Modern Threats to Ancient Reefs
A Ridge to Reef Visualization of Oahu’s Coral Vulnerability

Introduction

The island of Oahu uniquely exemplifies the impact of rapid human population increase in the Central Pacific. Boasting both beautiful natural reefs and over one million inhabitants, Honolulu is the largest and most remote urban center in the world.

The coral reefs of Oahu are among it’s most valuable and endangered ecosystems. Scientists recognizing the fragile ecology of this environment have often examined highly localized coral stressors such as salinity variation, sedimentation, and physical reef destruction. However, our understanding of reef health is far from complete.

This project visualizes the impact of various coral stressors with emphasis on the Ridge to Reef model of island ecology. This model emphasizes the ties between distinct ecosystems influenced by the same watershed. Revolutionary though it may be, it is not a new idea. Ridge to Reef conservation is similar to the traditional Polynesian Ahupua’a land use system.

Future urban planners might use the information provided by this poster to increase their awareness of the extensive impacts of our decisions. With this knowledge we might protect the environment both for ourselves and the reefs that build the white sandy beaches of Hawaii.

Methodology

Oahu’s coral reefs are exposed to two major types of stressors: those present in the marine environment and those in the watershed above the reef.

Marine Stressors (shown on left) include physical damage to the reef caused by trash dumping and boat anchors. Waste and excrement pollution released from sewer lines negatively affect reef growth. Also, proximity to the shoreline increases the vulnerability of the reef in two ways. First, reef damage caused by human activity is higher near shore due to ease of access. Second, decreased water flow slows the flushing of dissolved and suspended pollutants.

Watershed health (shown on right) significantly impacts reef health as the two ecosystems are tied by a common hydrology. A high road density increases runoff, high slope leads to increased erosion and sediment load. The toxicity of this runoff is also influenced by land use. Agricultural lands are a negative factor because tilled soil erodes easily while chemical fertilizers and pesticides damage coral physiology. Similarly, industrial lands generate many pollutants and generally consist of non-permeable surfaces which also contribute to runoff.

Marine Stressor Analysis

The proximity to marine stress indicators used in this analysis was calculated using the Euclidian Distance tool. Distance from the shoreline, anchorage areas, dumping zones and sewage outlets were reclassified and assigned values based on distance from the stressor. These values were added to create the marine stressor index.

Conclusions

The Marine Stressor Index shows that the reefs located on the southern central shore of Oahu are highly stressed from human and development driven factors.

The Watershed Health Index indicates two areas of particularly high vulnerability. The south central shore is again subject to the most significant stressors. Areas around Pearl Harbor are particularly steep and industrial with their effluent being focused on the large reef near the mouth of the harbor. North Shore watersheds with high WIH were often both steep and agricultural.

Further research on this subject might attempt to determine the effect of ocean currents and wave movement on pollutant dispersal and better model the points of pollutant release from the watersheds into the sea.