



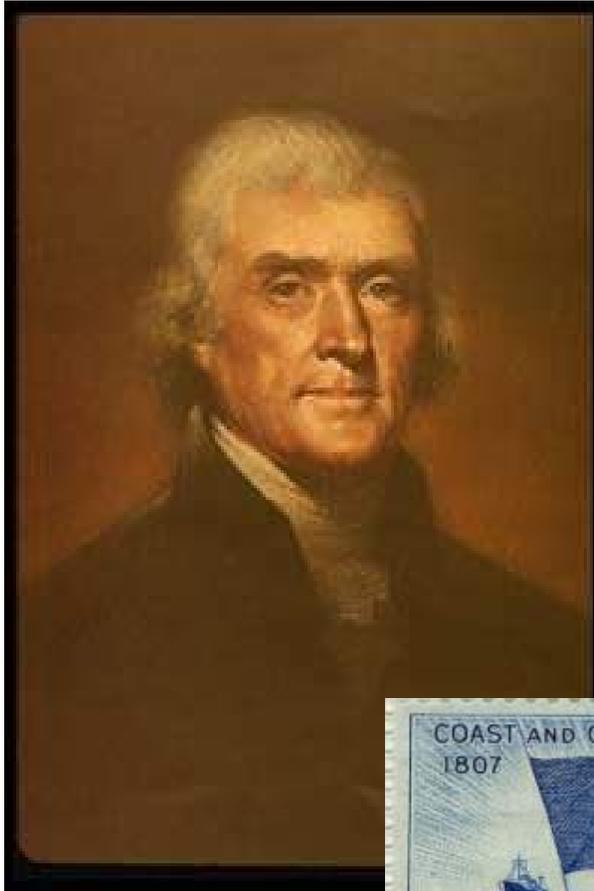
# NOAA Overview

*Civil Commercial Imagery Evaluation Workshop*

*Fairfax, VA*

*March 20-22, 2007*

*Stephen White*



# February 10, 2007 Marked the 200<sup>th</sup> Anniversary of the U.S. Coast and Geodetic Survey

NINTH CONGRESS OF THE UNITED STATES.

At the Second Session.

Begun and held at the city of Washington, in the territory of Columbia, on Monday the first of December, one thousand eight hundred and six.

AN ACT to provide for surveying the coasts of the United States

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, That the president of the United States shall be, and he is hereby authorized and requested, to cause a survey to be taken of the coasts of the United States, in which shall be delineated the islands and shoals, with the rocks or places of anchorage, within twenty leagues of any part of the shores of the United States; and also the respective courses and distances between the principal capes, or head lands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the aforesaid extent.

Sec. 2. And be it further enacted, that it shall be lawful for the president of the United States, to cause such examinations and observations to be made, with respect to the bays, harbors, and every other part of the coast, and the soundings and currents beyond the distance of ten leagues from the shore, as he may deem proper, and he is especially authorized to the command of the United States.

Sec. 3. And be it further enacted, that the president of the United States shall be, and he is hereby authorized and requested, for any of the purposes aforesaid, to cause proper and intelligent persons to be employed, and also such of the public vessels in actual service, as he may judge expedient, and to give such instructions for regulating their conduct as to him may appear proper, according to the tenor of this act.

Sec. 4. And be it further enacted, that for carrying this act into effect there shall be, and hereby is appropriated, a sum not exceeding fifty thousand dollars, to be paid out of any moneys in the Treasury, not otherwise appropriated.

For the Speaker of the House of Representatives

Richard M. Johnson, Vice President of the United States, and President of the Senate

