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## The Tools and Technologies of Transdisciplinary Climate Change Research and Community Empowerment in Barbuda

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TOOLS AND TECHNOLOGY

## The Tools and Technologies of Transdisciplinary Climate Change Research and Community Empowerment in Barbuda



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Focusing on the smaller sister-island of Barbuda, part of the Caribbean nation of Antigua and Barbuda, a group of collaborating anthropologists, archaeologists, biologists, education specialists, geographers, and environmental scientists are studying long-term human ecodynamics, the relationship amongst people, place, and the environment from the beginning of the peopling of a place through modern day. Our *transdisciplinary* approach brings together various field methods, tools and technologies from each field and crosses the boundaries of conventional science. This approach furthers our knowledge of climate change and facilitates practical and sustainable solutions for vulnerable populations.

### *History and Context*

In 2005, Sophia Perdikaris began her archaeological research in Barbuda. She soon realized that her research had important implications for the local population. Over the last seven years, Sophia has invited a number of scholars from a variety of disciplines to visit Barbuda beginning with individuals focused on archaeological site excavation and rescue, and others to collect paleoenvironmental data (ie, Allison Bain, U Laval, Quebec, coordinator of paleoenvironmental investigations). Through this work, it became clear that there was a pressing need to create more accurate maps of the island, to create a single integrated GIS mapping system, and to conduct more ethnographic and ethnohistorical research of Barbudan life from elder and youth perspectives. In an effort to integrate research with community need and effort, Sophia and John Mussington, the secondary school principal (who also leads many other community initiatives), and Reginald Murphy from National Parks Antigua began working together to integrate scholarship with sustainable island living. As a result of this collaboration, the Barbuda Research Complex (BRC) was formed.

The BRC is the “home base” for a variety of projects and programs in Barbuda that focus on sustainability and resilience. Outside and local scholars work together to understand human-ecodynamics in Barbuda—in particular the relationships amongst humans and communities, climate change, environmental degradation, and population growth. The BRC recognizes that the study of human-ecodynamics is inherently interdisciplinary. One discipline cannot explain all human-environmental interactions or offer holistic solutions to build community resilience or long-term sustainability. At the same time, issues of environmental sustainability are not abstract academic concepts divorced from local experience. In order to investigate human-ecodynamics with both academic and practice implications in mind, local experts and US college students and faculty came together in summer 2012 in the first GIS field school in Barbuda to collect quantitative and qualitative data investigating the connection the human ecodynamics of the past to those of the present.

### *Summer 2012*

In July–August 2012, Rebecca Boger, an environmental scientist from Brooklyn College, CUNY, conducted a Geographic Information Systems (GIS), Global Positioning Systems (GPS) summer field school in Barbuda. Using GPS and GIS tools and technologies, students from Brooklyn College and Barbuda’s Sir McChesney George Secondary School worked together to map various sites in Barbuda. John Mussington and Calvin Gore, two local experts, led field excursions where college and high school students mapped locations of wells, gardens, waste disposal sites, caves, the lagoon, archaeological sites and historic buildings. Under the tutelage of Rebecca, these students constructed the first GIS maps of Barbuda.

In addition to tools and technologies of GPS and GIS, Rebecca, John and their students also tested the soils and water of wells, trash sites, and areas near the

lagoon. Water and soil testing illuminates the dramatic increase in salinity of the well water on the island.



Photo 1: Castle Well where students and faculty map and test soil and water in Barbuda. Photo courtesy Amy E Potter

Photo 1 is Castle Well, an example of one of the wells where college and secondary school students gathered to test the soil and water, and map the site. These data are recorded and shared with Barbudans for current information of the state of local well water and future generation knowledge preservation. Rebecca also provided the Barbuda Archaeological Research Center (BARC, see below) with a NASA weather station. This weather station collects weather data for Barbuda, which is also integrated with soil, well test data, and GIS and GPS coordinates. This data provides a more complete understanding of current and past weather patterns, water quality and quantity, and location of water sources. This data provides local stakeholders with important information on how to sustainably manage their freshwater resources. Working with John, high school students will continue to monitor the depth, temperature and conductivity of the water to assist in the development of a ground water model and how salt water may be intruding with sea level rise and changing recharge from changing weather patterns. External funding is being sought to establish data loggers similar to the weather station to collect continuous data at selected wells. Between the student-collected and the data logger data, a robust model can be developed.

Rebecca completed her portion of the GIS and GPS field school with kite-aerial photography. Using cameras attached to kites, Rebecca and students took images of the sites they mapped using GPS and GIS. Therefore, in addition to the GIS maps available for Barbuda, aerial photography of these sites provides an additional material artifact for viewing Barbuda. For example, kite-aerial photographs and GPS and GIS mapping provide a better understanding of where and how the land is being used for subsistence agriculture and waste disposal, especially in proximity to the lagoon and village.

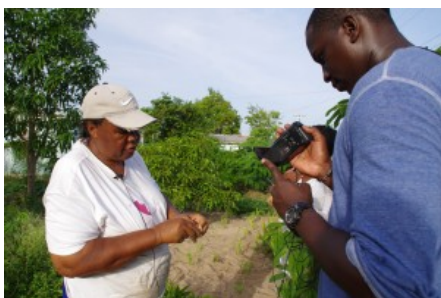


Photo 2: Aerial kite photograph of Danville Aaron's garden in Barbuda. Photo courtesy Rebecca Boger

Photo 2 is an image taken from a kite of Danville Aaron's garden in the middle of the village of Codrington.

