



# Creating Resilient Caribbean Communities

By Elma Felix, Andrew Georgiadis and Chris Podstawski

*"When houses and settlements are reconstructed in the aftermath of disaster, we need to recognize that materials and social space have profound meanings on people, meanings that divide and separate as well as unify communities" (Oliver-Smith 1990, 17)*

The names of hurricanes that have caused devastation within the Caribbean region have remained implanted in the minds of those that have lived through them. Other natural disasters such as volcanic eruptions, floods and earthquakes, landslides and mass movements, river and stream flooding, shoreline erosion and long term sea level rise – although less predictable – cause widespread concern for the nations that have been affected. Although hurricanes and tropical depressions are common, their effects are becoming much more severe as predictions of global warming and sea level rise materialize. The region is prone to serious and repetitive natural disasters and the trends suggest that vulnerability of people and property will grow even greater. What can we do at the forefront of these events to better prepare ourselves? What measures can we take today to reduce our vulnerability to natural disasters of the future? It is known that the best time to reorganize, restructure and rebuild is in the recovery period. It offers an opportunity to strengthen local, economic, and physical development. Hurricanes of the past indicate the need for major and more effective programs for smarter physical planning and land management. This article explores a few ideas that allow us to think about our current communities, and how their design, location and density affect our readiness in disaster preparedness.

## SMART LOCATIONS

Selecting an appropriate site for development can make all the difference in a neighborhood's vulnerability to disaster. The main goal is to make Caribbean communities less vulnerable to the effects of storm surge, torrential rains, and sea-level rise. On each island, a comprehensive analysis of land conditions can identify those areas that are most likely to be adversely impacted. High-risk areas can include floodplains, steep sloping terrain and shoreline erosion. Development should be avoided in these high-risk areas.

Rather than continue the practice of deforestation for new development that is prevalent in many parts of the Caribbean, the islands should seek to redevelop sites in existing cities and towns. This helps to preserve the environment while reducing the need to extend services to previously undeveloped areas. Another benefit of redevelopment and densification is the creation of a community of residents who are more likely to be aware of their neighbors and may more easily identify those who could be missing in the wake of a disaster.

Development on steep slopes should be discouraged. Deforestation of steep slopes serves to destabilize the ground and increases the likelihood of landslides and mudslides during a storm event. Further deforestation may adversely affect both those who already reside on these slopes and those on the valley floor where the debris often comes to rest.

With rising sea levels and stronger storms on the horizon, it is important for the Caribbean to protect its coastline. Legal measures should be enacted to protect existing mangroves and other coastal barriers, which are the first line of defense in a storm. Mangroves are a natural barrier that helps soften the blow of waves during a hurricane or severe storm. Structures should be kept away from the water's edge and low-lying areas to minimize loss with rising waters and storm surge.

## CLIMATE-RESPONSIVE ARCHITECTURE

Traditional building techniques that have been adapted to suit the tropical climate should be embraced. They have been developed over many centuries to withstand natural disasters, and can be practical when translated into modern building practices. When locating a building on site, an analysis of sun angles, breezes, topography, and vegetation should be made. Buildings should be situated on the site to take full advantage of these conditions. Mature trees should be saved, as well as most of the existing vegetation.



**Figure 1. The Rain Building along the Derek Walcott Square in St. Lucia; an example of a traditional Caribbean vernacular building.**

Buildings should be designed to withstand the forces associated with natural disasters. Homes constructed with steep roof pitches are more efficient for rainwater run-off than roofs with shallower pitches. Thick walls, preferably made of stone or concrete on lower levels, are stronger than wood walls and provide a more secure barrier against high winds and driving rain. Wood construction, when properly detailed and reinforced, can also provide an effective barrier against storms and also can resist earthquakes. Louvered

storm shutters keep out rain while still allowing light and air in to the building. These features also prove useful in the dry season, allowing protection from the heat; the louvered shutters, high ceilings, and vents allow a cooling of the interior by constant air circulation. This reduces the need for artificial cooling mechanisms.

The introduction of concrete has represented a revolution in Caribbean Architecture. With the advent of reinforced concrete, however, we see the replacement of traditional building forms and techniques with industrial and 'modern' types. Modern concrete is the image of the dominant culture, while traditional building techniques are being disregarded (Martine, 2002, 124). When the use of concrete disregards traditional proportions and materials, this causes an erosion of the building culture of each community and serves to homogenize the appearance of the various islands. Houses constructed of wood and stone construction often retain their structural integrity, while hastily built contemporary buildings often prove vulnerable (Gravette, 2000, 2). Traditional building practices should be able to evolve into a new language, integrating new technologies with time-honored techniques.

