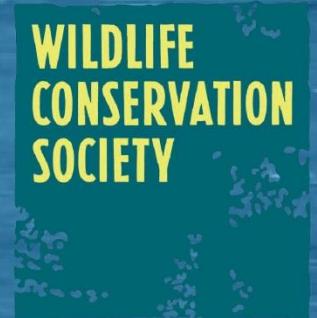


The Pearl Cays Region of Nicaragua's Caribbean Coast



Hayley Solak
Anne Clark Baker
Alex Kappel

Objectives

- Classify coral and seagrass – critical habitats for sea turtles and other important marine species
- Investigate the utility of Landsat 8 imagery for marine habitat mapping



Study Area

Landsat-8 Path 15, Row 51

Atlantic
Ocean

Nicaragua

Pacific
Ocean
2

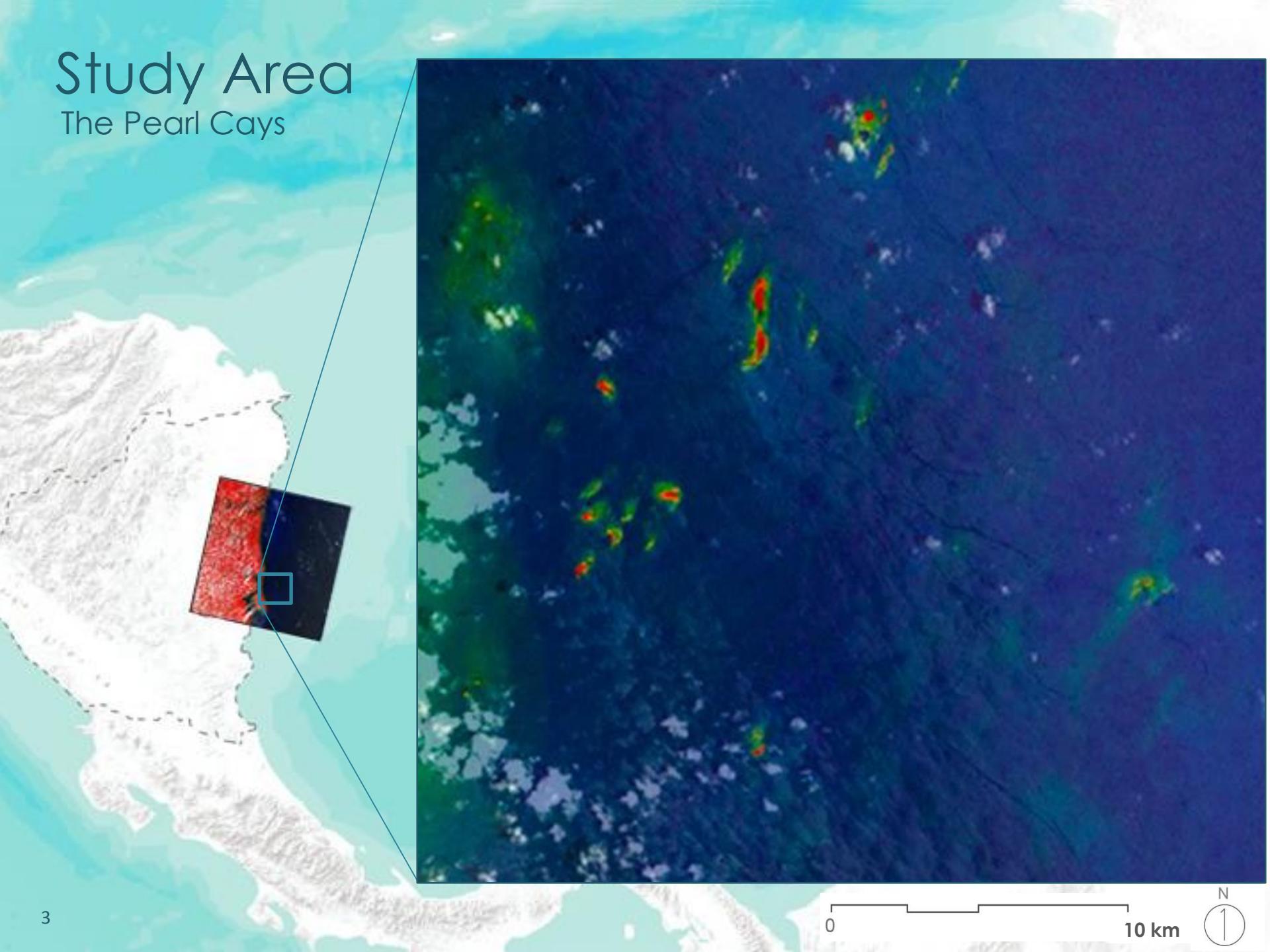


0 500 km

N
1

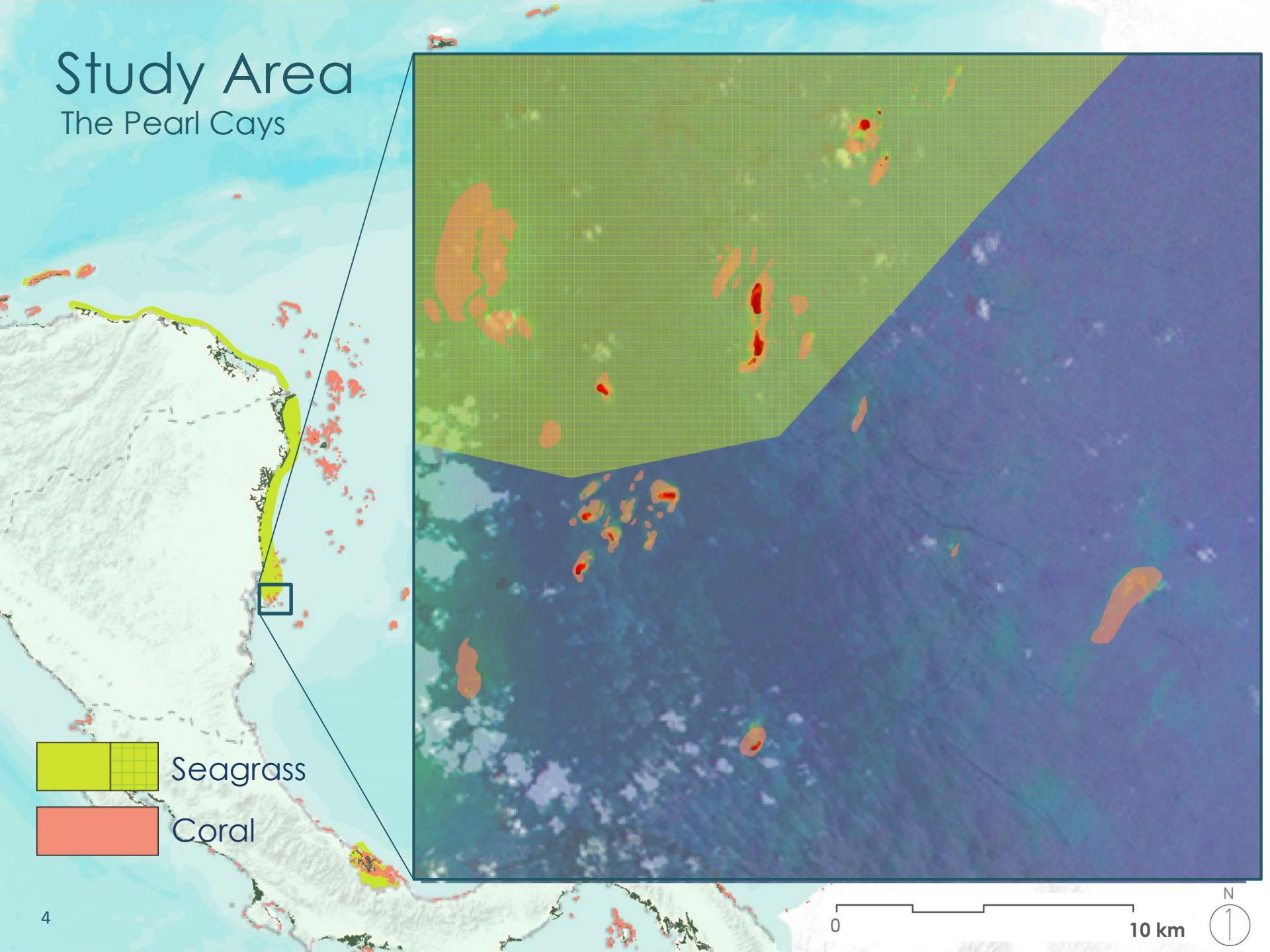
Study Area

The Pearl Cays



Study Area

The Pearl Cays



Preprocessing

Preprocessing



Training Site
Development



Classification



Post-
Classification

Landsat 8 Images



Reflectance



Cropped Images



Cloud and Land Masking

Two Dates:
September 2013
March 2014

Quality Assessment Band
Iterative Cluster Analysis

Training Site Development

Preprocessing



Training Site
Development

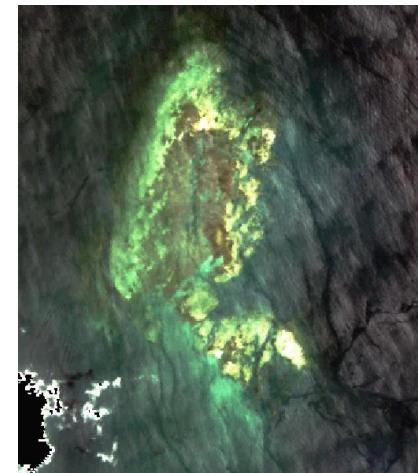
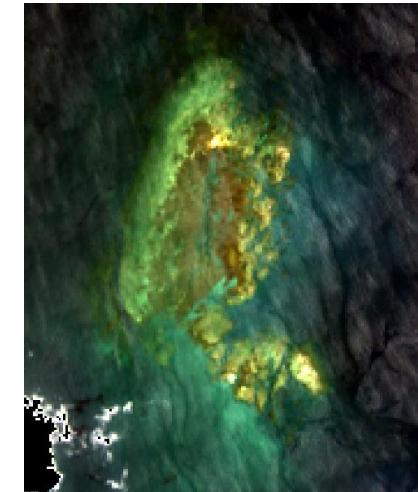
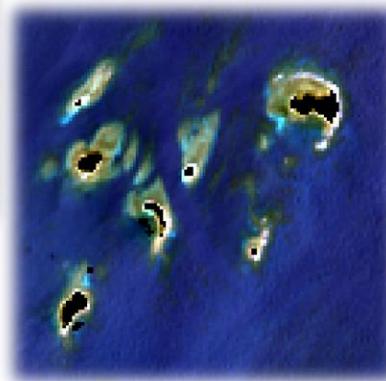
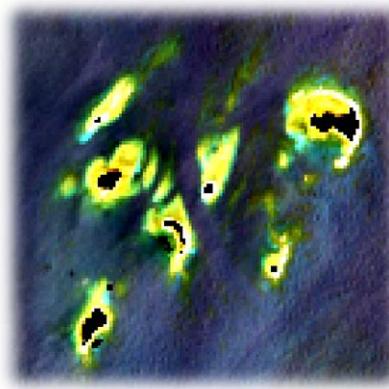


