



## Goal

By the end of 2009, WWF expects to identify climate change adaptation strategies that will foster maintenance of the biological diversity within the MAR and sustain current socio-cultural factors and livelihood aspects that are dependent upon it.

## Activities Underway

WWF's efforts to promote adaptation to climate change effects within the MAR Ecoregion are listed below:

**1.** Collect and compile ecological data verifying (or not) coral bleaching threat models for the MAR. WWF has been working closely with TNC, the Healthy Mesoamerican Reef Ecosystem Initiative (HMREI) and other local partners to complete this critical task. Data has been collected for over 300 reef sites within the MAR and findings are being verified with NOAA's coral bleaching threat models and TNC's bleaching threat maps.

**2.** Incorporate ecological and GIS outputs into MPA Network representation analysis and design. Maps will be generated based on the findings from ecological datasets to validate with current MPA network representation system. The best design for an ecoregional MPA Network that will be functionally capable of adapting to climate change will be investigated.

A case study on how to incorporate models of adaptation to coral bleaching into ecological representation analyses for MPA Networks will be produced for dissemination. The case study will also take into consideration the role of stakeholders.

**3.** Expand climate witness and socio-economic activities to obtain a good representation of the MAR ecoregion. Workshops to bring together WWF MAR staff and key collaborators in the 4 countries to build capacity in climate witness approaches and planned ridge to reef climate interventions will be conducted.

A journalist training on climate change and its predicted effects will be carried out to work with journalists on raising public awareness.

A knowledge, attitude and practice study for the MAR region will be conducted to gauge the public's knowledge about climate change, how they feel about it and what they propose for action.

**4.** Increase outreach to enable climate change adaptation. WWF will continue its outreach activities and build on current relationships with relevant institutions to advocate development and implementation of a climate change adaptation strategy for the MAR.



WWF is the largest and most experienced independent conservation organization in the world. WWF was founded in 1961 and is known by its panda logo. WWF is supported by more than 5 million people and its global network works in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption



**WWF Central America**  
Phone: +506 234 8434  
Fax: +506 253 4927  
Email: cifores@wwfca.org

P.O. Box: 629-2350  
San Francisco de Dos Rios,  
San José, Costa Rica



# Climate Change

M E S O A M E R I C A N R E E F E C O R E G I O N A L P R O G R A M

*Climate change is expected to have significant impacts on the Mesoamerican Reef (MAR), ranging from coastal inundation linked to rising sea levels, increased mass coral bleaching events due to warming seas, to increased mechanical damage and run-off (sediments, nutrients, other pollutants) due to high intensity storms.*



## Under changing climatic conditions

It is projected that global climate change will have significant adverse impacts on biodiversity as well as human livelihoods and way of life. Many biological systems worldwide (including coral reefs) are already threatened by overuse, degradation and fragmentation, and climate change will offer additional stress that could drive major biodiversity loss. When compounded, these threats can reduce ecosystem resilience (ability to bounce back after being negatively impacted) as well as human options for adapting to these rapid changes.

The Mesoamerican Reef (MAR) provides significant cultural and socioeconomic benefits to each MAR country through its provision of protection for the valuable shoreline and coastal infrastructure, and direct income from tourism and fisheries activities. Under changing climatic conditions, however, current benefits will be jeopardized. In order to improve the ability of the MAR to adapt to climate change, current human threats need to be minimized, ecosystem resilience enhanced and connectivity between habitats improved.



## Main Threats

Several human and natural stress factors currently threaten the ecological integrity of the Mesoamerican Reef (MAR), and its associated goods and services. Climate change is expected to compound impacts from these threats.

