



for a living planet®



Diego M. Garces

# The Meso American Reef

## Adaptation Case Studies for Responding to Climate Change Impacts

### Characteristics

The Mesoamerican Reef (MAR) system contains the largest barrier reef in the Western Hemisphere, extending approximately 1,000 kms along the Caribbean coasts of Mexico, Belize, Guatemala and Honduras. The MAR hosts more than 65 species of stony coral and more than 500 species of fish, including commercially vital grouper, snapper and spiny lobster. The region includes important coastal habitats such as estuaries, beaches, coastal rivers, mangroves, seagrasses, and coastal wetlands that provide important breeding and nesting grounds for species such as marine turtles. However, multiple stressors from global climate change, over-harvesting of fish populations, along with pollution (largely from agricultural sources), and poorly-managed tourism are contributing to a decline in the health and integrity of this fragile ecosystem. The MAR sustains nearly 2 million people from the four neighbouring countries, a large proportion of whom live along the coasts and islands. The reefs and mangroves have tremendous socio-economic as well as ecological value. A World Resources Institute (WRI) report estimated the combined value of reef- and mangrove-related fisheries, tourism, and shoreline protection in Belize to be **US\$395 - 559 million/year**. Mangroves provide an estimated **US\$174 - 249 million** of this total<sup>1</sup>.

### Climate Change Impacts

Coral reefs have been referred to as the “canaries of the sea” due to their high sensitivity to rising temperatures and other anthropogenic stressors. The effects of climate change on the MAR are mainly in

the form of coral bleaching events and violent storms. Coral bleaching is a stress response caused primarily by increased water temperature and often also enhanced by increased irradiance levels and doldrums conditions. It involves the loss of symbiotic algae that coexist with the coral and provide it with much of its food. This loss can result in diseases, failed reproduction, partial or even complete mortality of affected coral colonies. As reef building corals in the MAR already exist near their thermal limit (around 30°C), sea water temperatures need only rise one or two degrees over relatively short time periods for bleaching effects to occur. The MAR has already been considerably impacted by mass bleaching events in 1995, 1998 and 2005 – and the frequency of both bleaching events and hurricanes are projected to increase due to global climate change. According to the Caribbean Community Climate Change Centre (CCCCC) predictive regional models suggest a further regional temperature increase by 2080 of up to 5°C, with the greatest warming being experienced in the north-west Caribbean (including Belize, Jamaica, Cuba, Hispaniola). Storm surges and sea level rise will also threaten critical freshwater resources in coastal areas through saline water intrusion. Other climate related impacts, already emerging, include increased incidence of pests and diseases, flooding in inland areas as riverbanks are more frequently breached in flash flooding events, and the exacerbation of the impacts of forest fires due to higher temperatures and drought. The combined effects of global climate

change, with the ensuing sea level rise, seawater temperature increases, and reduction in CaCO<sub>3</sub>; together with other anthropogenic stressors such as damaging tourism practices; sewage discharge and pollution; tourism infrastructure development leading to vast tracts of mangrove clearance; sedimentation; coastal urban development; overfishing and unsustainable fishing practices; and, finally pollution from upland agrochemical use, are having devastating effects on marine and terrestrial ecosystems in the region. As biodiversity and ecosystem integrity is lost, adaptation options are diminished, increasing the vulnerability of human and natural systems.

### WWFs Response

In response to these threats, WWF has been working with a wide range of partners and stakeholders in the region for 10 years, and since 2006, has developed and implemented a project specifically focusing on adapting to the threats of climate change, focusing predominantly on Belize. To date, the MAR climate change project has broadly focused on three key elements: (1) science-based monitoring of climate change impacts on biological and social systems (reefs and mangroves), (2) field level implementation of adaptation strategies (including better management practices), and (3) an advocacy strategy to raise awareness of climate change and to lobby for climate change issues at local and national policy levels.