February 10 1807

Approved

Thomas Jefferson

Passed in the House of Representatives

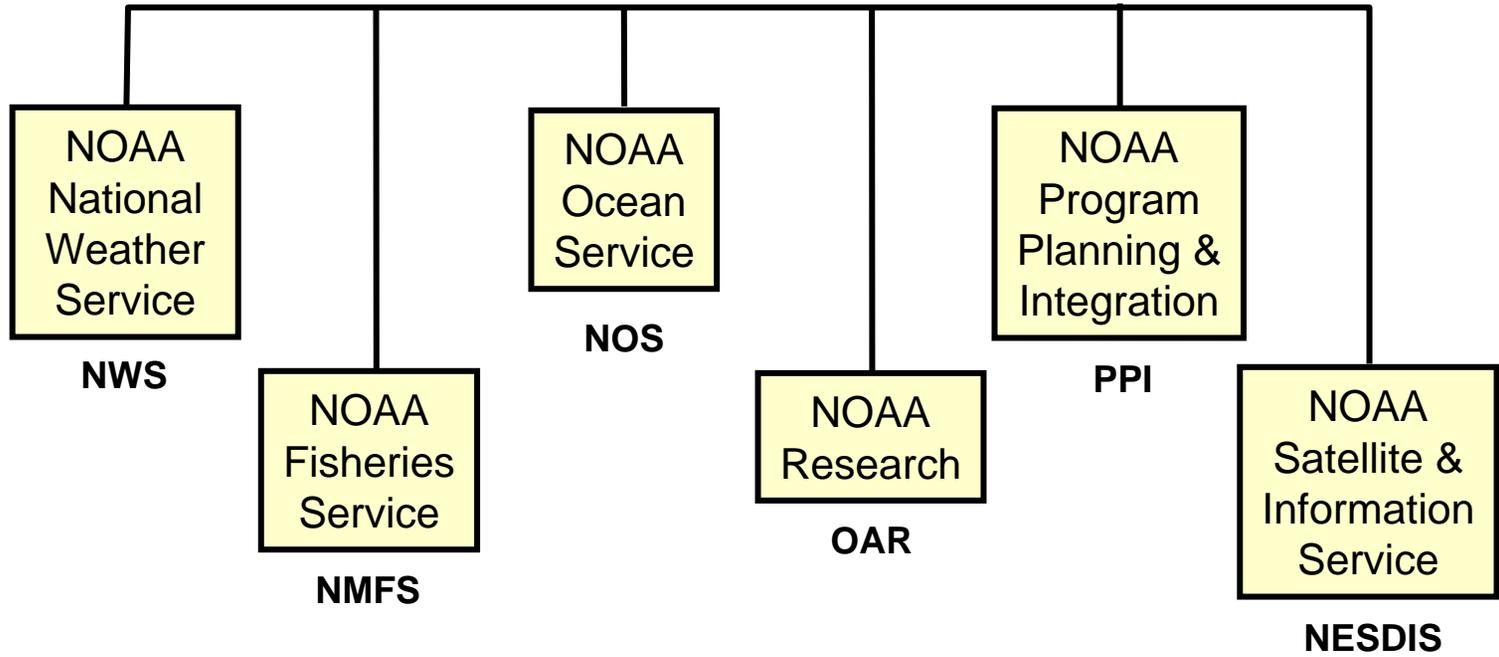
John C. Calhoun



## The First Science Agency in the U.S. Government



# National Oceanic and Atmospheric Administration



**Mission: To understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs.**



# NOAA Mission Goals

---

- **Ecosystems**
- **Climate**
- **Weather and Water**
- **Commerce and Transportation**



## The Commercial Remote Sensing Licensing (CRSL) Program:

- NOAA operates a comprehensive licensing program of U.S. Commercial Remote Sensing Satellite firms
- Seeks to ensure that commercial remote sensing systems are operated consistently with U.S. national security, homeland security, and foreign policy interests.
- Facilitates the development of a vibrant, growing and competitive U.S. commercial RS industry to support the U.S. industrial base, and promote economic growth and job creation.





# The Commercial Remote Sensing Licensing (CRSL) Program:

## Licensing Summary

- **26 Licenses Granted to nine companies for over 45 Satellites**
  - Approximately \$3.5 billion in system investment
- **Over 60 Amendments Approved**
- **Over 30 Foreign Partnership Agreements Approved**
  - Approximately \$800 million in revenue
- **Best Capabilities Licensed**
  - panchromatic (black/white):
    - 0.50 meter commercial sale
    - Better than 0.5 meter for government use only
  - multispectral (color):
    - 2.0 meter commercial sale
    - Better than 2.0 meter for government use only
  - synthetic aperture radar (SAR):
    - 3 meter commercial sale
    - Better than 3.0 meter for government use only
  - hyperspectral (HS):
    - 8 meter product, 20 meter raw data for commercial sale





# Office of Space Commercialization

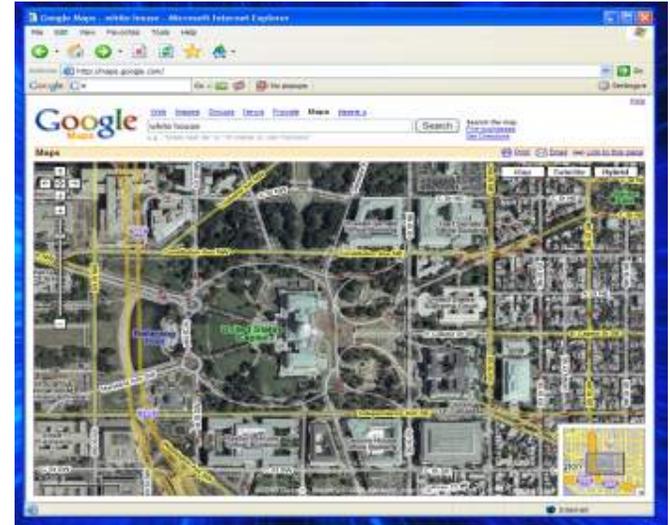
- Established in 1988 as principal DOC unit for space-related policy issues and advocacy
  - Initially within the Office of the Secretary
  - Transferred to NOAA in 2004
- Focus:
  - Policy Development
  - Market Analysis
  - Outreach Education
- Vision: ***A robust and responsive U.S. space industry that is the world leader in commercial space capabilities.***
  - Commercial Remote Sensing (CRS)
  - Positioning, Navigation and Timing (PNT)
  - Space Transportation and Exploration
- 2005: Assigned to support the National Space-Based PNT Executive Committee
  - National GPS management system established by the President
  - OSC provides facilities & staff, responds to Committee tasking



