economic productivity. Currently, there is little potential for economic and commercial growth in Tuvalu due to geographic obstacles, such as distance between each of the islands, and a lack of training within the native Tuvaluans. If new agricultural methods, such as hydroponics, prove to be effective and are able to produce a surplus of food, trading between the islands and perhaps even neighboring nations (New Zealand, Fiji, Australia) could be intensified. Increased trading would provide a new source of income for many of the rural farmers, increasing the economic growth of Tuvalu.

If Tuvalu became a more economically independent nation, it would be less reliant on aid from other nations. It would also be more economically involved in the world; another participating nation in the world economy will likely boost the economy for many countries. Also, if projects, such as Atoll Fresh, are proven to be effective in Tuvalu, they can be implemented elsewhere in the world where crop cultivation is difficult, like in sub-Saharan Africa. Wherever these agricultural projects implemented, it is important that the local people remain involved and receive education and training so they can become self-reliant in the future.

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