Once the soil testing, GIS/GPS mapping, and aerial-kite photography were complete, Amy E Potter, a cultural geographer from Louisiana State University, whose dissertation fieldwork focused on the island of Barbuda, alongside Jennifer Adams, a science education specialist from Brooklyn College, CUNY led and supervised both undergraduate and graduate students in utilizing qualitative field methods to better understand Barbudan backyard gardens like Danville Aaron's. Amy and Jennifer introduced the students to qualitative research methods by mentoring the students during videotaped interviews. These interviews elicited Barbudans' understandings and changing practices of subsistence agricultural as gardeners deal with soil challenges, drought, and increased water salinization due to global climate change. For example, students and faculty, in addition to aerial-kite photography, also interviewed Aaron about his extensive garden that makes use of every available inch of space in his yard for rain-water collection, raised fields, and an irrigation canal (see again Photo 2). He has been using many of these techniques he learned from his

native home of Guyana in Barbuda for decades. In addition, Aaron also puts forth sustainable gardening practices using recycled tires, suitcases and a refrigerator door for potting plants. The long-term goals from this initial research, under the larger themes of sustainability and food security, are to highlight the variety of agricultural practices on the island of Barbuda, how islanders are growing their own food, and, most importantly, to understand the daily challenges they face in the hopes of making policy recommendations to better address their needs. The backyard-garden project culminated in a documentary by Brooklyn College undergraduate Dexter Curbin, a forthcoming museum exhibit for the new Barbuda Museum, undergraduate conference presentations, and forthcoming scientific publications. Photo 3 features Dexter Curbin conducting an interview with a long-time Barbudan-backyard gardener, Eva May James.



Undergraduate student Dexter Curbin using video equipment during garden interview. Photo courtesy Amy E Potter

Conducting interviews with islanders such as Eva May James and Danville Aaron to learn about various gardening practices illustrates how the students successfully combined aerial-kite photography, GPS/GIS, soil testing, and ethnographic data in order to better understand the impacts of environmental changes for Barbudans and the island. Students were able to investigate their own research questions that integrated the disciplinary expertise of both the faculty and local-Barbudan experts present at the field school.

### *Outreach and Education*

In addition to BRC's commitment to field schools and academic research, Sophia, John, and Reginald are also using BRC to facilitate a variety of outreach and education projects including the research station (Barbuda Archaeological Research Center or BARC), an aquaponics research facility, three museum spaces

(Barbuda Museum, Barbuda Children's Museum, Traveling Exhibition Space), land for the creation of a culturally and historically relevant botanic garden (currently in the planning stages), and an artists' residency and studio space.

On January 18, 2013, the first Barbudan museum and an aquaponic research facility opened. The museum spaces provide Barbudans and visitors with year-round access to content produced through the various scientific endeavors on the island, including research that has been conducted by local youth. The museum spaces will house documents and computers allowing Barbudans to access various maps, historical documents, and archaeological artifacts pertinent to Barbuda's history, natural environment, and cultural heritage. This space will also exhibit artwork produced by the efforts envisioned in the artists' residency program. Barbudans and visiting artists will explore themes of landscape, seascape, sustainability, and people-environment interactions.

The BRC aquaponic facility, also inaugurated on January 18, 2013, was built in direct response to curricular needs by the Sir McChesney George Secondary School and to government initiatives that have identified aquaponics as a livelihood initiative countrywide. While aquaponics is a required subject in secondary school, lack of funds and expertise throughout Antigua and Barbuda, has made aquaponics a subject that exists only in the literature. While there are a number of schools in Antigua that have been identified as potential recipients for aquaponic facilities, none of them have been able to receive any funding to spearhead that initiative. BRC's facility is the first and only research facility in the country that allows local secondary school students the use of the facility for fulfilling their curricular requirements. This facility is critical for exploring options towards food security and locally based sustainable solutions that will enable the production of food without further taxing wild resources.

The focus on secondary school youth is critical because 800 of the 1,600 Barbudans are under the age of 18. In addition to outreach and education, Katherine Hejtmanek, cultural anthropologist from Brooklyn College, CUNY, is initiating further ethnographic research with children and youth focusing on how Barbudan youth understand their future, their island's future, and how young people are making sense of the threat their island faces due to climate change. Because young Barbudans make up more than half of the population and the island could be under water in their life time, their perspective and future plans and use of new technologies, such as aquaponics, are fundamental to understandings the future of Barbudan cultural knowledge and identity.

The research from summer 2012 and the continued research, educational, and outreach efforts of Sophia, John, Rebecca, Amy, Jennifer and Katherine to integrate the various disciplines they represent facilitates the development of grassroots resilience strategies in Barbuda as this island faces dramatic sea-level rise, shifting resource dependence, and cultural knowledge and identity change. Using new tools, technologies, and transdisciplinary collaboration our research results speak directly to global issues of climate change and sustainable solutions for vulnerable populations through the empowerment of local Barbudan stakeholders.

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