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### **Barbados: An Island with Limited Water Resources**

Barbados is a Caribbean island nation, founded and nurtured for over 300 years on agricultural exports, which is both prospering and suffering from diversification of its economy. While enjoying the benefits of being one of the more prosperous nations in the Caribbean and having a well educated population, Barbados finds itself unable to produce adequate food supplies to feed its population. To a large extent, this is due to the removal of arable land from agriculture and placing it into golf courses and hotels in order to accommodate the growing tourist industry. Another factor is the limited potable water supply from wells and precipitation.

Barbados, with an area of 166 sq. miles, is located at the east end of the Caribbean island chain. The country is located approximately 1,600 miles southeast of Miami, Florida. Barbados is largely made up of coral formation, with a terrain that is generally flat except for the North-East where it is rather hilly and rugged. Surrounded by the Caribbean Sea and the Atlantic Ocean, Barbados enjoys North-East trade winds all year which help to keep the island relatively cool when compared to other Caribbean nations. The climate is warm throughout the year, with a dry season from December to May, and the rainy season between June and November. The average temperature is around 82.4 degrees F, and rarely varies by more than 5 degrees in the day or 10 degrees at night.<sup>4</sup>

Barbados has been an independent state since 1966. The government is a parliamentary democracy where the political party with the supreme representation in parliament forms the government. The leader of government, which is the Prime Minister, selects a cabinet from party members in the legislature. Barbados has two chief political parties - the Barbados Labor Party and the Democratic Labor Party. Both are dedicated to democracy, the rule of law and a free-market economy as the foundation of political stability, social and economic prosperity.<sup>4</sup>

The land occupied by agriculture is about 50% of the area of the island –including crop and pasture land, but excluding forest lands, disused and potentially productive land, and land with buildings and roads. When Barbados became independent in 1966, agriculture (primarily sugar cane), mining, forestry and fishing were the mainstays of the Barbados economy. Today they still export commodities such as cotton, foodstuffs, rum, and other beverages. Other crops produced in Barbados include corn, onions, other vegetables, root crops, bananas/plantains/figs, other fruits, and cut flowers.

Since independence, the government of Barbados has been working to make a more diverse economy, facilitate sustainable agriculture, and help economic momentum on the island. In recent years, the Barbados economy has diversified into tourism, offshore finance and information services. Additionally they have a light manufacturing business, mainly making electrical components to be shipped to partner countries such as the United Kingdom, Jamaica, Trinidad & Tobago and Brazil. It is estimated that three quarters of GDP and 80% of exports revenues come from the services sector.

As a small island developing state that is limited by its size and water quantities, Barbados is acutely aware of the need for attaining food security. Since 2002, the value of its food imports has increased at an average annual rate of 10 percent. This has prompted Barbados to pursue a strategy of food sovereignty as opposed to the narrow policy of food security.

In Barbados, the pressure on land resources is reflected in a population density of approximately 120 persons per square kilometer. Increases in population and demand for land for housing and commercial developments are forcing small scale agriculture and subsistence farming to shift to marginal lands. The demand for land to be used for housing projects is removing productive land from agriculture and necessitates the need for updated storm water run-off plans due to increased surface run-off and the potential for flooding.

Agriculture has had to compete for limited resources such as land, labor and capital in an environment in which liberalization; privatization and deregulation are dominant features. Over the past 5 years, the government has begun to push growth in the agriculture sector through various programs and incentives. The development challenges to the food, agriculture and natural resources system in Barbados develop from domestic and external trade and economic factors. Reduced to its most basic essence, Barbados imports and consumes much more food than they grow. Presuming that the current trend in rising oil prices will continue in the future, a new set of challenges will have a serious cost on Barbados' economy and by extension agriculture.

About 39,500 acres, or 37.2% of the total land area, are classified as arable. Arable land is defined as land being cultivated and having some form of production. At one time, nearly all arable land was devoted to sugarcane, but the percentage dedicated to other crops for local use has been growing. In 1999, 500,000 tons of sugarcane was produced, which was down from the annual average of 584,000 tons in 1989-91. In 2001, sugar exports amounted to US \$22 million, or 8.4% of total exports.<sup>4</sup>

Key food crops are yams, sweet potatoes, corn, eddoes, cassava, and several varieties of beans. Insufficient rainfall and the need of irrigation have prevented the progress of other agricultural activity, although some vegetable farming takes place on a commercial scale. Additionally, some cotton is grown in drier parts of the island.