***Focus on space policy and outreach***



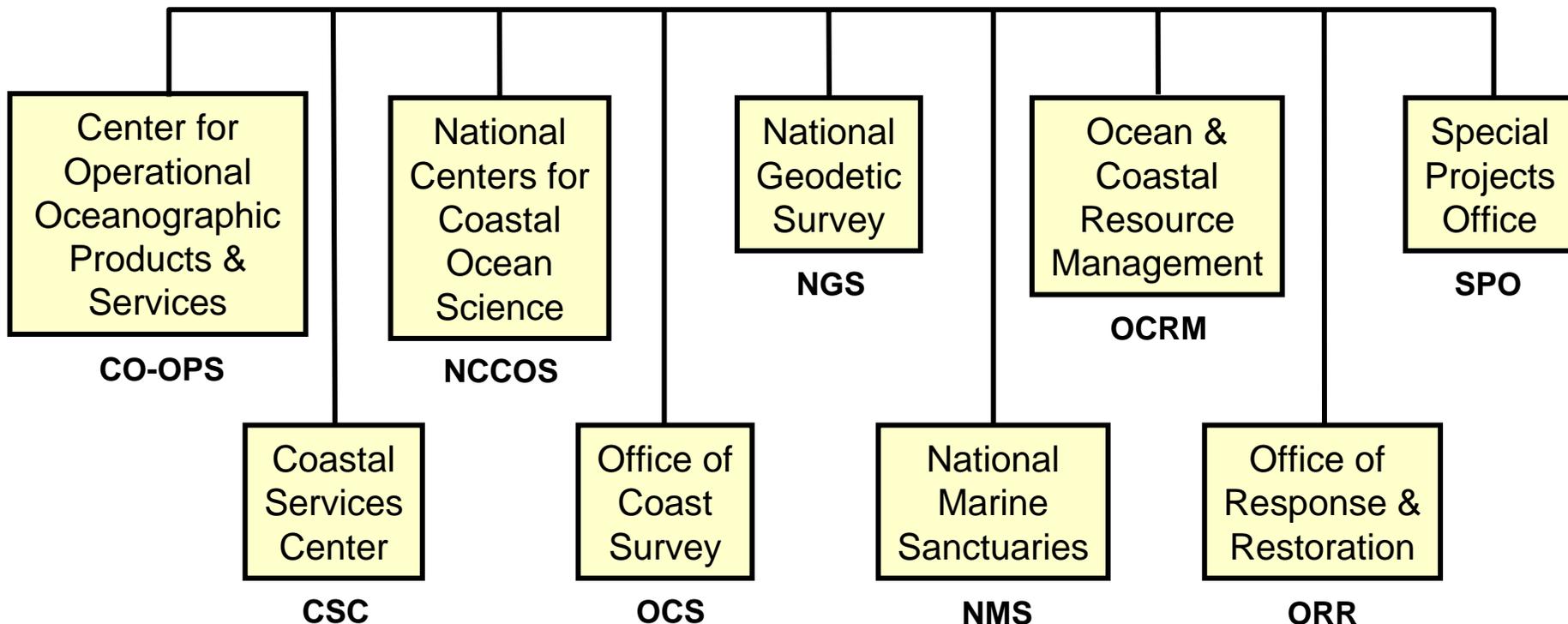
# Space Commerce: Key to U.S. Interests



***Strategic Goal: OSC is Value-Added "Going Concern"***



# NOAA Ocean Service



**High-resolution use and expertise is concentrated in NOS**



# Importance of Imagery

- **Coastal hazards and flooding**
- **Coastal uplands and wetlands**
- **Ecosystem management**
- **Coastal erosion**
- **Benthic habitats**
- **Shoreline mapping**
- **Aids to navigation**
- **Emergency response efforts**



# Coastal Uplands Mapping

- **Land cover: Coastal Change and Analysis Program (C-CAP)**
  - 22 category land cover classification derived from Landsat Enhanced Thematic Mapper (ETM)
- **Next generation C-CAP**
  - Land cover classification derived from high-resolution sensors
- **Key coordination groups**
  - Multi-Resolution Land Characteristics (MRLC) Consortium, federal and state agencies