- **Unsustainable fishing practices:** Over-exploitation of critical fish stocks and destructive fishing practices have been ongoing problems in recent years. Both have resulted in altering the abundance and size dynamics of key fish stocks, and disrupting the ecological balance within reef systems.
- **Unsustainable tourism activities:** Snorkelers and divers have been known to damage corals through tramping and other forms of abrasions while boat anchors cause further damage to reefs in other areas. Waste disposal from hotels and resorts also adversely impact reefs.
- **Unwise coastal development practices:** Activities such as unsound dredging, mangrove clearance and high density coastal developments can have significant adverse impacts on reefs. All that can result is coastal erosion and pollution that severely impact reefs. Many reefs within the MAR (e.g. off the coast of Honduras and Guatemala) have been smothered by sediment runoffs.
- **Storms, hurricanes, and increased runoff:** Storms and hurricanes have had measurable impacts on the MAR for many years. As the global climate warms, it is expected that the intensity and frequency of these events will increase and as well as their impact on human settlements and way of life. These high energy systems are usually associated with torrential rains that can cause increased runoff and pollution. This is a critical problem at locations where unsound inland land use and unsustainable agricultural practices exist.
- **Warming seas:** A warming atmosphere will bring about a warming of oceans and seas. Reef building corals in the MAR already exist near their thermal limit (around 30°C). Once sea temperatures increased above this limit, corals become stressed, expel their internal symbiotic algae and take on a pale or white coloration (a condition known as bleaching). When such a condition is prolonged corals often die. A total of three mass bleaching events (1995, 1998 and 2005) have impacted the MAR thus far. Given the predicted increases in sea surface temperature under changing climatic conditions, the MAR is likely to continue to be impacted by bleaching.
- **Sea level rise:** As the atmosphere, and seas and oceans warm, this will result in a melting of glaciers and ice caps that will drive global sea level to rise. MAR countries will be very likely impacted by sea encroachment because most of their mainland and insular coasts are at or slightly above sea level.



## Achievements

Critical to reef conservation efforts, in light of climate change, is the ability to determine and monitor reef condition over time, as well as quantify factors (natural and human-related) that adversely influence reef health and the livelihoods dependent on it.

1. **Building scientific and technical capacity to assess MAR reefs.** A total of 27 individuals representing various local organizations (Governmental, NGOs, Community Based Organizations CBOs) were technically trained in Rapid Reef Assessment techniques in Belize. These individuals are now able to design their respective monitoring programs to answer important management questions and effectively contribute to management efforts within the region.

2. **Rapid assessment of the Mesoamerican Reef.** In collaboration with TNC and other local partners, over 300 reef sites were monitored as part of a comprehensive reef assessment study for the MAR in 2006. The study allows a thorough analysis of habitat representation for the MAR as well as the identification of bleaching resilient reefs (with corals that bleach and may die but the coral community bounces back) and resistant reefs (with corals that do not bleach) within the Ecoregion.

3. **Marine protected areas (MPAs) as a promising tool for protecting coral reefs in the face of continued impacts from climate change.** Plans are underway to incorporate bleaching resilient and resistant reefs into a current MPA Network representation analysis and design.

4. **Investigation of socioeconomic values, predicted socio-economic impacts from climate change and key considerations for adaptation.** Climate witness studies have been carried out in Belize to gather information on people's perceptions on climate change and how they foresee their lives, livelihoods and way of life being affected by changing climatic events. Through this effort, WWF is building a connection with people on the ground to get them talking about these critical issues, and promote advocacy for identifying strategies to alleviate human adverse effects and increase resilience to climate change impacts.

WWF is working with the World Resources Institute (WRI) to develop a standardized methodology for

conducting economic valuation of coral reefs and mangroves goods and services (based on tourism, fisheries and shoreline protection) for Belize. Information collected through this project will be used to create policy recommendations on how to mitigate threats to corals reefs and mangroves as well as explore alternative financing arrangements for MPAs in Belize.

Work is underway to conduct a case study analyzing potential socioeconomic impacts of climate change effects on the already economically and ecologically disadvantaged community of Port Layola, Belize.

5. **Climate change outreach with local partners.** WWF has initiated discussions with relevant policy, regulatory and civil society institutions on climate change adaptation possibilities for the MAR region.

*The Mesoamerican Reef's developing nations will be hit hard by climate change with essentially most existing development efforts placed at risk. WWF is starting to work with key stakeholders in the MAR to identify the best measures to adapt to changing climate, while maintaining their economic development for the future.*

*The climate change program of the Mesoamerican Reef (MAR) is linked to existing ecoregional efforts based on working from the ridge to reef.*

For more information:  
Nadia Bood  
MAR Reef Scientist  
WWF Central America  
nbood@wwfca.org



Produced by:  
Communications Department  
WWF Central America  
2006

Editing and graphic  
design supervision:  
Cynthia Flores Mora  
Communications Director  
cflores@wwfca.org

Writer:  
Nadia Bood  
nbood@wwfca.org

Design and layout:  
Priscila Coto  
priscilacoto@gmail.com

Photographs:  
© Anicke CROSS  
© Melanie McFIELD  
© WWF / Cynthia FLORES  
© WWF / Nadia BOOD  
© WWF-Canon / Anja BURNS  
© WWF-Canon / Michel GUNTHER