Classification



Post-
Classification

- Unsupervised Classifications
- Contrast Adjustment
- High Resolution Imagery
- Pan sharpening



Classification

Preprocessing



Training Site
Development



Classification



Post-
Classification

Unsupervised Classification



Supervised Classification
(Entire Scene)

Multi-Layer Perceptron



Create sectors

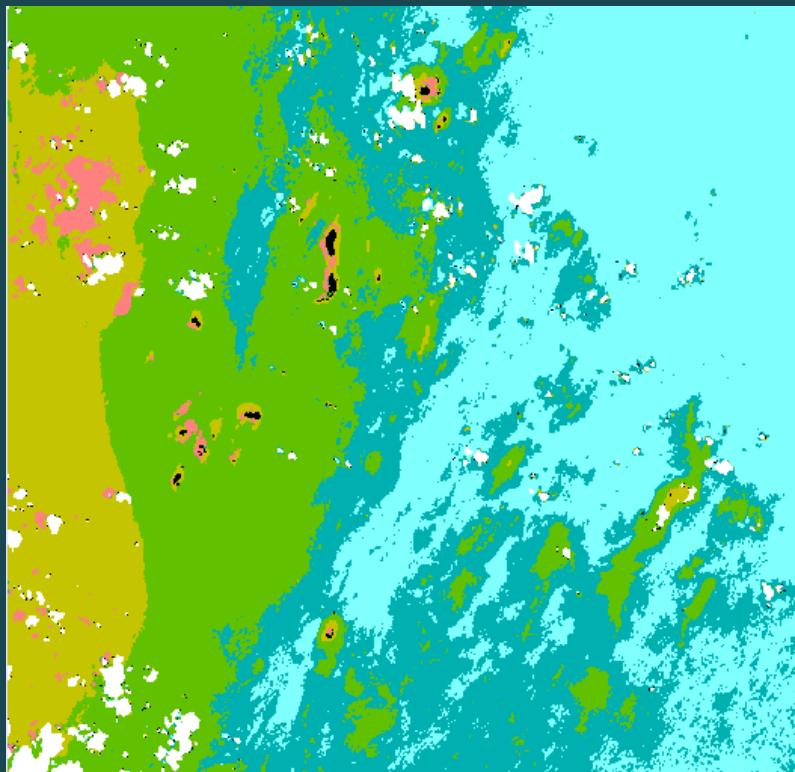


Supervised Classification
(sectors)

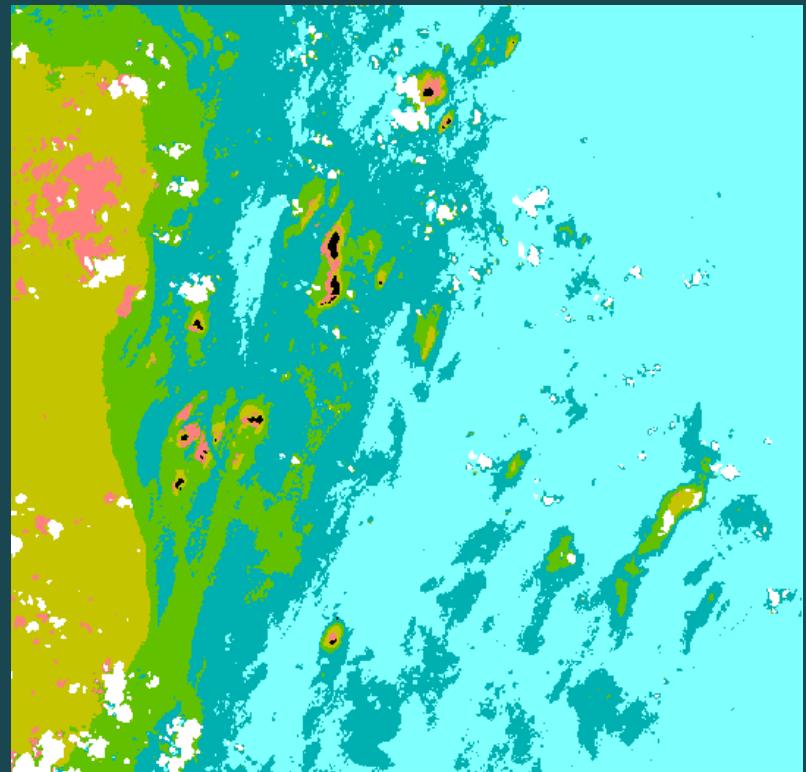
Maximum Likelihood
K Nearest Neighbor

Exploring Landsat-8 Band 1 (Coastal Blue)