**NOAA goal relevance: Ecosystems**

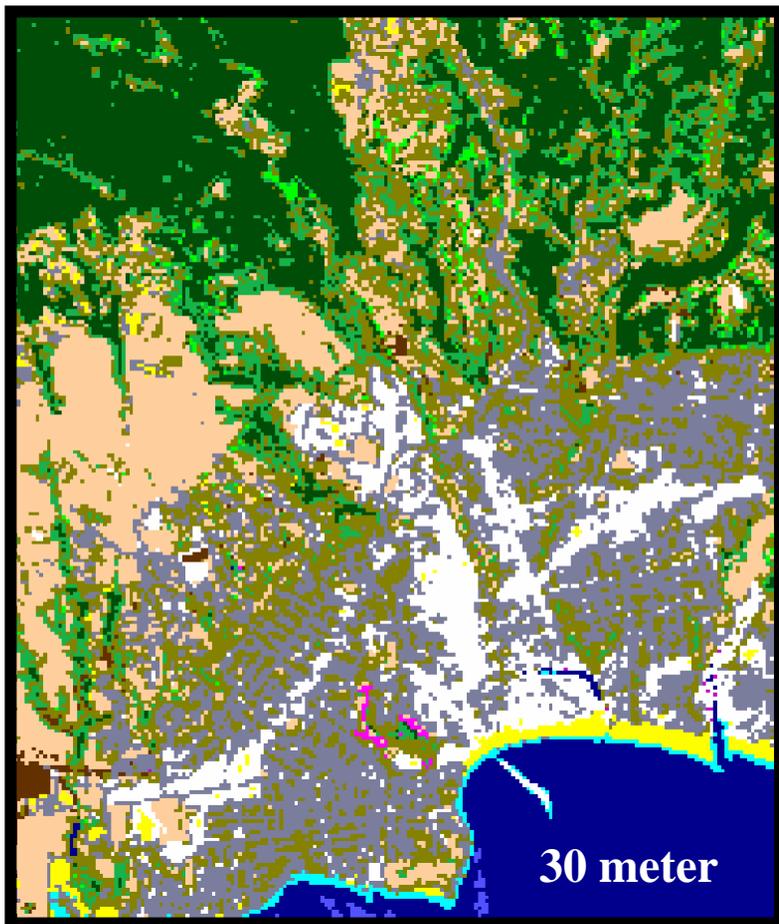
# Coastal Uplands Mapping

## C-CAP high-resolution prototypes

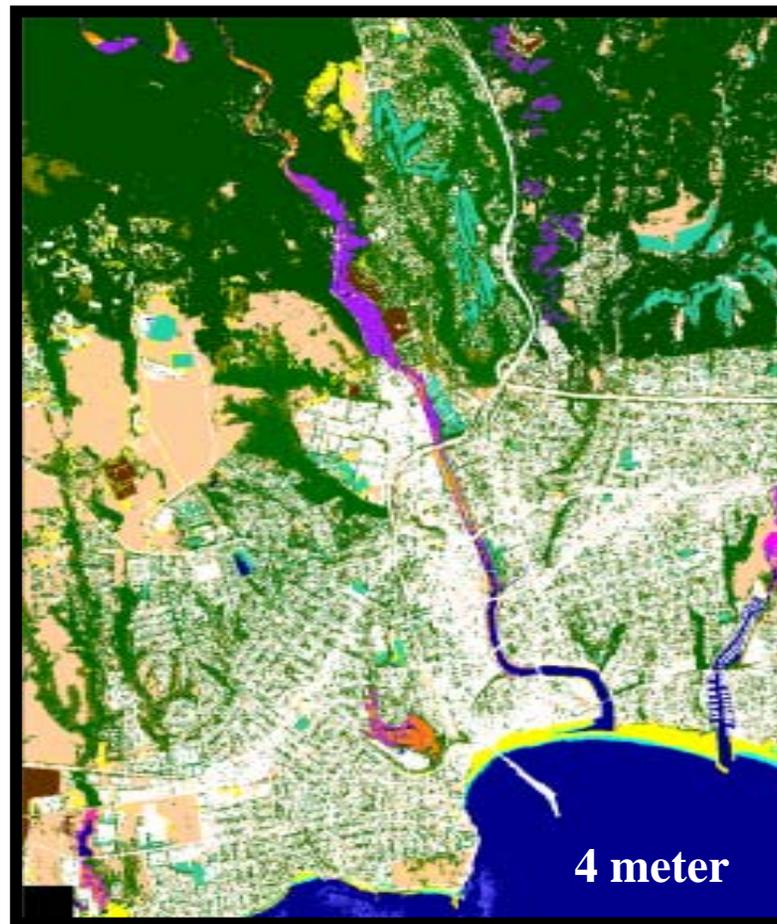
- **IRS ResourceSat-1**
  - 23.5m multispectral
  - 5.8m multispectral
- **SPOT5**
  - 10m multispectral
  - 2.5m pan-sharpened
- **IKONOS**
  - 4m multispectral
  - 1m pan-sharpened
- **Quickbird**
  - 0.67m pan-sharpened
- **UltraCam**
  - 0.5m multispectral



