



REMOTE SENSING OF CORAL REEF ENVIRONMENTS

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CORAL REEFS

- Diverse ecosystems that are home to tiny organisms that secrete calcium carbonate to form the rigid structures.
- Located in the midlatitudes in shallow water environments.



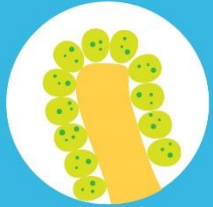
CORAL REEF BLEACHING

CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

HEALTHY CORAL

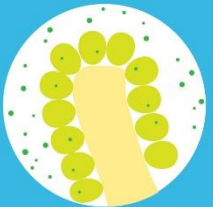
1 Coral and algae depend on each other to survive.



Corals have a symbiotic relationship with microscopic algae called zooxanthellae that live in their tissues. These algae are the coral's primary food source and give them their color.

STRESSED CORAL


2 If stressed, algae leaves the coral.



When the symbiotic relationship becomes stressed due to increased ocean temperature or pollution, the algae leave the coral's tissue.

BLEACHED CORAL


3 Coral is left bleached and vulnerable.



Without the algae, the coral loses its major source of food, turns white or very pale, and is more susceptible to disease.

WHAT CAUSES CORAL BLEACHING?

- Change in ocean temperature**
Increased ocean temperature caused by climate change is the leading cause of coral bleaching.
- Runoff and pollution**
Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants — these can bleach near-shore corals.
- Overexposure to sunlight**
When temperatures are high, high solar irradiance contributes to bleaching in shallow-water corals.
- Extreme low tides**
Exposure to the air during extreme low tides can cause bleaching in shallow corals.



NOAA's Coral Reef Conservation Program
<http://coralreef.noaa.gov/>

Why we should care:

- Acts as a barrier
- Home to millions of species
- Source of fishing
- Natural beauty

REMOTE SENSING APPLICATIONS

- Since 1984 Landsat TM has been a primary sensor used in coral reef remote sensing.
- 1999 Holden and LaDrew showed that geographic location has no affect on the reflectance of healthy coral.

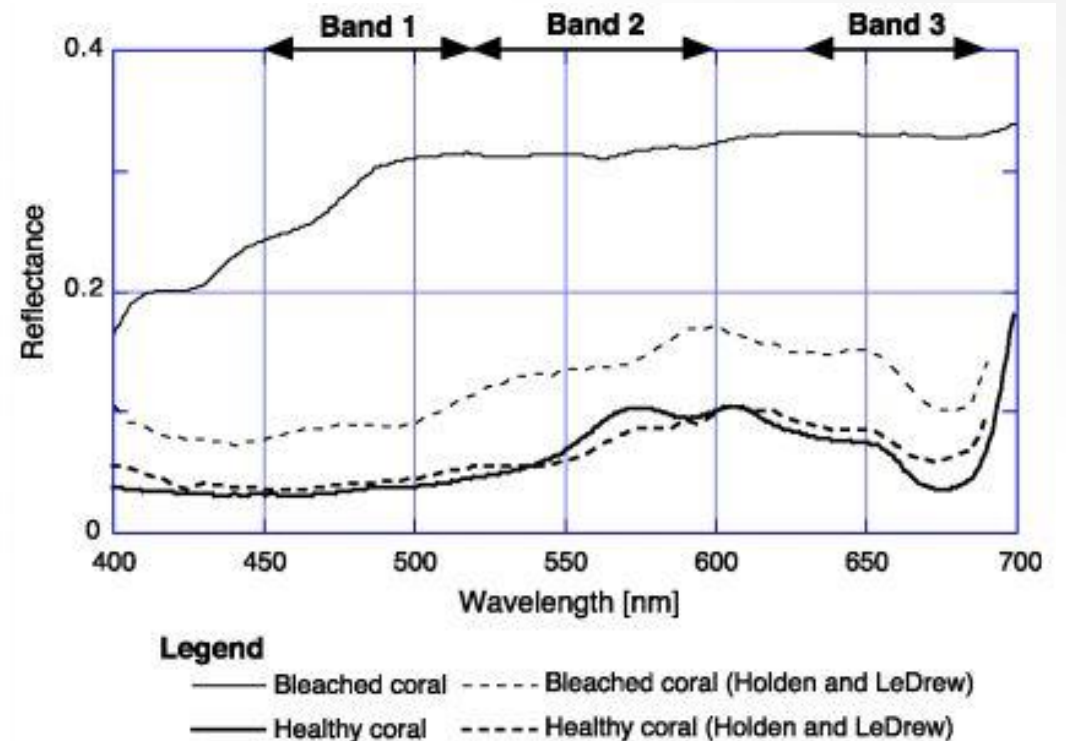


Considerations:

- The detection of coral bleaching requires spatial resolutions to be high.
- Bleached coral has a similar reflectance pattern as sand.

METHODS

- Determine adequate sites
- Collect reflectance patterns from these locations.
- Compare reflectance to the standard from Yamano et al.
- Decreased reflectance in the red portion indicates loss of zooxanthellae (bleaching).



RESULTS

In the visible portion of the spectrum, bleached coral has a higher reflectance than healthy coral. Detecting coral bleaching relies on spatial resolution not spectral resolution.



<https://www.dreamstime.com/stock-images-tropical-coral-reef-fish-image4494144>



<http://www.globalcoralbleaching.org/>

Although costly, advanced sensors like IKONOS, QuickBird, and ALOS would aid in the detection of bleached coral due to their high spatial resolution.

Thank You!



Yamano, H., & Tamura, M. (2004). Detection limits of coral reef bleaching by satellite remote sensing: Simulation and data analysis. *Remote Sensing of Environment*, 90(1), 86-103. doi:10.1016/j.rse.2003.12.005

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