Blue Band



Coastal Band

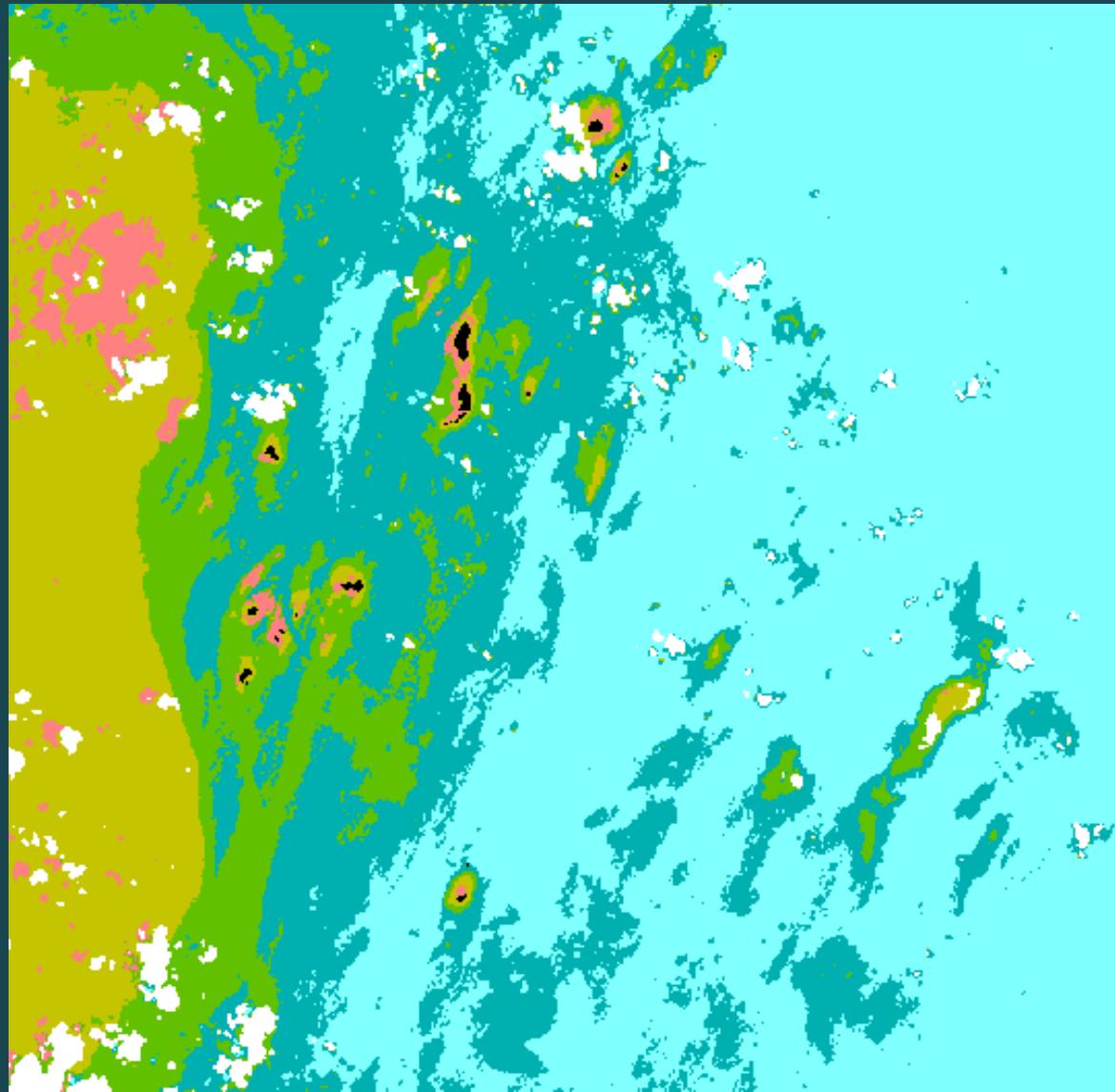


- Coral
- Seagrass
- Deeper Coral/Seagrass
- Sediment/Sand
- Water
- Cloud

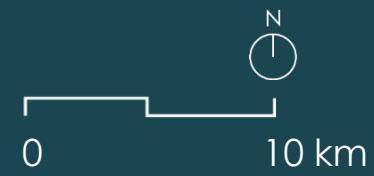


Pearl Cays Classification

Multi-Layer Perceptron: Coastal Band

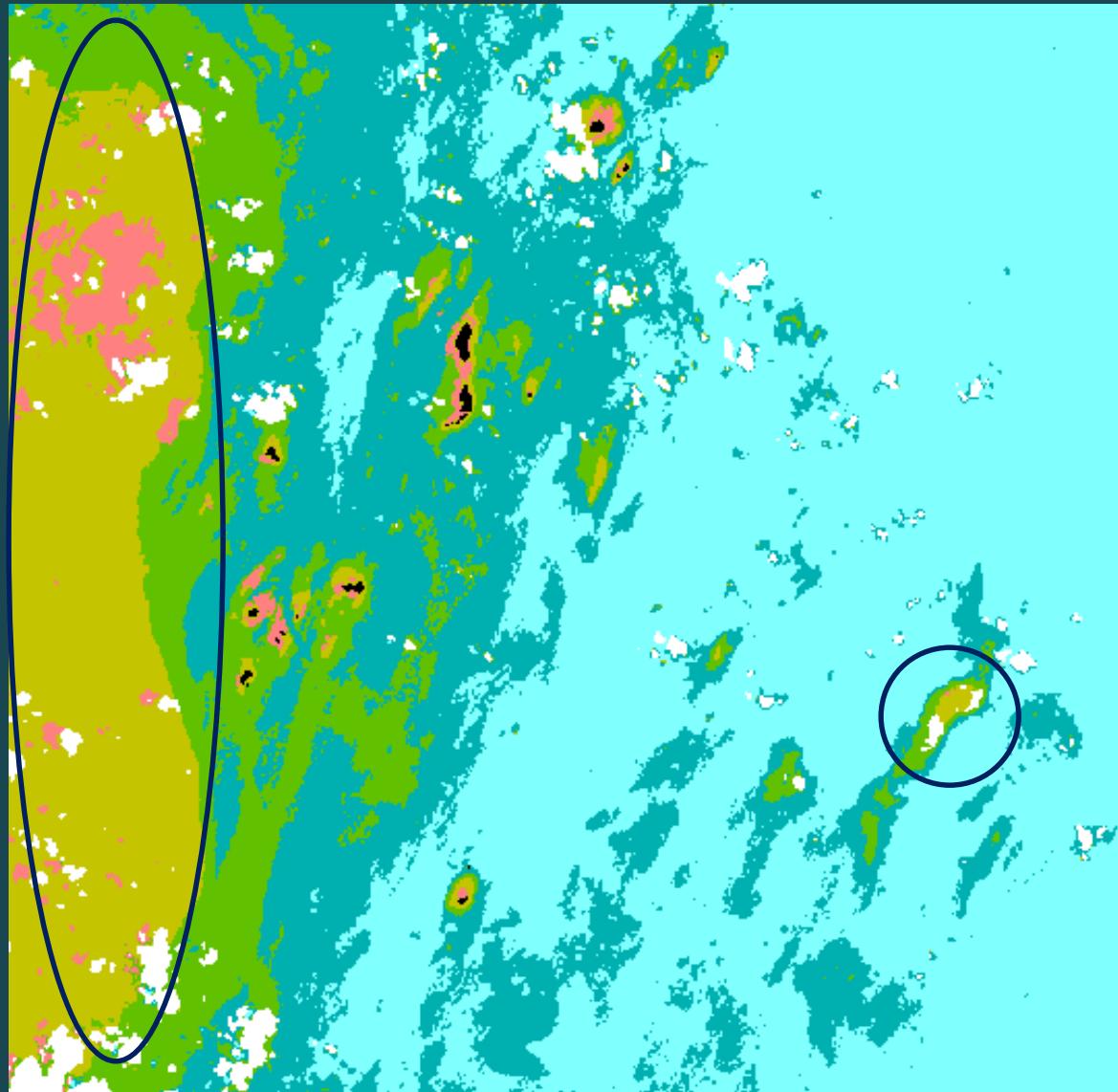


- Coral
- Seagrass
- Deeper Coral/Seagrass
- Sediment/Sand
- Water
- Cloud



Pearl Cays Classification

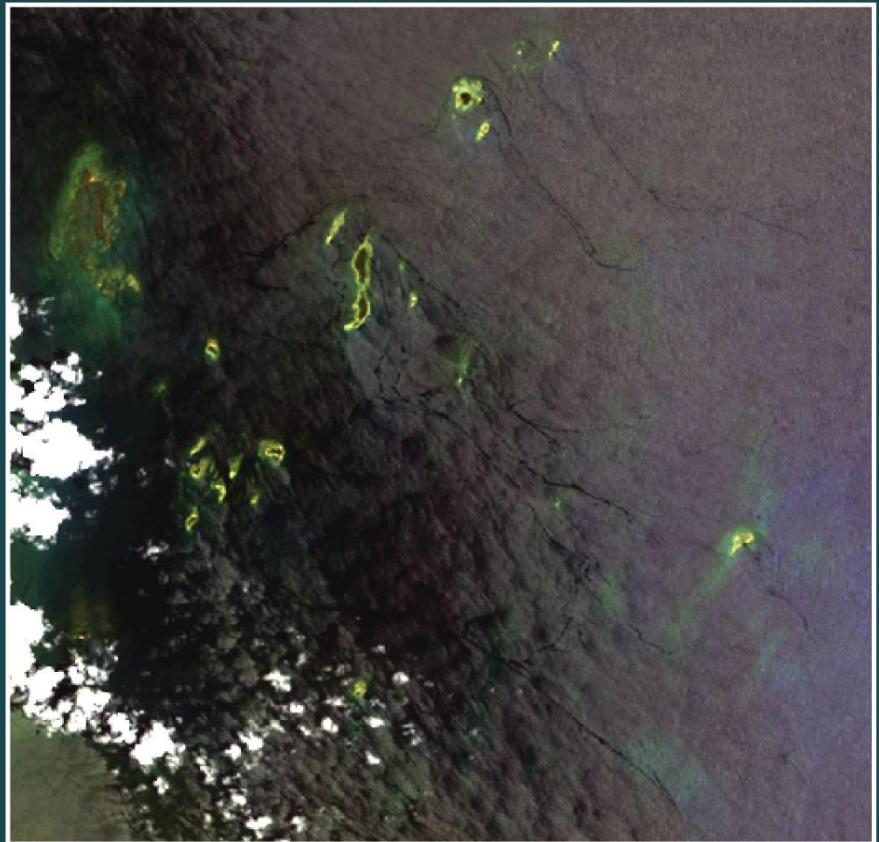
Multi-Layer Perceptron: Coastal Band



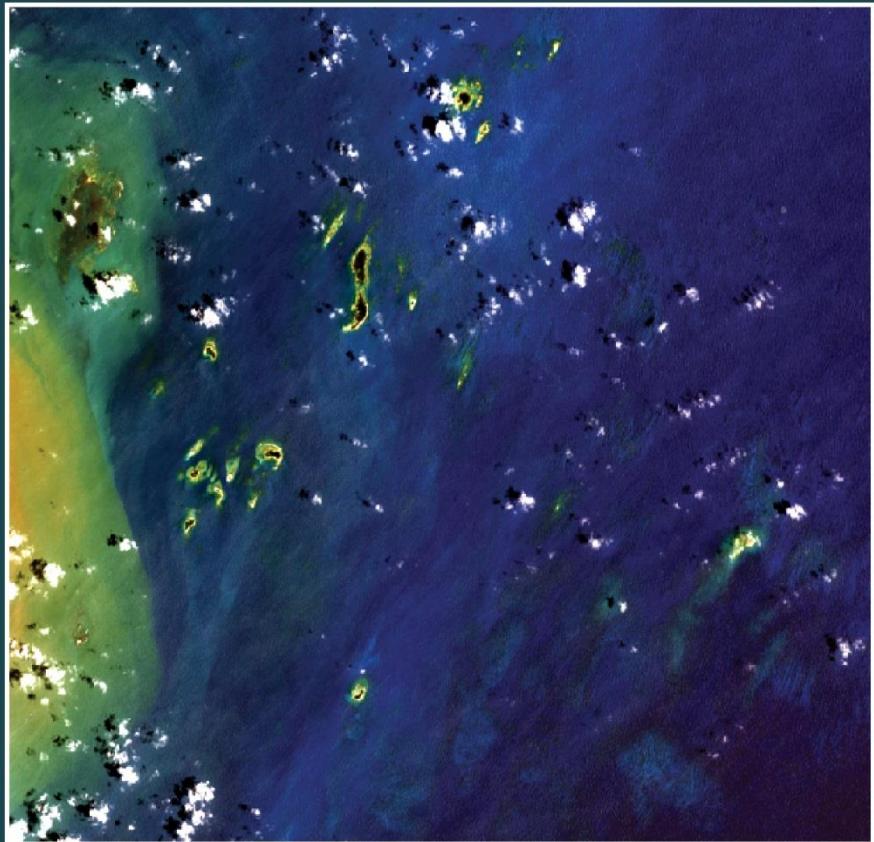
- Coral
- Seagrass
- Deeper Coral/Seagrass
- Sediment/Sand
- Water
- Cloud



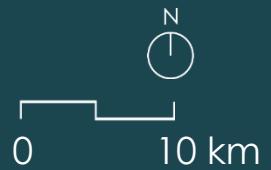
Multi-date Image Selection



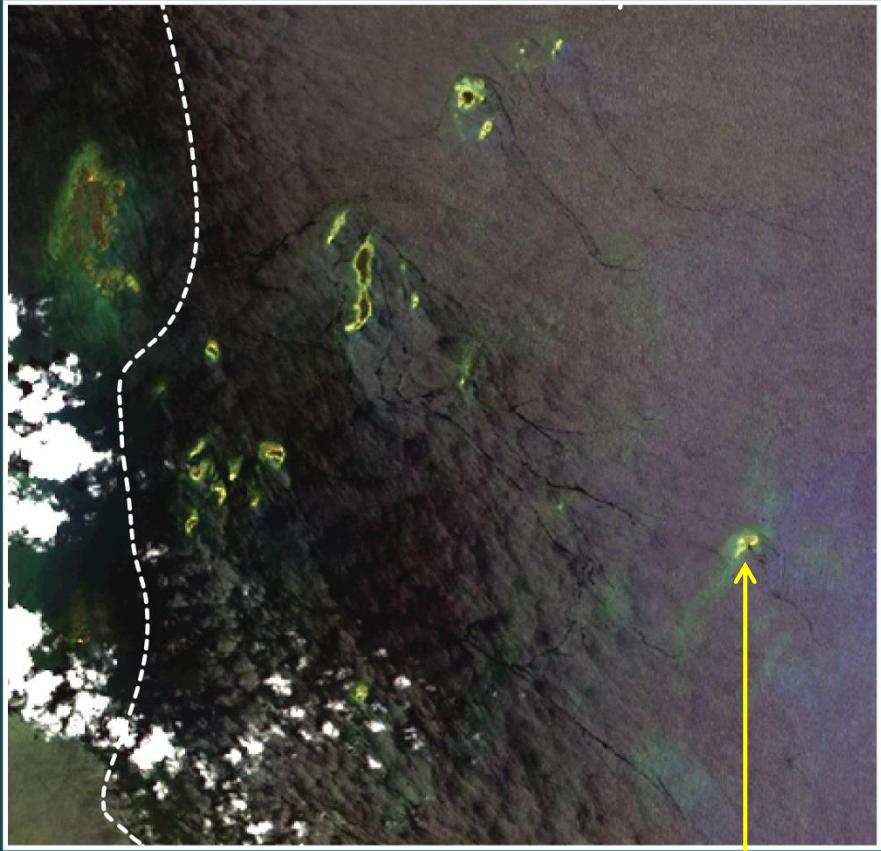
Landsat 8
Path 15, Row 50
September 12, 2013