# Coastal Uplands

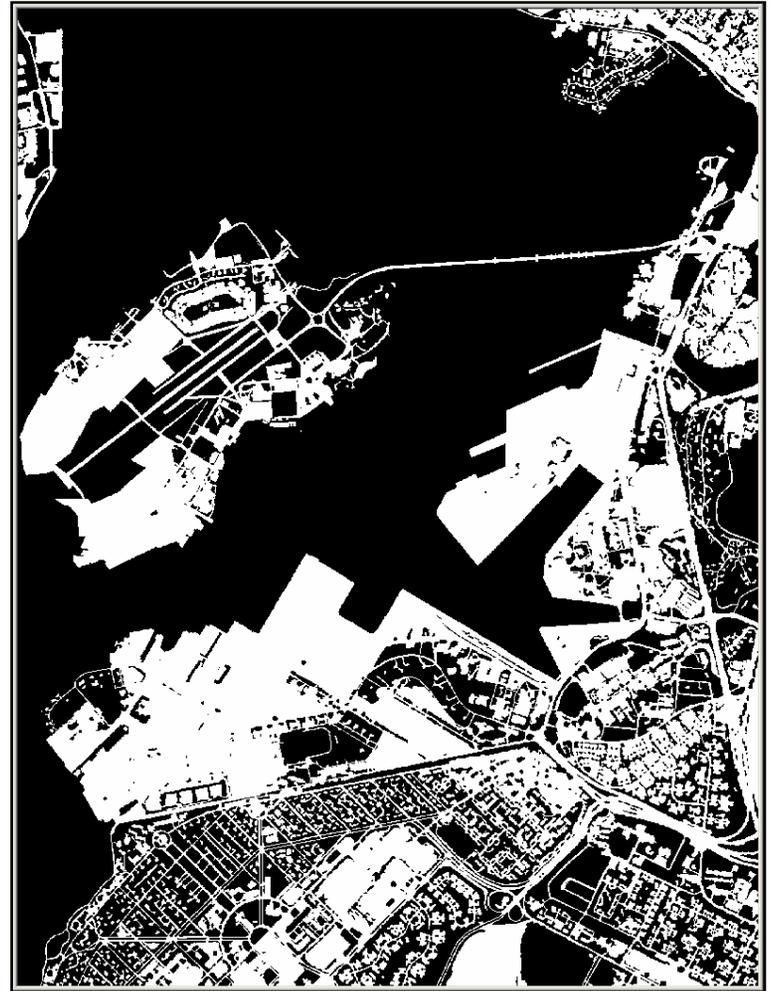


Landsat ETM C-CAP product



IKONOS high-resolution land cover

# Impervious Surface Mapping





# Coastal Wetlands

- **Project goal**
  - Investigate the utility of using lidar data and imagery in wetland vegetation mapping
  - Develop standardized methodology for species level mapping in coastal wetlands, targeting *phragmites*
- **Sources**
  - 0.5 meter ADS-40 color infrared
  - 1.0 meter posting lidar elevation data
- **Key coordination groups**
  - University of Connecticut – Center for Land Use Education and Research (CLEAR), NOAA

**NOAA goal relevance: Ecosystems**

# Coastal Wetlands

## Wetland categories

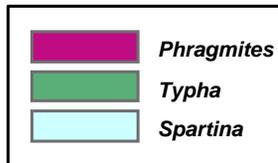
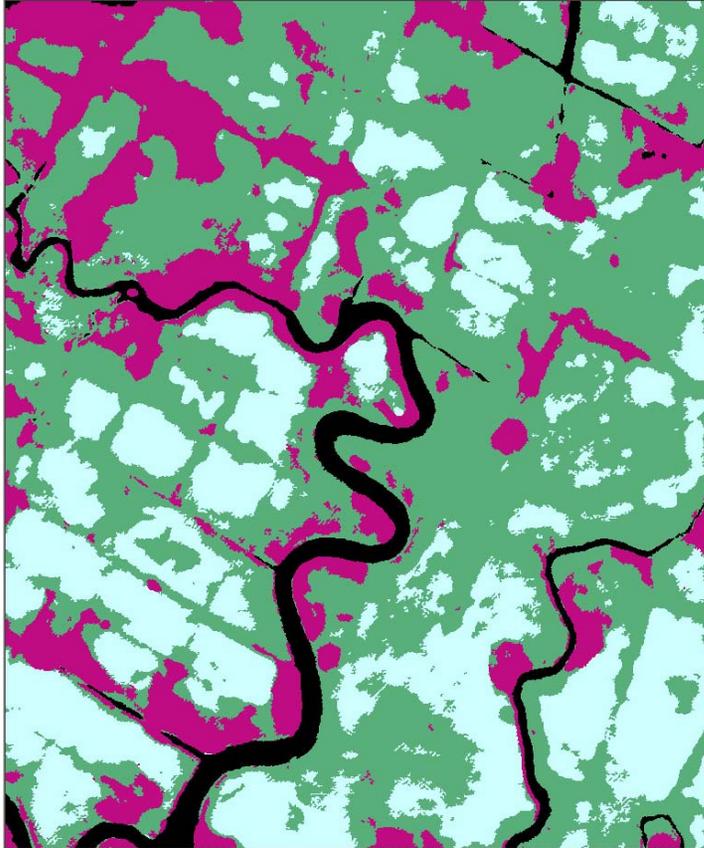
- *Phragmites australis* (invasive)
- *Typha angustifolia*
- *Spartina patens*

