



Climate Smart Agriculture in the Eastern Caribbean States

Increasing agricultural productivity through the application of innovative technology to overcome drought and unpredictable climate conditions in Barbuda

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Contributions to Climate Smart Agriculture



Diversification, integration and innovative technologies that enable production under extreme and unpredictable climate conditions, have increased the resilience of the farming system to climate risks.



Year round availability of locally produced poultry products, fish and fresh fruits and vegetables has enhanced the food security of the island's 1800 inhabitants and decreased reliance on food imports, which is especially important during and after tropical storms and hurricanes.



Locally produced agricultural products reduce the need for imports arriving to Barbuda by boat and air, thus decreasing greenhouse gas emissions. The use of poultry manure and compost as fertilizer, and the capture and use of rainwater, eliminating dependence on reverse osmosis and the public water supply, have reduced GHG emissions.

Climate change signals:	Climate smart practices and technologies:
 <p>Changes in precipitation patterns</p>	 <p>Water management</p>
 <p>Increased climate variability</p>	 <p>Soil Management</p>
 <p>Increased temperatures</p>	 <p>Alternative farming methods</p>
 <p>Sea level rise</p>	 <p>Agroforestry</p>  <p>Diversification</p>

The challenges posed by climate change

Barbuda, the smaller (62 sq mile) of the islands in the state of Antigua and Barbuda, is flat with thin soils, low rainfall (average 35 inches annually) and frequent droughts. These conditions create many challenges for conventional farming, which are now being exacerbated by climate change, thus threatening the traditional activities of fishing and slash and burn agriculture, upon which the livelihood of the island's population of 1,800 people depends.

Conventional farming methods, which are heavily dependent on predictable seasonal rainfall, have not been successful due to the changes in weather patterns as well as in the wet and dry periods. Land preparation and planting dates are no longer predictable as a result of changes in precipitation patterns. Increased climate variability, higher temperatures, drought and low rainfall periods are becoming more frequent, making traditional farming unviable.

Sea level rise has led to salt water intrusion in the ground water supply, much of which has now become unusable for crop production, while traditional crop lands in coastal areas have become unusable due to salinization. Farmers have observed an increase in the frequency of droughts, prolonged dry spells and extreme storm weather with flooding. Increased evapotranspiration and a lack of adequate water harvesting and storage have contributed to a near cessation of vegetable production on the island.

Over the years, these climate change impacts have contributed to increased crop failures and a sharp decline in agricultural production; today there are no full time farmers. The

historically agriculture based economy was once able to export many agricultural products. Today, there are less than ten families that farm part time, compared to the past when almost all engaged in some form of food production. Barbuda has become a net importer of food (over 90% is imported), traditional livelihoods are threatened and food security is compromised. These impacts have been accompanied by a significant decline in the number of youth entering the agriculture sector.



The solution

Since its establishment in 2005, Sir McChesney George Secondary School has been working to reverse this trend, improve food security and address climate change impacts on agriculture. Located on the outskirts of the single village, it is the only secondary school on the island. Agricultural Science was made a key component of the school's curriculum when it opened in 2005 and a school farm was established to teach and demonstrate how agricultural production can be carried out in spite of the many challenges. The farm, which consists of poultry production (eggs and broilers), vegetables, an orchard (mango and cashew) and aquaponics (fish

and vegetable), is run as a commercial entity in order to provide students with practical experiences and skills training. A strong capacity development process, involving both the students and other farmers on the island, underpins the success of the climate risk interventions.

Over time, it became clear that climate change would negatively affect the island's food security. To help address the increasing climate risks Barbuda's agricultural sector faces, new practices and technologies that help increase production in spite of the increasing climate variability were introduced as part of the school's compulsory agriculture science program. These included



Rainwater harvesting : Water is now harvested and stored for operating the farm and the school. The roof of the school buildings were equipped with gutters and a piping system that transfers the rain to a 60,000-gallon water storage cistern, which is now the source of water available for the farm.



Mulching and Composting : Grass produced on the fields of the school grounds is harvested and used for mulching the vegetable plots. This conserves water and improves the productivity of the soil over time. Hay is also used as litter in the fixed poultry pens as traditional material (sawdust/wood shavings) is not available locally. The used litter is then composted and used in the crop plots to improve the soil.



Integrated Farming : The school utilizes a movable poultry pen system which allows the birds to graze on the grass in the fruit tree orchard. This reduces feed costs, decreases unpleasant odors, fertilizes the fields and increases the health of the birds. In addition, hay is produced for use as mulch and litter in poultry production and in turn, poultry manure is used as fertilizer for crop production.



Aquaponics addresses the challenges created by low and unpredictable rainfall and extreme weather. It allows for year-round production of high value vegetables along with fish, given the conditions that prevent traditional agricultural production.



Fruit production : This helps to diversify production, thus mitigating risk and stabilizing or increasing incomes.

Each year, the Board of Education provides start-up funds for the purchase of feed and birds. Profits generated for the rest of the year, averaging EC\$30,000 (US\$11,112) are used to sustain and expand the program and to finance school operations.