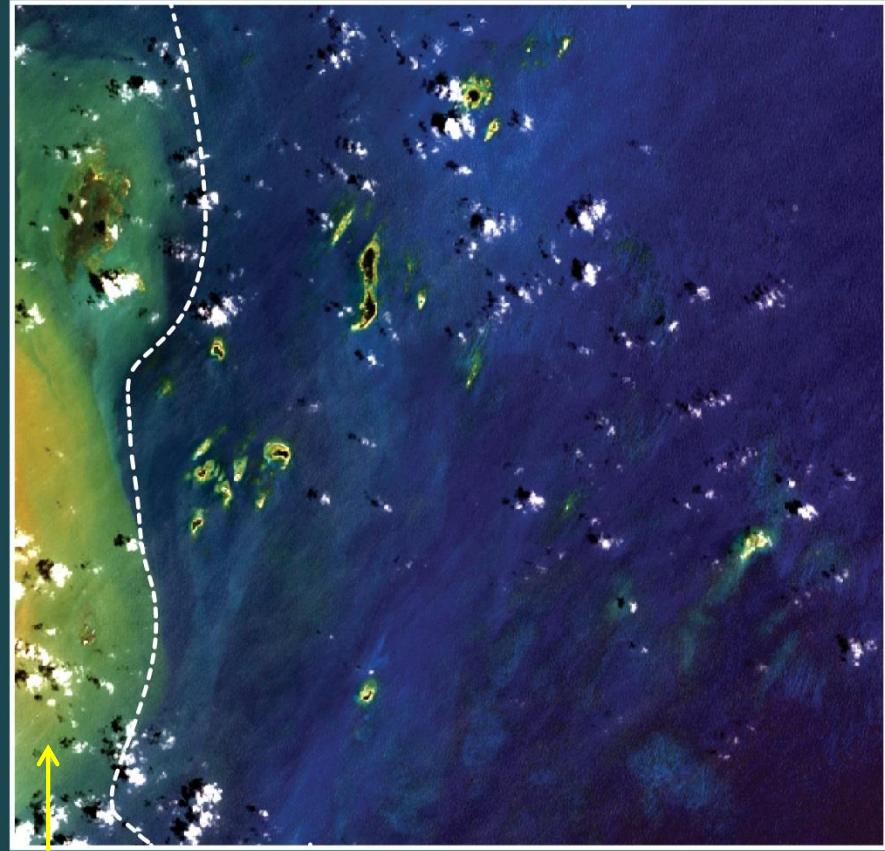
Landsat 8
Path 15, Row 50
March 23, 2014



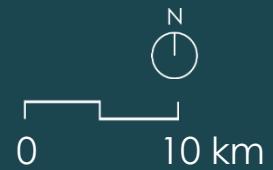
Multi-date Image Selection



sun glint and
saturation



sediment

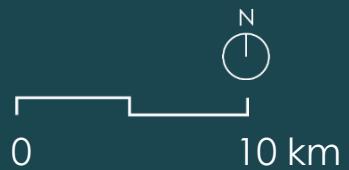
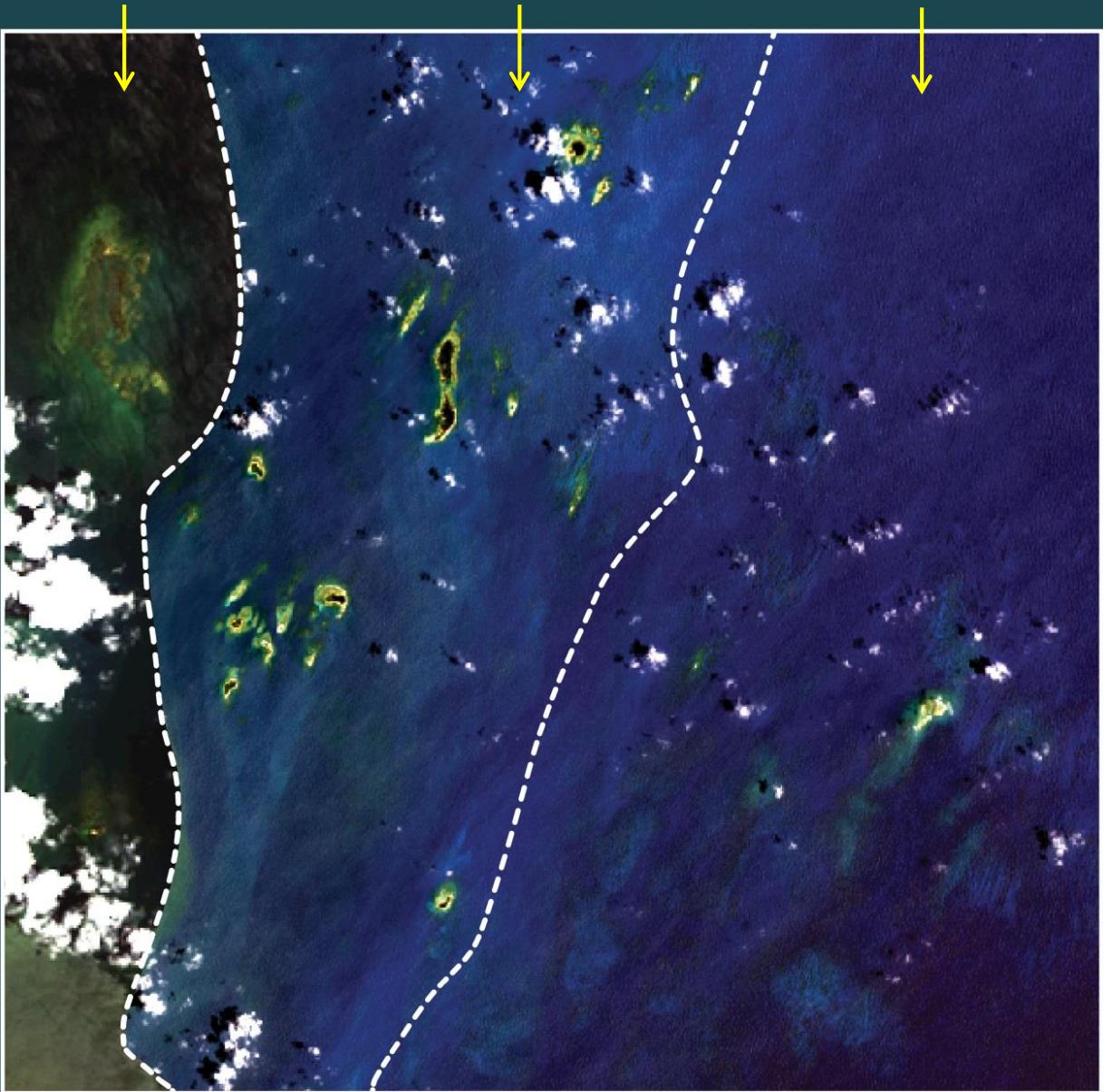


Sectors:

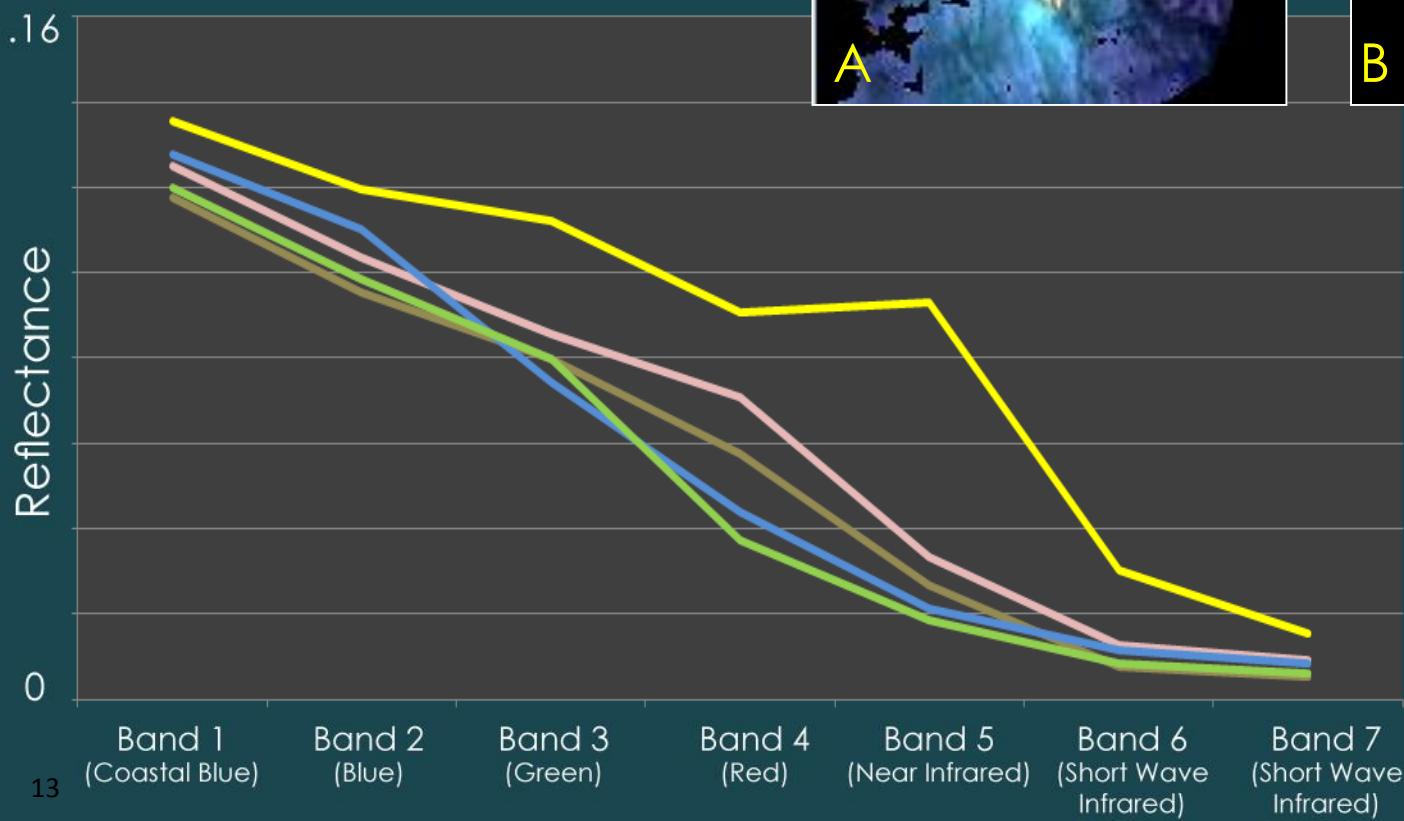
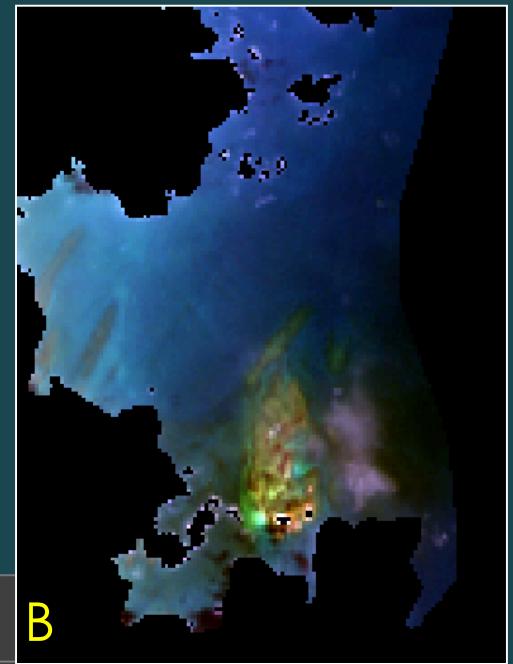
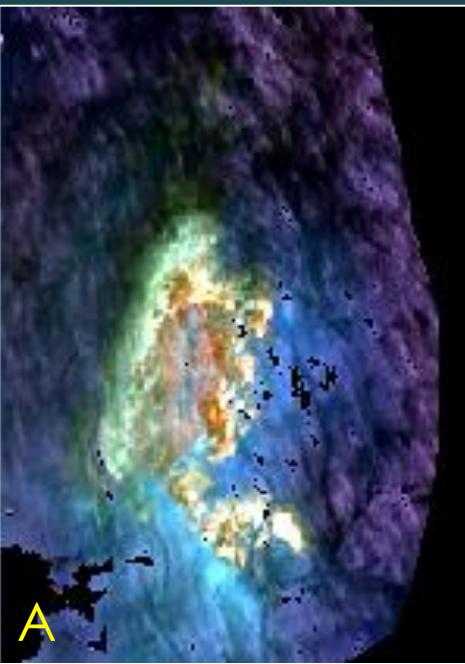
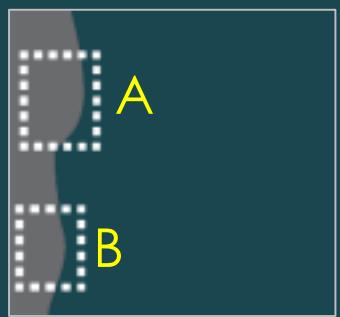
Sept 2013
Reefs