## Methods and software

- Supervised classification
- eCognition
- Feature analyst



# Coastal Wetlands



0.5m ADS-40 Imagery



# Imagery Support to Coastal Programs

- **Project goal**
  - Assist state and U.S. territory coastal programs with image collection within the coastal zone
  - Hawaii, Pacific Islands, Florida, Connecticut, Louisiana, Mississippi
- **Sources**
  - ADS-40 digital camera
  - IKONOS, Quickbird
- **Key coordination groups**
  - State agencies, universities, nongovernmental organizations, NOAA

**NOAA goal relevance: Ecosystems**



# Benthic Habitat Mapping

- **Projects**

- Intertidal Oyster Habitat
- Submerged aquatic vegetation (SAV)

- **Sources**

- Digital camera (ADS-40, Ultracam, DMC, etc.)
- Film Photography

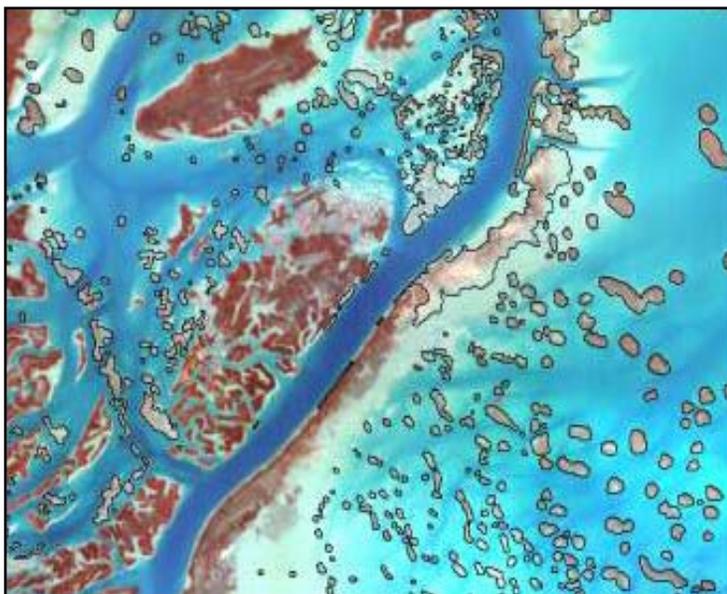
- **Key coordination groups**

- State agencies, NOAA

**NOAA goal relevance: Ecosystems**

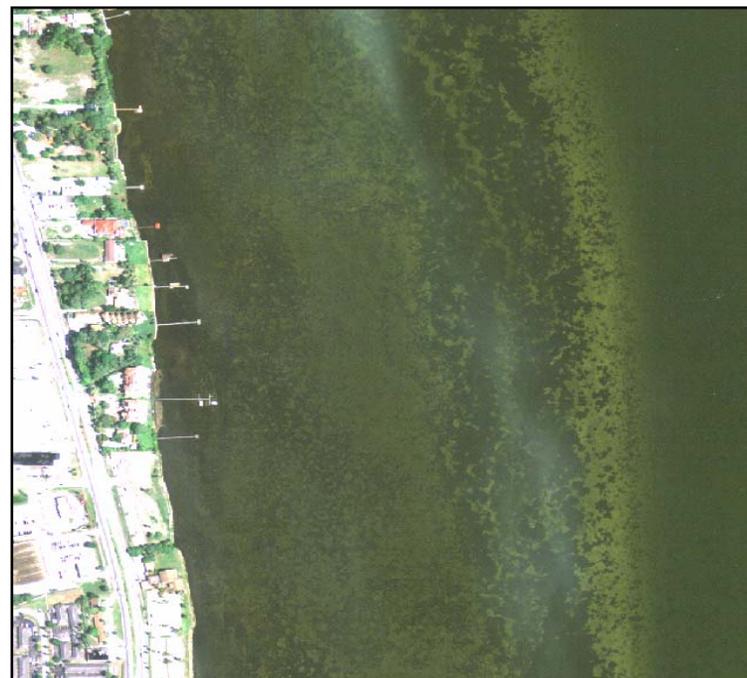


Oyster patch reef



Oyster reefs mapped at low tide

## Benthic Habitat



Submerged aquatic vegetation

# Benthic Habitat



NAIP ADS 40 imagery  
from 2004 of Aransas  
Pass, TX.