## FORTIFIED CONSTRUCTION

While buildings naturally serve the everyday needs of shelter, commerce and recreation, they have a greater role to play during a disaster, namely, that of providing refuge from danger. Buildings also represent a significant financial investment on behalf of their owners. For this reason, every effort should be made to make them as resilient as possible in response to the effects of wind and water so that they may still function after the danger has passed.



**Figure 1. Fixtures that are not properly attached can become dangerous in a hurricane.**

While efforts can be made to construct resilient buildings, code enforcement and maintenance are paramount for maintaining that resiliency. Code enforcement officials should cite building violations, and building owners, in turn, need to be vigilant and fix any conditions that may become a hazard during a disaster. Loose shutters and improperly attached roofs can become projectiles during a hurricane.



## FORTIFIED INFRASTRUCTURE

Basic infrastructure networks such as roads and utilities provide vital links for those affected and for those attempting to provide relief services in the aftermath of a natural disaster. City and national governments need to ensure that these networks remain in working order. Regular maintenance should take place to increase the chances of a network continuing to function after a disaster.

Roads and bridges are one of the most important networks that need to remain viable. They provide evacuation routes for people and need to remain passable so that emergency vehicles can access affected areas of the country. Care needs to be taken in the construction of stable roadways that will not wash away during a flood or heavy rain. A connected grid of streets allows for more exits and entrances during evacuation, and allows multiple rescue crews to thoroughly canvas the area. Emergency vehicles cannot easily perform search-and-rescue when roads are blocked.

It is also important to locate roads away from hazard areas and to keep them clear of debris, minimizing the likelihood of clogged drains or culverts during a storm. Waterways also need to be kept clear of debris to avoid flooding upstream.

Utility networks such as water, sewer, gas and electricity need to handle the effects of a disaster without causing additional damage to life or property. Electric lines should be buried underground to reduce the number of them that may be blown down during a storm. Care needs to be taken to avoid high hazard areas when placing utility lines. Major utility components such as sub-stations and pump houses should be reinforced so that damage to these elements is either avoided or greatly reduced.

It is important to concentrate efforts on developing energy and water sources that can be used by residents without having to rely on a utility grid. Wind turbines and solar

panels can provide energy to a neighborhood long before repairs are made to major transmission lines. Cisterns and other rainwater harvesting devices can provide alternative sources for water when municipal water supplies have been disrupted.

## RESILIENT AGRICULTURE

A secure food supply is essential for creating a resilient community that can survive a natural disaster and thrive in its aftermath. Agriculture should be conducted in a sustainable manner, without synthetic pesticides and fertilizers, which can pollute streams, soil and the human body through

consumption. Livestock and poultry should be raised without hormones or antibiotics, as consumption of animal products that have been tainted with these could lead to precocious development in humans and microbes' resistance to certain drugs. Organic methods of composting recycle nutrients on site and keep top soil rich. Though each island and farm is different, crop rotation should be practiced, and fields should be left fallow occasionally in order to replenish their own nutrients. Composting can be used to accelerate the enrichment of top soil. When steep slopes are farmed, they should be terraced in order to retain rainwater and prevent erosion. Each farmer should attempt to cultivate a variety of crops, rather than just a few, or just one. Monocultures are the enemy of resilience.

Even urban areas can produce a prodigious amount of food. Empty lots, front and back yards, and even trees planted along streets can help feed the neighborhood. By eating locally

cultivated produce, each household can avoid having to purchase high-cost imported products. Not only are imported products more costly, but the burning of fossil fuels needed to transport them (either by airplane, ship, or truck) to each community, can result in an enormous amount of greenhouse gas emissions. Because we have likely reached the moment of peak worldwide oil production, we have also likely entered a period of declining access to the fuels that are needed for the long-range transport of goods.



**Figure 1. Waterways should be kept clear of debris for water free-flow in heavy rains.**



**Figure 4. Electrical wires should be installed correctly; in the event of a disaster, power can be generated to residents quickly.**



**Figure 1. This arugula garden—planted along a walkway—is an example of successful gardening in small places.**

Considering the rising cost of fuel and its inconsistent supply, every island will need to examine how it can become more self-sufficient as regards food and other necessities. Locally grown fruits and vegetables can also be enjoyed out of season by pickling and preserving. Other products such as honey have an indefinite shelf life if stored properly.

Eating locally grown produce has several health benefits as well. Because imported fruits and vegetables are usually picked prematurely and un-ripened, both taste and nutritional value may be harmed by the practice of eating imported produce. Eating locally also pays tribute to the many ethnic groups of the Caribbean who hold a wealth of knowledge regarding the medicinal benefits of local herbs, fruits and vegetables. This knowledge can fill an important void, especially in remote areas where conventional medicine is not readily available. Much of this knowledge is passed down orally and is in danger of being lost.