Mar 2014
Islands

Mar 2014
Deep

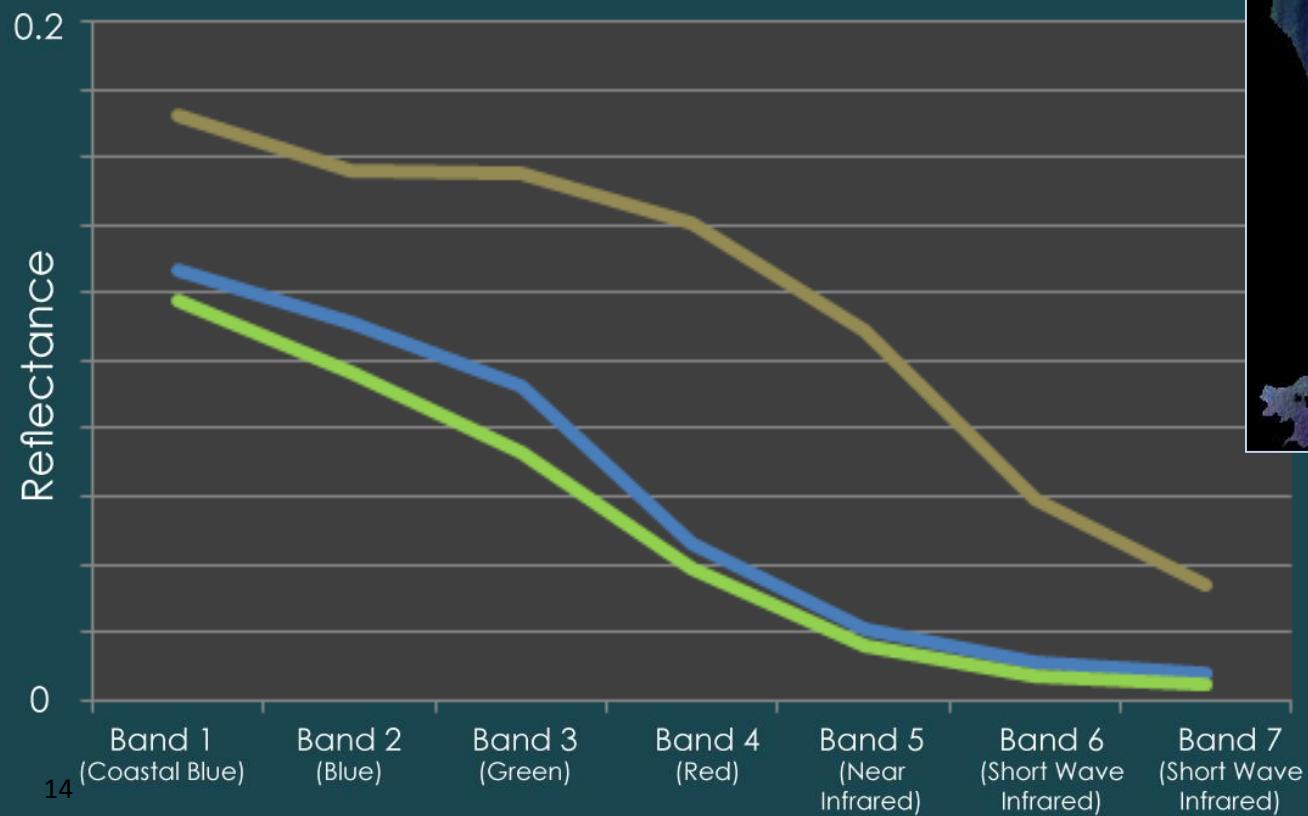
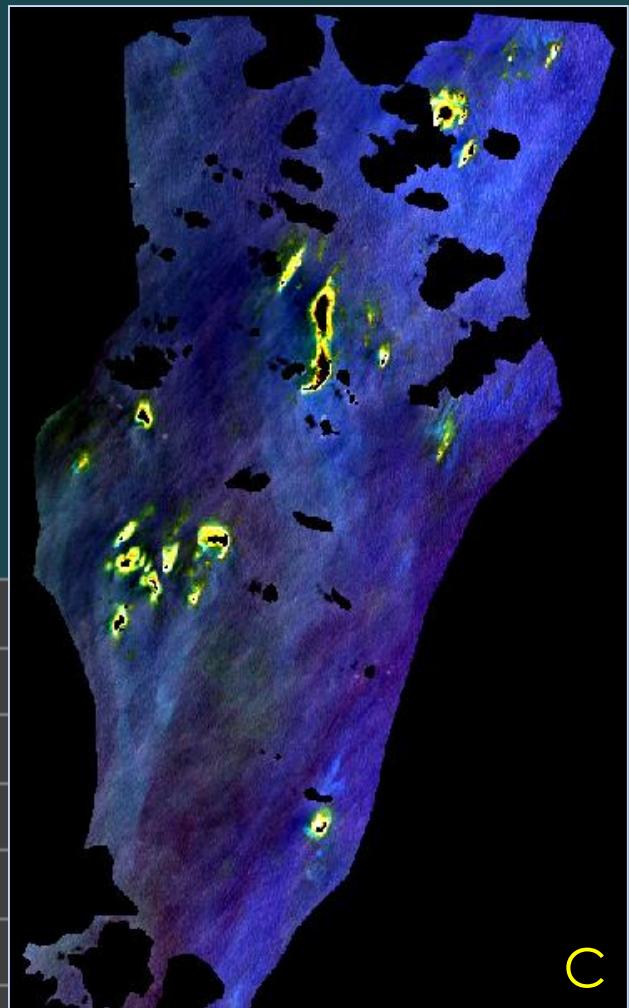


Reef Sector



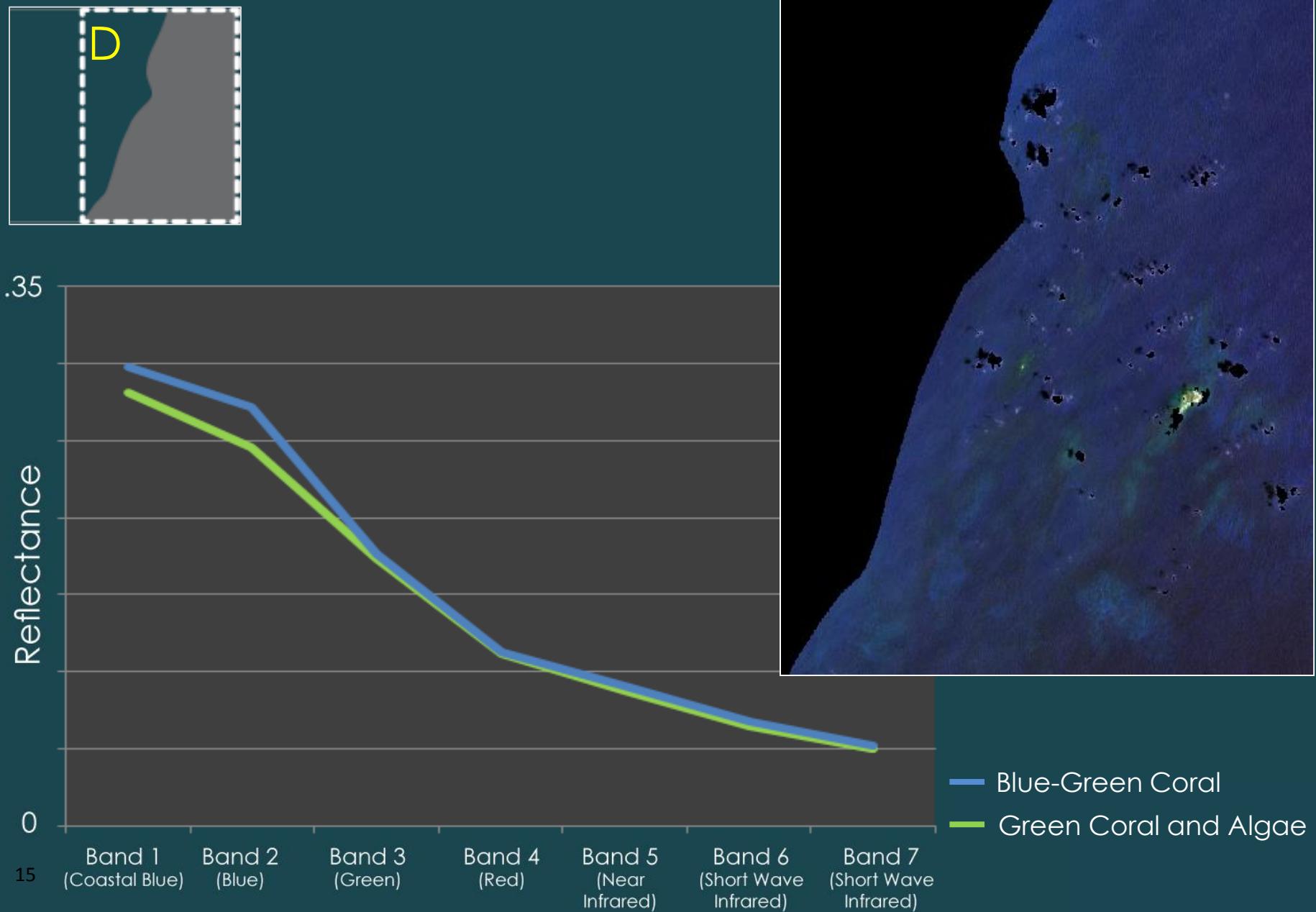
- Brown Coral
- Tan/Pink Coral
- Yellow Coral/Sand
- Blue-Green Coral
- Green Coral/Algae