Livestock farming is not a main profession in Barbados, chiefly because good quality pasture has always been scarce & imported animal feed is expensive. The island imports large quantities of meat and dairy products. The bulk of the livestock on the island is owned by individual households. Estimates for 1999 showed 23,000 head of cattle, 41,000 sheep, 33,000 hogs, 5,000 goats, and 4,000,000 chickens. Poultry production in 1999 included 9,000 tons of meat and 1,000 tons of hen eggs. Apart from self-sufficiency in milk and poultry, the limited agricultural sector means that Barbados imports great amounts of basic foods, including wheat and meat.

Fewer than 50 acres of original, native forests have survived the 300 years of sugar cultivation. Currently, there are an estimated 12,350 acres of forested land, covering about 12% of the entire land area. In 2000, Barbados imported \$35.3 million in wood and forest products in order to meet construction needs from the tourism business.

Where the diversity of any economy is ideal, it is important that a nation recognizes the importance of being able to feed its people. Barbadians no longer have grounding in agriculture. Although a few schools do keep what is familiarly called "kitchen gardens". In the past, families used parts of their land to grow cash crops, and children grew up rearing chicken, cows, goats, sheep and rabbits. Added to this, the culture of an agriculture spirit was driven by the fact that most family members were employed in the agricultural sector, and the 4-H movement served to promote the culture among the youth.

Due to the change of consumer patterns, and the ability of the United States, Canada and European nations to flood world markets with their consumer goods, Barbados finds itself without a healthy agricultural economy. It can be said that this is part of the price that has to be paid for advancement.

With the continuing change from agriculture to tourism as the main driver of the economy, substantial acreage of former agricultural land has been lost. The lands have been utilized for construction, golf courses and other tourism related projects.

Barbados also must now find an answer to its high food import bill. In order for a country to successfully feed its people it must have an active agriculture program.<sup>8</sup> Barbados needs to actively encourage agriculture and agriculture related activities, including farming with acreages from less than a single acre to 20 plus acres and producing crops such as: carrots, beets, onions, tomatoes, beans, chive, cauliflower, peppers, eggplant, parsley, squash, pumpkin, peas, lettuce, cucumber, melons, and papaya. Implementing a program similar to the successful 4-H program found in the United States would encourage the Barbados youth to consider careers in agriculture.

One way in which Barbados can reduce the costs of importing foods would be to encourage the farming sector to focus on foods that are expensive to import (e.g. fresh fruits, vegetables, and meat items like beef, pork, and lamb) and import less expensive grains. Farmers should also research the availability of hybrid seeds which may produce higher yields given the available arable land and the prevailing climate.

Barbados needs to also encourage the establishment of a market for selling farm goods to urban populations and/or an agro-processing unit which would package and market the semi-processed and/or finished products through the supermarkets or to hotel and food service industries.

Women food producers manage approximately 39% of the total number of the farm holdings, which comprise only 5% of the total area under agricultural land. Women are also responsible for the marketing and distribution of a significant volume of the fresh vegetables produced and consumed on the island. The majority (72%) of these female farmers are 45 years old or older – a statistic which has serious implications for the future involvement of women in farming. With the economy of Barbados oriented towards the tourist industry and the desirability and status of the higher salaries offered by the tourist sector. It is highly unlikely that younger women will opt for entering the agriculture sector.<sup>9</sup>

Another challenge is the agricultural water usage in which a significant portion of the food crops produced by the small farm sector relies on the potable water supply. Irrigation is integral to agricultural production and rural farmers have experienced difficulties in tapping into available water supplies. Dr. David Estwick, Barbados Minister of Agriculture notes “We can no longer simply rely on when the rain falls. And to set up your planting cycles around when you have rain and when you don’t have rain is a rather precarious way of managing your output.”<sup>8</sup>

Barbados water is particularly vulnerable to the effects of cyclic droughts as much of its drinking and irrigation water comes from rain.<sup>10</sup> Drought conditions affect agriculture, health, food, and tourism, and at times they contribute to devastating fires such as in 2001 when a 120 cane fires and 340 grass fires were reported.