This project has provided an important test bed for pilot adaptation approaches, raising awareness and understanding of adaptation, and building in-country



networks with a wide range of stakeholders (including reef monitoring groups, communities, government and the private sector). The project has taken an integrated approach, addressing social and ecological aspects of climate risk, assessing vulnerability and identifying adaptation measures that promote ecosystem resilience and help ensure the sustainable provision of ecosystem services on which vulnerable communities rely. The project has made some critical advances, particularly in terms of:

- enhancing reef monitoring systems (including training local tour guides to identify coral bleaching and working extensively with a coalition of marine experts in a 'coral reef monitoring group' to monitor the health of reefs, and provide early warning alerts for bleaching events).
- testing the feasibility of 'coral nurseries' to help restore areas of reef that have been damaged (due to coral bleaching, coastal development or tourism) faster than would normally naturally occur;
- collaborating with the World Resources Institute to assess the socio-economic value of the reefs and mangroves for Belize;
- increasing awareness and understanding of climate change impacts (through direct awareness raising activities with communities, engagement with policy decision-makers, development of media and dissemination materials);
- engaging with local communities to assess and identify key vulnerabilities, and provide tangible local solutions for adaptation (including mangrove restoration and local development planning). Three community level vulnerability assessments have been conducted in Belize, and recently an additional four vulnerability assessments have been conducted in Honduras. A pilot community in Belize has recently replanted approximately 17,000 red mangrove propagules in the Placencia Lagoon area; with a plan underway to develop private mangrove reserves at strategic locations along the Placencia Peninsula.
- encouraging developers to conserve mangroves through a 'mangrove friendly development challenge'.

Detailed monitoring of mangroves, identifying hotspots most vulnerable to sea level rise, storm surges and other drivers of environmental degradation will commence this year. WWF is also working with policy decision-makers in Belize to ensure adaptation measures are integrated into national climate change policy, relevant sectoral policies and local development plans. Policy measures planned by WWF include:

- Engagement in the national Climate Change Committee to assist in finalizing the development and adoption of the draft **national climate change adaptation policy** and the **national adaptation strategy**, and to ensure adaptation measures identified recognize the role of healthy ecosystems in building resilience to climate change impacts;
- Ensuring **mangrove legislation** prevents unsustainable degradation of mangrove ecosystems which provide a natural buffer to climate impacts;
- Supporting development of a **national sustainable tourism strategy** to improve environmental standards. Adaptation planning for the tourism sector is critical as the vast majority of tourism infrastructure is located within 10 km of the coast, and is therefore highly vulnerable to climate change induced sea level rise and storm surges;
- Supporting the development of the national **Coastal Zone Management plan** and local development plan for San Pedro, Ambergris Caye, taking into account adaptation planning;
- Improvements to **EIAs** regulations (currently these are only required on plots of land over 100 acres. Under 100 acres the land may be evaluated with an 'environmental checklist' only);
- Improvement of **enforcement measures** of environmental regulations, including establishing 'local watchdogs' in communities to support government in identifying areas where regulations are being breached.

1 Cooper, E., L. Burke, and N. Bood. 2009, "Coastal Capital: Belize. The Economic Contribution of Belize's Coral Reefs and mangroves." WRI Working Paper. World Resources Institute, Washington DC. 53 pp. Available online at <http://www.wri.org/publications>

#### Value of Ecosystem Services:

- Coral reef and mangrove related tourism US\$150 million - 196 million to the national economy in 2007 (12-15 % GDP);
- Economic benefits from reef and mangrove dependent commercial fisheries are estimated at US\$14 - 16 million per year.
- Reefs and mangroves also play an extremely significant role in protecting coastal communities from erosion and storm surges, providing an estimated US\$231 - 347 million per year in avoided damages.
- For the Caribbean region generally, the mean forecast of the worth of reefs and mangroves is US\$ 26 billion/ year 2050-2100 or greater than 10% GDP.

#### Costs of Inaction:

Figures on the cost of climate change impacts are not available on a country specific basis but there are some of estimates for the Caribbean region:

- US\$11.2 billion or 11.3% GDP of GDP of all 20 CARICOM countries by 2080 (WB, 2008)
- US\$21 billion or 10.3% GDP by 2050 and US\$46.2 billion or 21.7% GDP by 2100 (Bueno et al, 2008)



WWF® for a living planet®

#### For further information:

Ms Nadia Bood  
WWF-CARO  
Programme Coordinator  
[nbood@wwfca.org](mailto:nbood@wwfca.org)