Islands Sector



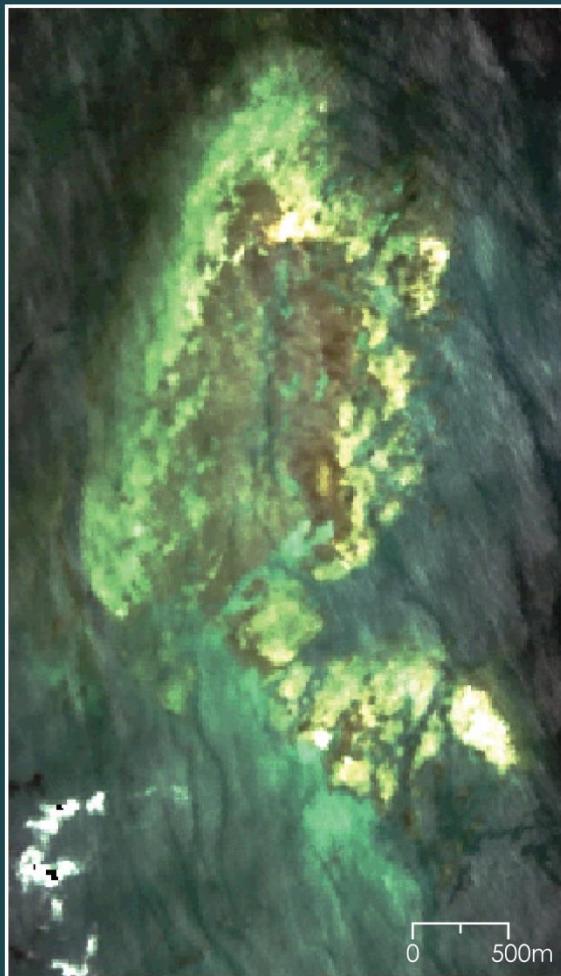
- Brown Coral
- Blue-Green Coral
- Green Coral and Algae

Deep Sector



Reef Sector

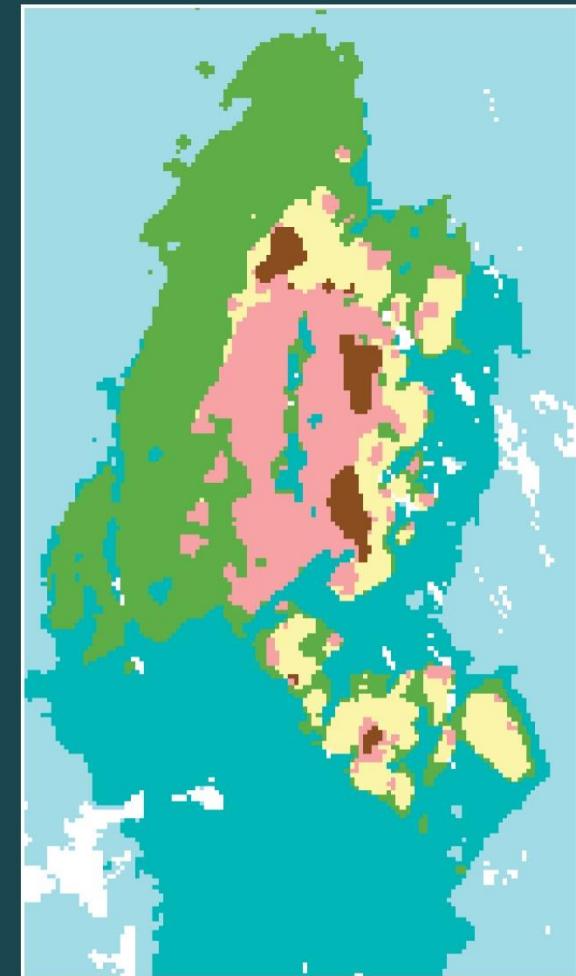
Landsat-8



Study Area Classification



Sector Classification

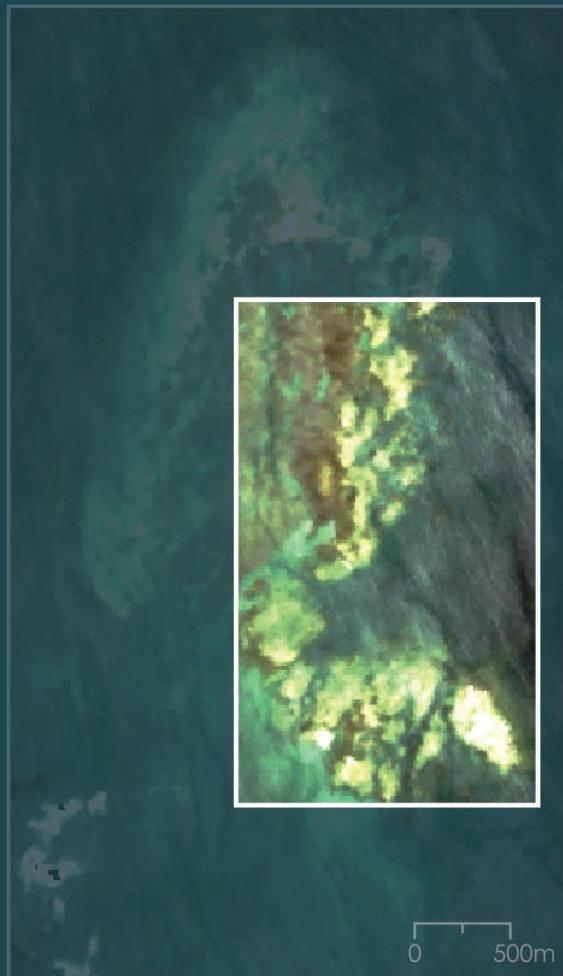


Coral
Sand
Seagrass
Deep Coral/Seagrass
Cloud

Brown Coral
Tan/Pink Coral
Yellow Coral/Sand
Green Coral/Algae/Seagrass
Blue-Green Coral
Water
Cloud

Reef Sector

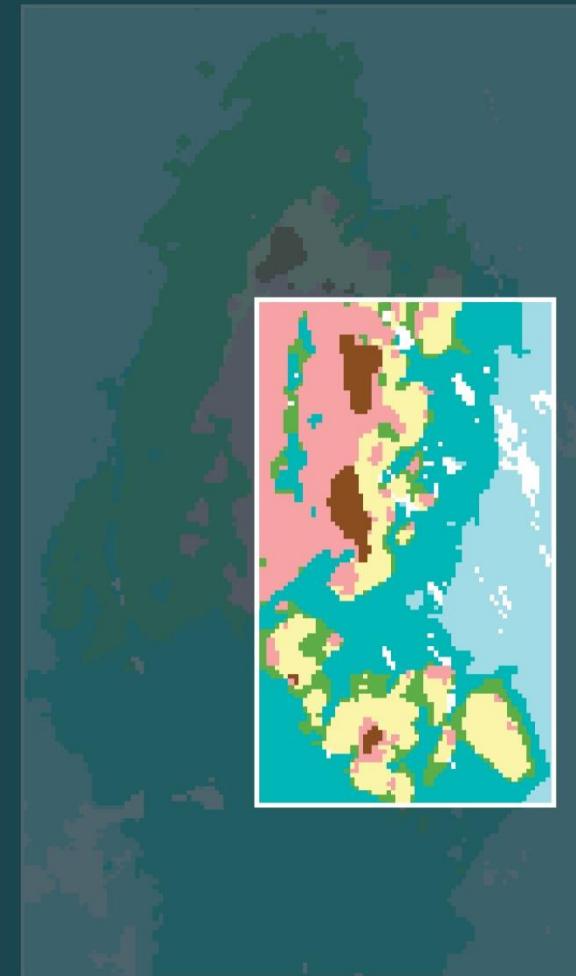
Landsat-8



Study Area Classification



Sector Classification

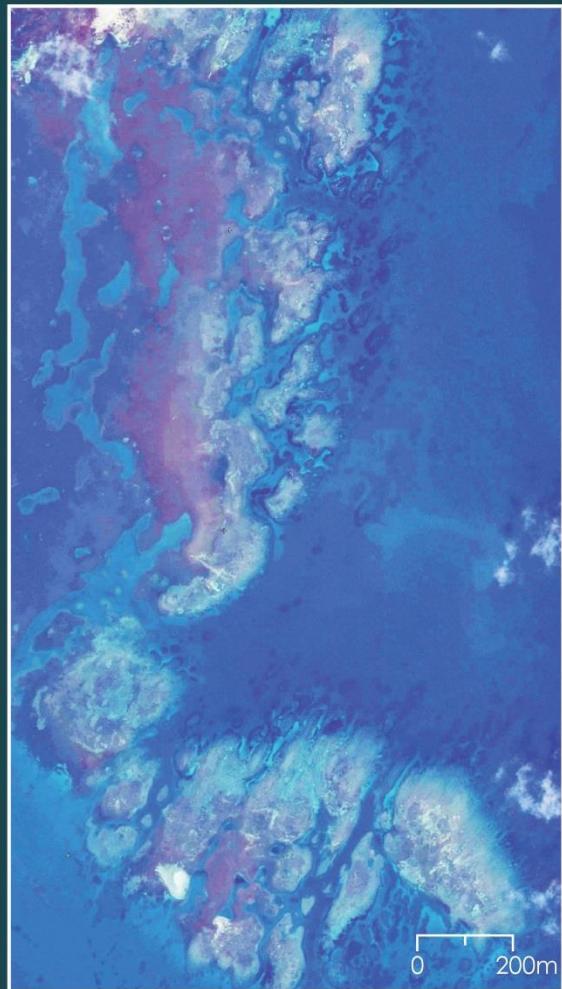


- Coral
- Sand
- Seagrass
- Deep Coral/Seagrass
- Cloud

- Brown Coral
- Tan/Pink Coral
- Yellow Coral/Sand
- Green Coral/Algae/Seagrass
- Blue-Green Coral
- Water
- Cloud

