

Evaluating Local and Global Stresses on Coral Reefs: A Case Study of Caribbean/Atlantic Reefs
GIS Term Project: Proposal
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Problem Statement

The coral reefs in the Caribbean Sea and Atlantic Ocean comprise 10% of the world's coral reefs. These reefs contain sixty-five species of reef-building corals, 90% of which are unique to the area. Sadly, 75% of these reefs are considered threatened with 30% categorized in the high to very high threat levels. Local and global stresses are the cause of coral bleaching and the decline of reefs due to disease. Local stresses include coastal development, watershed-based pollution, marine-based pollution and damage, and overfishing/destructive fishing. Global stresses include changes in ocean water temperature and ocean acidification, the increase of CO₂ dissolved into the ocean.

For this project, coral reef risk levels will be modeled based upon the proximity of local and global stresses. Present day risk levels will be compared to risk levels seen ten and twenty years ago to establish trends of risk levels with time. Conclusions regarding the impact of stresses on coral reefs will be made after completing the following objectives.

Reefs at Risk of Bleaching and Disease in the Caribbean (WRI, 2004)



Example of a Healthy Reef (Source: TheEcologist.org)



Example of a Bleached Reef (Source: ThinkProgress.org)



Objectives:

Objective 1: Distinguish between local and global stresses.

Deliverables

1. Caribbean/Atlantic Coral Reef Base Maps with:

- Local stress feature classes (e.g. size of city, number of ports and airports, watershed catchments, and economic dependence on the reef) created using ReefBase data sets containing information about reef geographic locations and using Census Bureau as a source for population and economic development data.
- Global stress feature classes (e.g. increased water temperature and ocean acidification) created using ReefBase data sets containing point data for observations of coral bleaching, data sets from

National Aeronautics and Space Administration regarding sea-surface water temperatures, and CO2 concentrations in the ocean from the Surface Ocean CO2 Atlas (SOCAT) .

2. Analysis of reef threat levels and their causes.

Objective 2: Compare the coral bleaching risk level of present day to risk levels of ten and twenty years ago.

Deliverables

1. Figures showing the estimate of the coral bleaching risk level (present day, 10 years ago, 20 years ago) using Spatial Interpolation with Inverse Distance Weighting method of coral bleaching monitoring points from ReefBase data sets.
2. Tables created using Zonal Statistics as Table to determine the coral bleaching risk level for coral reefs in the Caribbean/Atlantic Coral Reef geodatabase for comparison of present day levels to the levels seen ten and twenty years ago.

Data Sources

1. For Coral Reef Location Information: [ReefBase::Download GIS Dataset](#).
2. For Local Stress Information:
 - o Population Information: [Census Bureau Home Page](#).
 - o Watershed Catchment Information: [NHD Plus - NHDPlus Data](#).
3. For Global Stress Information:
 - o Sea-Surface Water Temperature Information/Data: [Data.GISS: GISS Surface Temperature Analysis \(GISTEMP\)](#).
 - o Ocean Acidification Information/Data: [Surface Ocean CO2 Atlas \(SOCAT\)](#).
4. For Coral Bleaching and Coral Disease Location Information: [ReefBase::Download GIS Dataset](#).