The intensely-cultivated landscape, humane animal husbandry, the possibility of foraging for delicacies that grow wild,

and the incomparable seafood available to every island, place the Caribbean in a privileged position. By embracing its own culinary traditions, each island can secure its food independence and enjoy a multitude of health benefits as a result.

## REFORESTATION AND LAND STABILIZATION

As recent hurricanes in Haiti and Cuba so poignantly demonstrated, landslides have caused immense loss of life, property and livelihood. The mountainous terrain of these and other Caribbean nations causes hurricanes and tropical storms to release tremendous amounts of precipitation. In deforested areas, rivers of mud, rocks and debris wash away or cover entire villages and towns. In contrast, areas with intact forests resist erosion better than deforested areas. In a memorable graphic, the border between Haiti and the Dominican Republic is evident because of a sharp line that separates the deforested and protected areas of Hispaniola.

How do trees prevent erosion and landslides? Their roots stabilize soils and reinforce hillsides, especially where the forest is mature and the root systems are interwoven and penetrate deeply into the soil. Also, they reduce runoff by absorbing rainwater through evapotranspiration. An additional benefit of healthy forests is their ability to sequester carbon dioxide and other greenhouse gasses. They act as "carbon sinks", mitigating the effects of man-made pollutants (both gasses and particulate matter) and potentially slowing global warming. Despite these free ecological services that forests provide and their important role in preventing catastrophic flooding, there are powerful short-term economic and survival reasons that cause residents to cut down trees. These include the need to secure cooking fuel and charcoal, the need to clear land for agriculture, and the need for building material and building sites.

In order to prevent precious topsoil from being lost in storms, and in order to save lives and property, each Caribbean nation should create or enforce forest protection programs while simultaneously replanting deforested areas. In order for these efforts to be successful, residents need to be educated on how to survive and prosper without engaging in slash-and-burn deforestation. What can leaders do to meet this challenge? The cultivation of native trees, shrubs, and flowers along with crops for alternative fuels should be promoted on barren sites. Many Caribbean nations have an ideal climate and rainfall for the cultivation of sugar cane, jatropa (a species of the *Jatropha* plant — *Jatropha cur*

cas – is also known as the castor oil tree within the region), palms, and other crops that can be tapped for the creation of biofuels. Not only will these plants contribute to the stabilization of slopes, but they can also reduce the demand for wood as a fuel source and invigorate the economies of rural areas. Additionally, fruit-bearing trees that thrive in the Caribbean should be reintroduced onto cleared lands. Flowering plants, especially native ones, help adjacent agricultural areas by attracting pollinators, while also increasing habitat and biodiversity. Costa Rica, while not an island nation, has made its intact forests a prominent tourist magnet and has marketed itself as the top eco-destination in Central America. Residents have begun to appreciate that there is more to be gained from the protection and restoration of the forest than by its short-term exploitation.

## CONCLUSION

In recent years, the Caribbean Region has been fortunate to emerge partially unscathed by the past hurricane seasons. This period allows governments to re-evaluate land development practices in regard to storm preparation. National Disaster Preparedness offices can evaluate how each community in their jurisdictions are to become more resilient. Some solutions will be common to all in the region while others will be highly specific and hand-crafted. Building a more resilient Caribbean will be a satisfying project, one that requires widespread collaboration, but which promises to create places of enduring value. The result is reduced anxiety due to unforeseeable events and the joy that can be experienced when one lives on nature's terms.

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*Bio on Andrew Georgiadis: Andrew has been with Dover, Kohl & Partners since 2001 and has participated in over 50 design charrettes with the firm. He produces many of the firm's watercolor and photorealistic renderings used to depict urban form. Andrew received both his Bachelor of Architecture and Master of Architecture in Suburb & Town Design from the University of Miami. He is a LEED-accredited professional, and a member of the Congress for the New Urbanism (CNU). Andrew speaks five languages, including English, Spanish, Portuguese, Italian and Greek.*

*Bio on Christopher Postawski: Chris has been with Dover, Kohl & Partners since 2002 and has participated in over 30 design charrettes with the firm. Chris combines his training in traditional-hand drawing techniques with his knowledge of cutting-edge computer technology to create compelling graphics and visualizations for master plans and codes. Chris draws upon his background in classical architecture to create realistic master plans and conceptual architectural designs. He has also assisted in developing and testing the LEED-ND prerequisite for determining a project's connectivity.*



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