Reef Sector

Flash Earth



Study Area Classification



Sector Classification

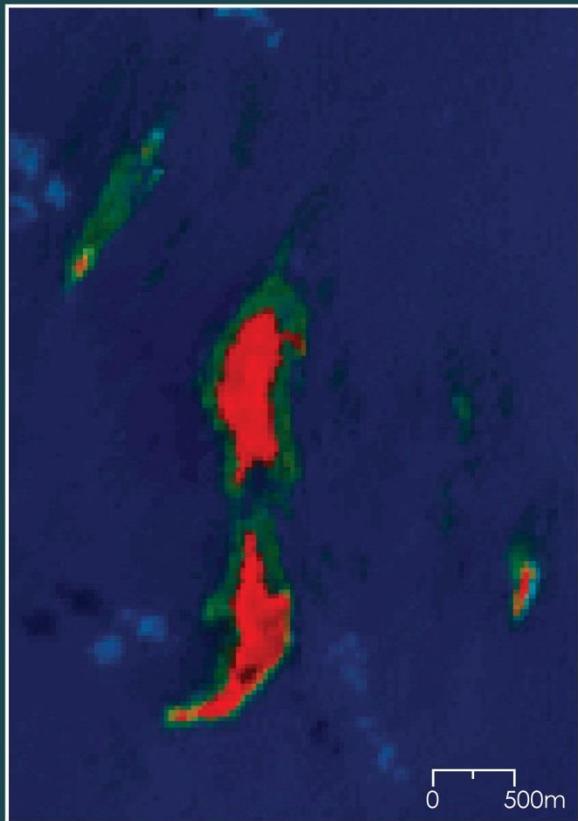


 Coral
Sand
Seagrass
Deep Coral/Seagrass
Cloud

Brown Coral
Tan/Pink Coral
Yellow Coral/Sand
Green Coral/Algae/Seagrass
Blue-Green Coral
Water
Cloud

Islands Sector

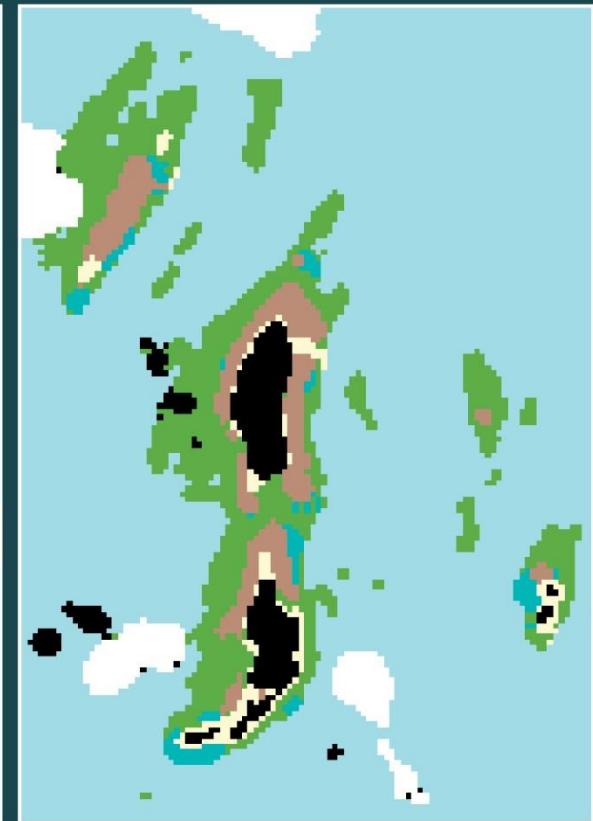
Landsat-8



Study Area Classification



Sector Classification



- Coral
- Sand
- Seagrass
- Deep Coral/Seagrass
- Cloud
- Water

- Brown Coral
- Sand
- Green Coral/Algae/Seagrass
- Blue-Green Coral
- Water
- Cloud

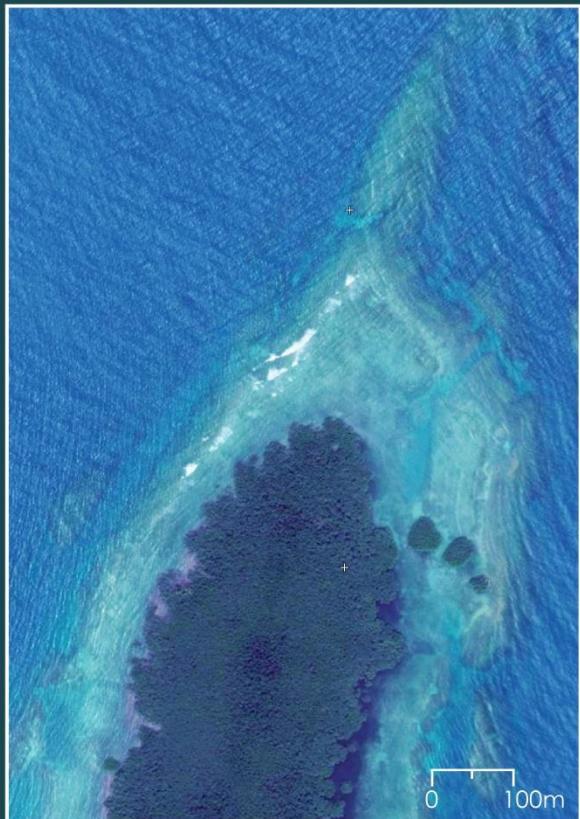


Coral
Sand
Seagrass
Deep Coral/Seagrass
Cloud
Water

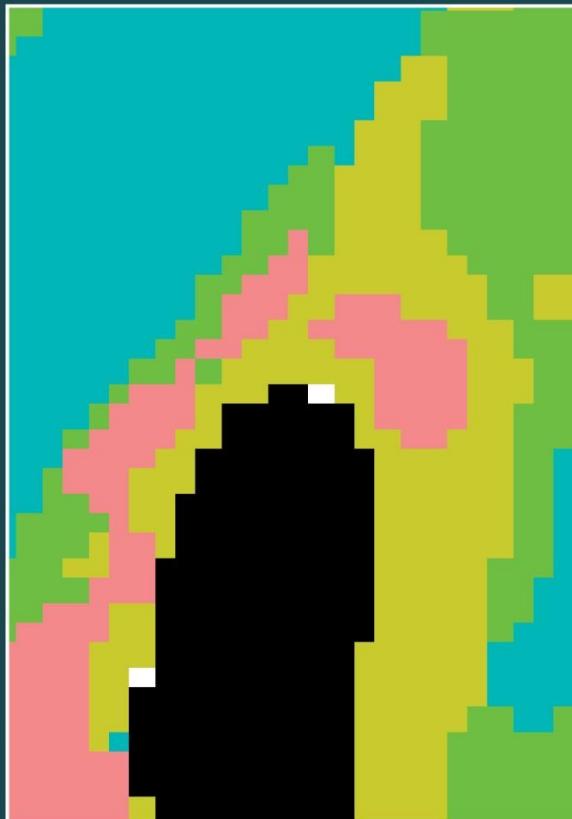
Brown Coral
Sand
Green Coral/Algae/Seagrass
Blue-Green Coral
Water
Cloud

Islands Sector

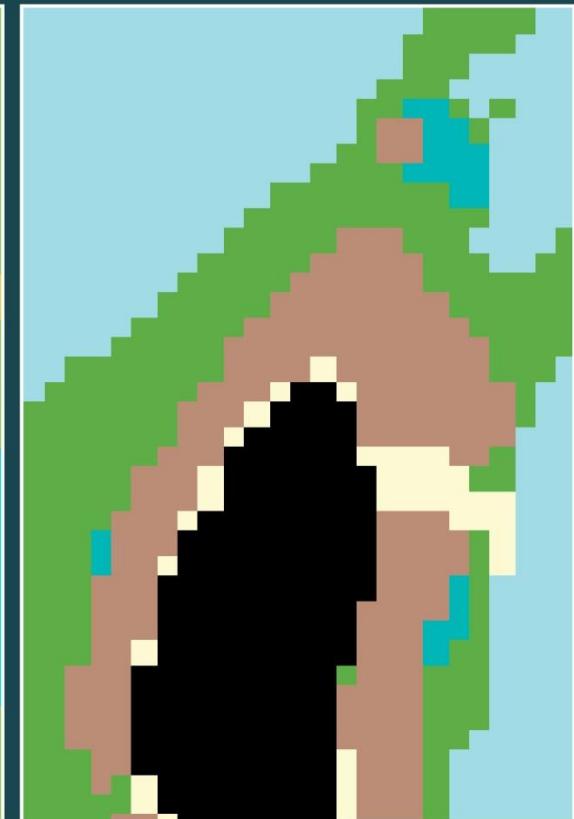
Flash Earth



Study Area Classification



Sector Classification

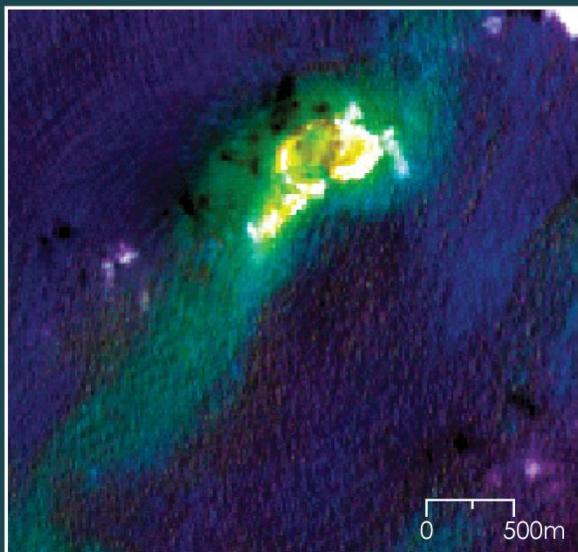


- Coral
- Sand
- Seagrass
- Deep Coral/Seagrass
- Cloud
- Water

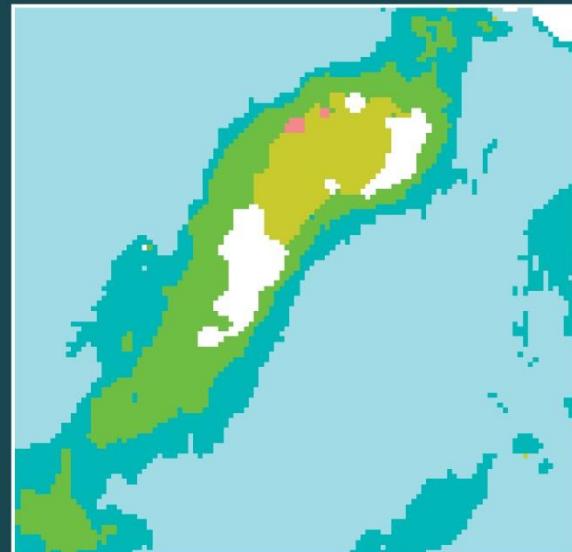
- Brown Coral
- Sand
- Green Coral/Algae/Seagrass
- Blue-Green Coral
- Water
- Cloud