One strategy for dealing with potential drought conditions is to leave some ground idle and apply saved water to high-value crops. This strategy works best when adopted by large numbers of farmers in the same geographic area. Soil should also be tested to determine its water holding capacity – some soils will not hold much water and should be irrigated frequently, but with less water applied after each irrigation.

The Barbados Water Authority (BWA) is the statutory corporation responsible for providing potable water to the citizens of Barbados. BWA monitors water quality for the ground water supply in conjunction with the public health inspectorate. In 1995, the BWA commissioned a study on water loss that identified leaks throughout the island and recommended ways to reduce water losses. An estimate placed 90% of the ground water resources as already committed.<sup>11</sup>

The island of Barbados has long been identified as one of the most water scarce nations on earth. For the years 1994-1995, a 150 year drought caused over 3,000 households to be without water for significant periods of time. On July 31<sup>st</sup>, 1995 most of the capitol at Bridgetown, including the Queen Elizabeth Hospital was without water. Rainfall on Barbados was not sufficient to replenish the main water supply.<sup>6</sup>

The drought also posed a threat to the islands primary industry – tourism.<sup>6</sup> Subsequent testing found an extensive brackish water aquifer and it was determined that it could be purified at a lower overall cost than sea water desalination. The BWA selected GE to help develop a solution and in February of 2000, the plant began producing fresh drinking water. That desalination plant distributes drinking water to 20% of the nation's 264,000 people.

While the desalination plant has temporarily resolved the islands need for water, other issues have presented themselves since the plant came online. Since 2009, Barbados Government Agency's have voiced concerns about the amount of pollutants finding their way into the water supply. The pollutants include the presence of pesticides, urbanization, sewage, and nitrates.<sup>5</sup> Of these, the most serious was identified as agrochemicals – specifically the two metric tons of pesticides imported annually and spread over the arable land.

Additionally, there are approximately 9,000 residential homes in Barbados, most of which are not connected to the central sanitary sewer – so the waste water generated from those homes is not treated and is permitted to seep through the soil and into the aquifer via the numerous suck wells.<sup>5</sup> The most effective method for resolving this situation would be implementation of a capital intensive project for building new sewage treatment plants and tying the island's population into these plants. Although not an inexpensive solution, it would be preferable to building water treatment plants with the capability to remove nitrates and other pollutants from water which will be used for drinking, cooking, and bathing.

Much of the run-off from arable lands eventually makes its way to the ocean surrounding Barbados; the Atlantic to the East and the Caribbean Sea to the West. The pesticides and fertilizers carried in the run-off threatened to disrupt the fishing, swimming, and other water activities which attract tourists to Barbados.

The pollutants which threaten the water supply of Barbados can cause serious health concerns for both the citizens of the island and the tourists who contribute significantly to the country's Gross Domestic Product (GDP). Without the revenues contributed by tourism the standard of living for Barbados would drop significantly, placing a large percentage of the population below poverty levels.

A cost effective method for alleviating this problem in the United States has been to incorporate buffer strips of vegetation to help slow down runoff and filter out the contaminates before they can pollute waterways and the surrounding ocean waters. This solution may be best implemented around the golf courses and resorts where retention ponds could also be built to hold and reuse the runoff.

Resolution of their water problems will necessitate education of the Barbados agricultural community – to help them understand which chemicals should be applied and in what quantities, for the best results. Within Iowa, county extension offices have been staffed with knowledgeable people who can help farmers and landowners with any questions regarding soils, crop selection, and farming practices.

The residential community and tourist industries will likewise need to learn to limit the application of chemicals on lawns and golf courses. Before any pesticides are applied, the landowner should verify that they have a pest problem and then should investigate non-toxic control methods first. If they determine that a pesticide must be used, they should select the least toxic chemical available and use only the recommended amount necessary to control the pests.

Finally, the limited supply will require that the Barbados residents learn to conserve the water resources they have today, so that these resources will be available for the residents of tomorrow. The recognition of water as a limited resource is the first step toward intelligent use of the water and development of practices for maximizing its use within the various agricultural, business, and residential communities of the island.

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