Results and contributions to the 3 pillars of climate smart agriculture

- The successful development and operation of a farm has generated funds for sustaining production over a ten-year period. The income provided by the farm supports school operations and provides direct benefits for all 142 students, as well as indirect benefits for the community. Funds have been sufficient to permit the expansion of the program and to support the school's operations when the budget allocated from the central government has been insufficient.
- Eggs produced by the school farm and other producers who have learned from the training and demonstration provided, have made Barbuda self-sufficient in egg production since 2015. The eggs produced locally are available at a cost that is lower per dozen (EC\$9.50) than those brought over by boat from Antigua (EC\$12-13). The development of a tractor pen poultry rearing system suited to conditions in Barbuda has facilitated the raising of poultry in small spaces. In 2016, two new egg businesses were established using the school's production model.
- The availability locally of poultry products and fresh fruits and vegetables enhances the food security of the wider community (approximately 1800 inhabitants.) In the 2011 – 2012 academic year, the school farm produced approximately 35,300 eggs and 600 pounds of chicken meat, valued at EC\$26,800 (~US\$10,000). For the 2015 – 2016 year, egg production has more or less doubled, which would not have been possible under the conditions that exist on Barbuda without the new climate-smart production techniques.
- Year-round production of eggs, fish and meat, as well as increased production of vegetables, has also reduced Barbuda's dependence on food imports. Reducing the dependence on food brought in via cargo boats is especially important for maintaining food security after the passage of tropical storms and hurricanes.
- Utilization of grass and by products from poultry production has improved barren soils and sustained vegetable production.
- Diversification beyond traditional slash and burn methods through the introduction of poultry, fruit, and aquaponic production, and the utilization of mulch and compost have improved natural resource management and made better use of the island's scarce natural resources, while improving productivity.

"The bottom line is we would not be able to operate the school at the standard that we do without the earnings from the farm. All therefore benefit and the lesson from this work is that even in the face of climate change, agriculture can a credible livelihood and contribute to food security in a practical way."

- John Mussington, Principal

- Through rainwater harvesting and use, the farm and school are now self-sufficient in freshwater, which enables year-round production at lower costs. Flooding is controlled by utilizing the exposed roof area of the institution to catch the valuable and increasingly scarce resource. This has also eliminated the challenge created by the soil salinization of the ground water aquifers, and allows year round production.
- The introduction of aquaponics technology to successfully produce fish and high value vegetables is helping to mitigate the effects of warmer sea temperatures and acidification that have affected the area's marine resources that contribute significantly to Barbuda's economy and food security. In 2014, during the dry months of the year (March to July) aquaponics lettuce and chives were produced, supplying a local supermarket with an average of 20 heads per week. Before this, weekly imports by boat were the only means of meeting demand for such produce.
- Changing attitudes towards agriculture and providing youth with training in skills which they can later use to earn a living is contributing to the regeneration of Antigua and Barbuda's agricultural sector.
- The capacity of both students and local farmers to understand climate impacts and potential solutions has been enhanced.
- Reduction of emissions through a decreased reliance on protein and vegetable imports, and elimination of the school's need to use the public water supply, generated by reverse osmosis, have been achieved



Lessons Learned

New technologies, such as aquaponics, long term tree crops, and intensive poultry production, can be adjusted to suit to local conditions and make efficient use of scarce natural resources, thus providing viable alternatives for farmers in the face of climate change. These can be successfully applied to provide agricultural products when conditions are no longer conducive to traditional production methods, thus aiding the Barbuda community to adapt and increase its resilience to climate change. Fishers who can no longer make a living from the sea can adapt backyard aquaponics systems that meet their needs for protein and, with good marketing, can reap additional income from sale to local markets of high value vegetables and fish. Several products also have the potential to support value adding processing, such as the

production of preserves and juices, which will be explored further in the near future.

Over the past ten years the school farm has demonstrated that year round production can be achieved under the extreme weather conditions that Barbuda faces as a consequence of climate change. It provides a real-life example of the need for finding and practicing adaptive measures to sustain livelihoods and food security. Given that they live on one of the most vulnerable islands in the OECS to climate change, Barbudians must find practical strategies to adapt to the changing conditions if they are to remain on their island. As the primary institution training future generations, The Sir McChesney George Secondary School, has taken up this challenge, with both students and staff working to implement the programme and ensure that the wider community shares the knowledge and the benefits. ■



Climate Smart Agriculture (CSA) is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. The goal of CSA is to enable the sector to transition towards more climate-resilient production systems and more sustainable livelihoods in the presence of climate change stressors and climate variability. The three pillars of CSA interventions and practices are intended to:

1. Sustainably increase agricultural productivity and incomes (i.e. strengthen livelihoods and food security, especially of smallholders);
2. Adapt and build resilience to climate change;

3. Reduce and/or remove greenhouse gases emissions, where possible and appropriate.

Caribbean countries are particularly vulnerable to climate change related risks, and in response, are actively seeking to develop agricultural production systems that are resilient to climate related risks and stressors and make efficient use of the limited natural resources available. In that regard, efforts are made to develop, identify, promote and disseminate innovative farming systems, farm technologies, strategies and measures that will help to build resilience and increase the productivity and viability of the agriculture sector in the region.

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