Deep Sector

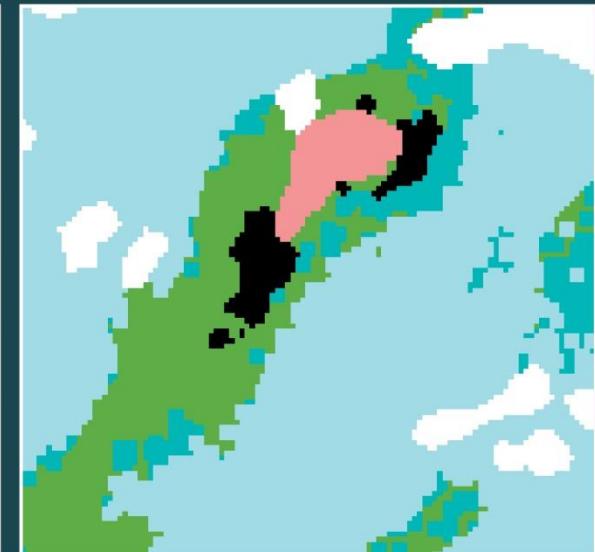
Landsat-8



Study Area Classification



Sector Classification

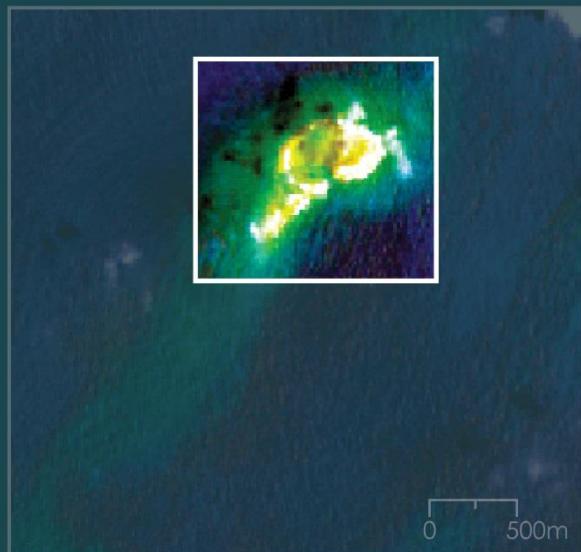


Coral
Sand
Seagrass
Deep Coral/Seagrass
Cloud
Water

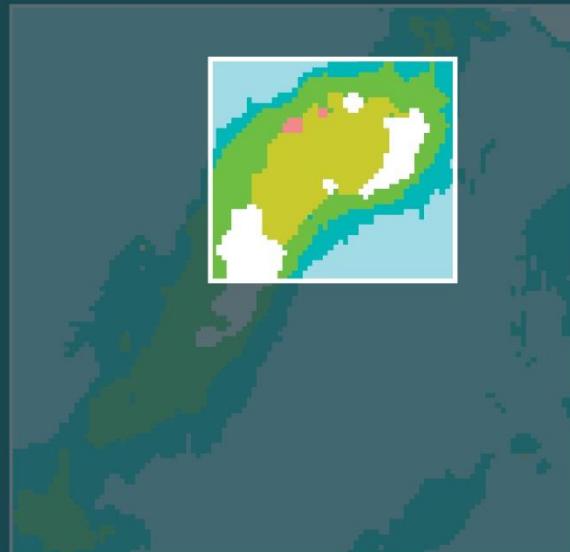
Coral and Surf
Green Coral/Algae/Seagrass
Blue-Green Coral
Water
Cloud

Deep Sector

Landsat-8



Study Area Classification



Sector Classification



- Coral
- Sand
- Seagrass
- Deep Coral/Seagrass
- Cloud
- Water

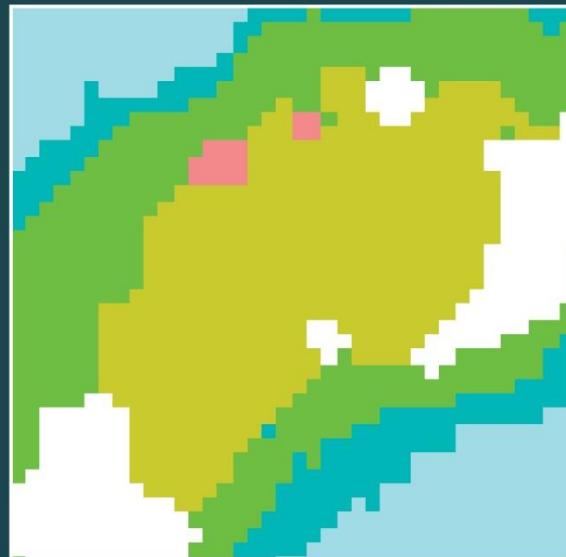
- Coral and Surf
- Green Coral/Algae/Seagrass
- Blue-Green Coral
- Water
- Cloud

Deep Sector

Flash Earth

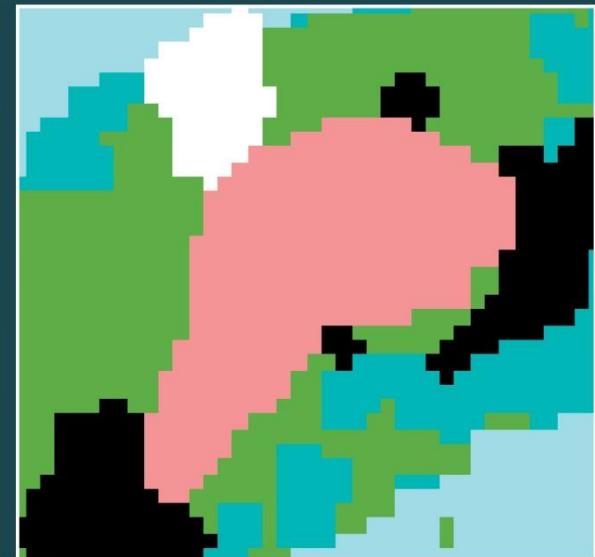


Study Area Classification

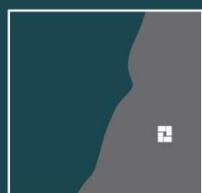


- Coral
- Sand
- Seagrass
- Deep Coral/Seagrass
- Cloud
- Water

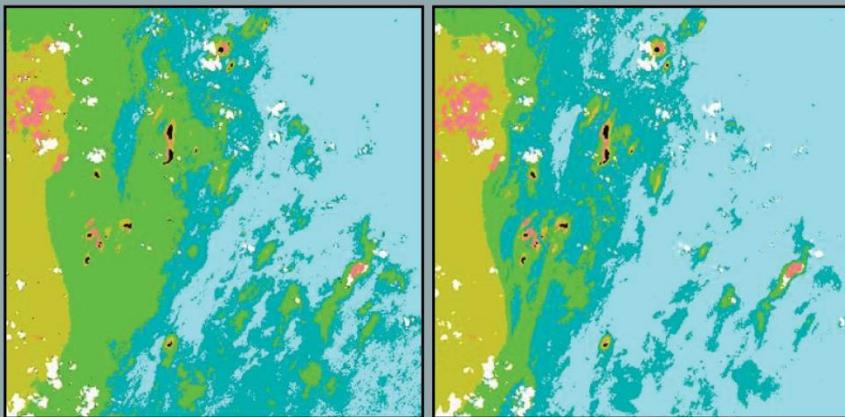
Sector Classification



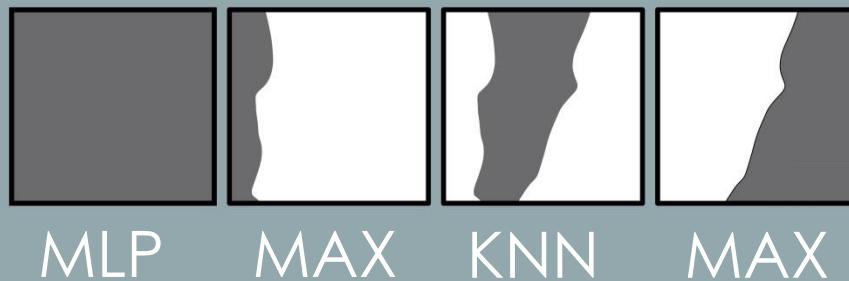
- Coral and Surf
- Green Coral/Algae/Seagrass
- Blue-Green Coral
- Water
- Cloud



Discussion

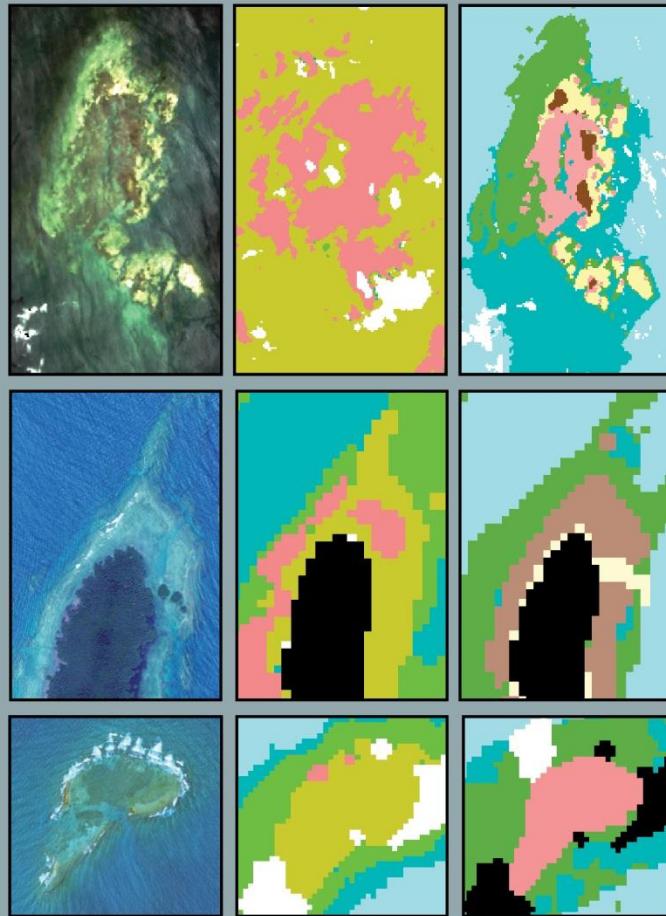


Landsat-8
Coastal Blue Band:
conservative
seagrass class



3 Classifications:
context-specific

Discussion



Sectors:

- informed contextual editing
- increased detail of coral
- decreased sand/sediment

Suggestions

- Using more than one image may be necessary to classify certain features.
- Using image sectors can provide a more detailed classification in study areas where depth and water column vary
- High resolution imagery and field data would greatly improve classifications
- Marine structure can inform future fieldwork

Thank You



Acknowledgements:

We would like to thank Dr. David Wilkie, Dr. Robert Rose, Dr. Florencia Sangermano, Arthur Elmes, and our Clark University colleagues for their support on this project.