Delineation of seagrass  
beds derived from an  
automated mapping  
processes



# Benthic Habitat Coral Mapping

•**Geography:** Hawaii (main islands and northwestern Hawaiian Islands), Florida, Guam, American Samoa, Northern Marianas, Puerto Rico, U.S. Virgin Islands, other U.S. flag islands

•**Sources and classification categories**

- Landsat imagery
- 4 meter and 1 meter IKONOS imagery
- 13 habitat structure types
- 21 habitat cover types

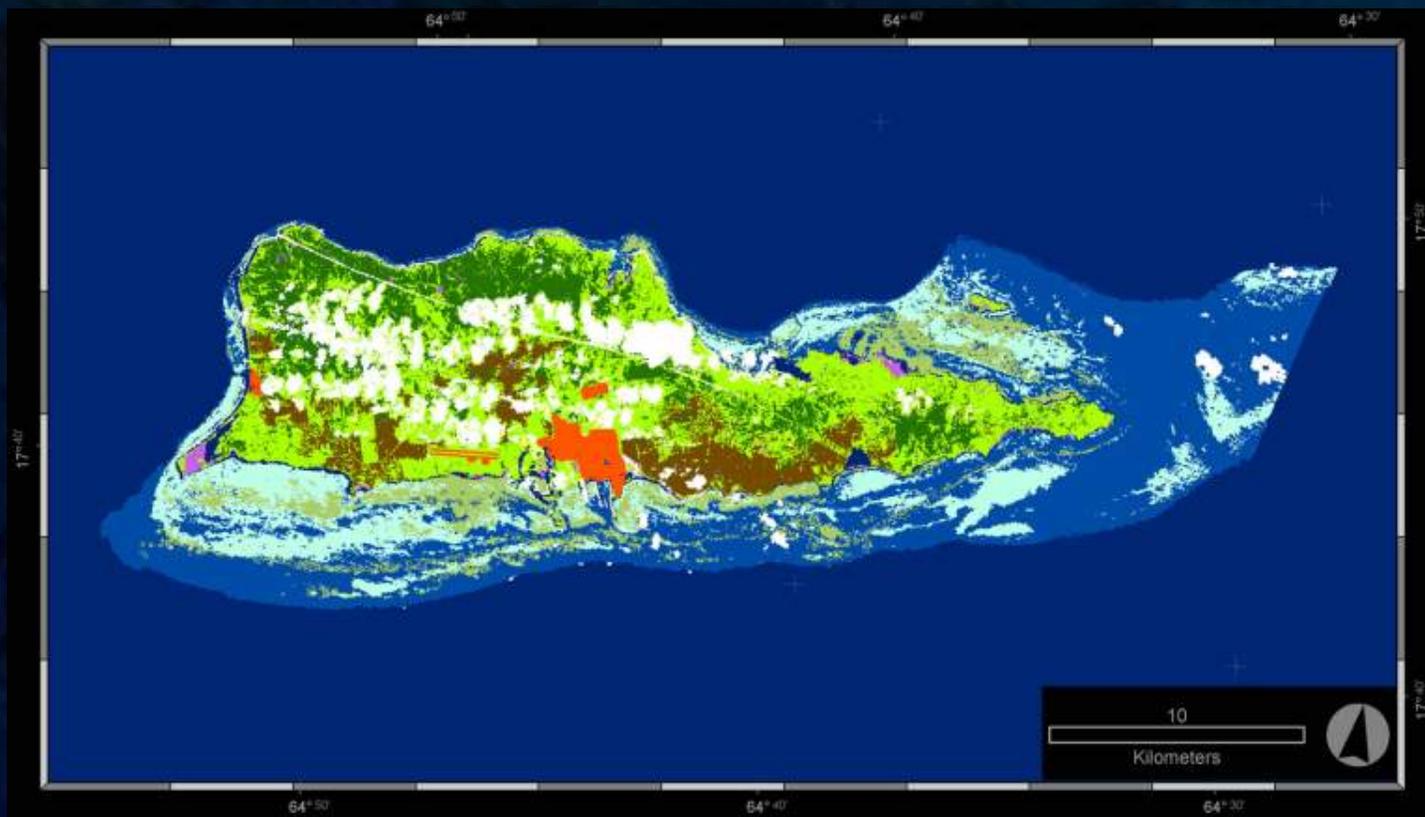
•**Key coordination groups**

State of Hawaii, University of Hawaii, territorial agencies, NOAA

**NOAA goal relevance: Ecosystems**

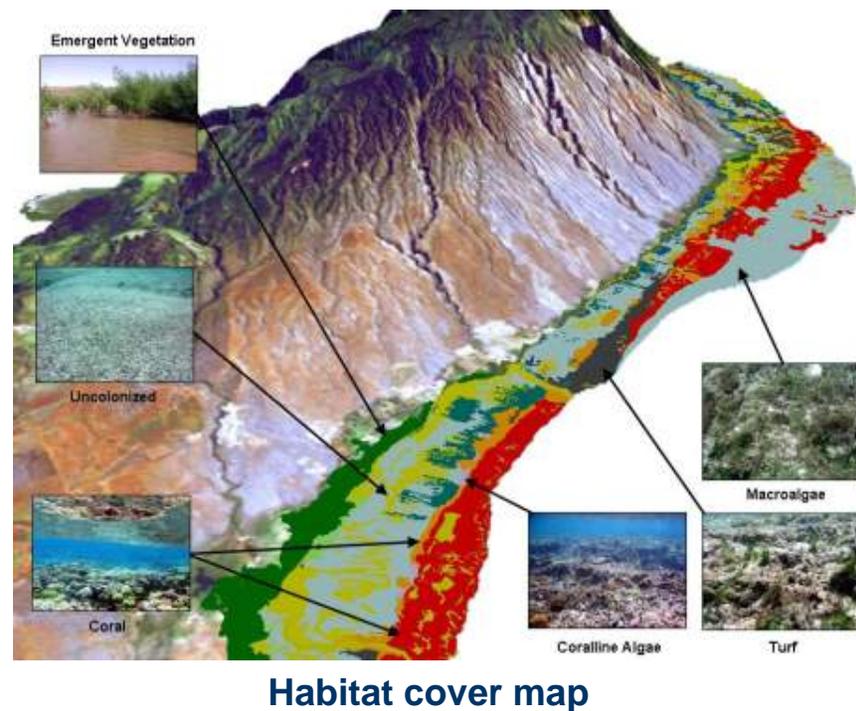
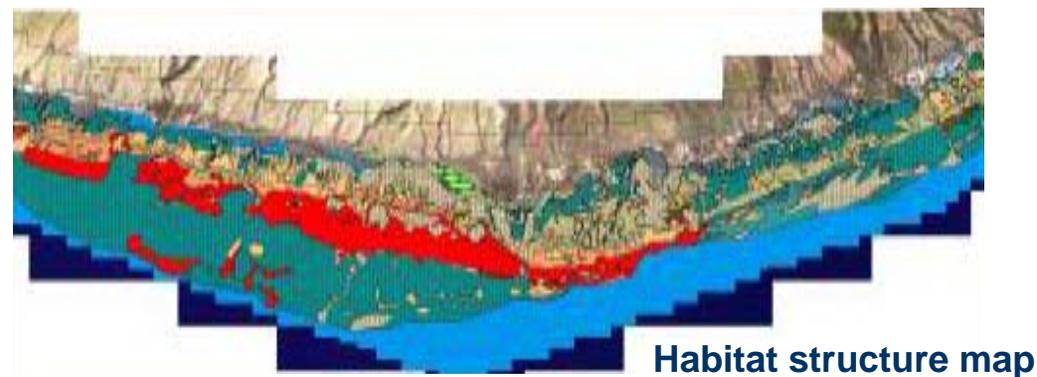
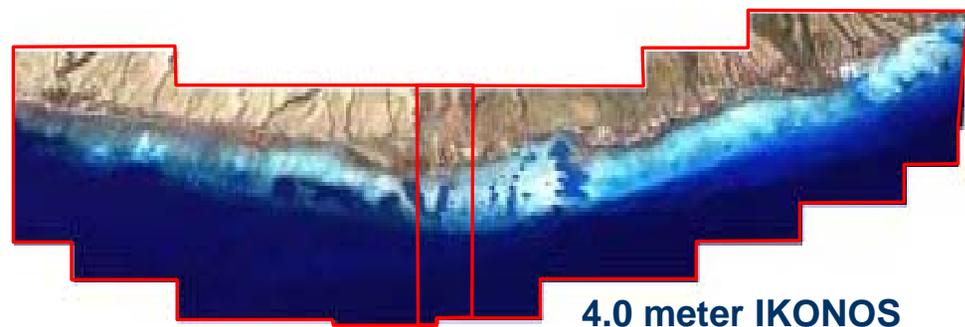


**summit-to-sea mapping** | *benthic habitats and land cover*



Utilizing Landsat Imagery

# Benthic Habitat



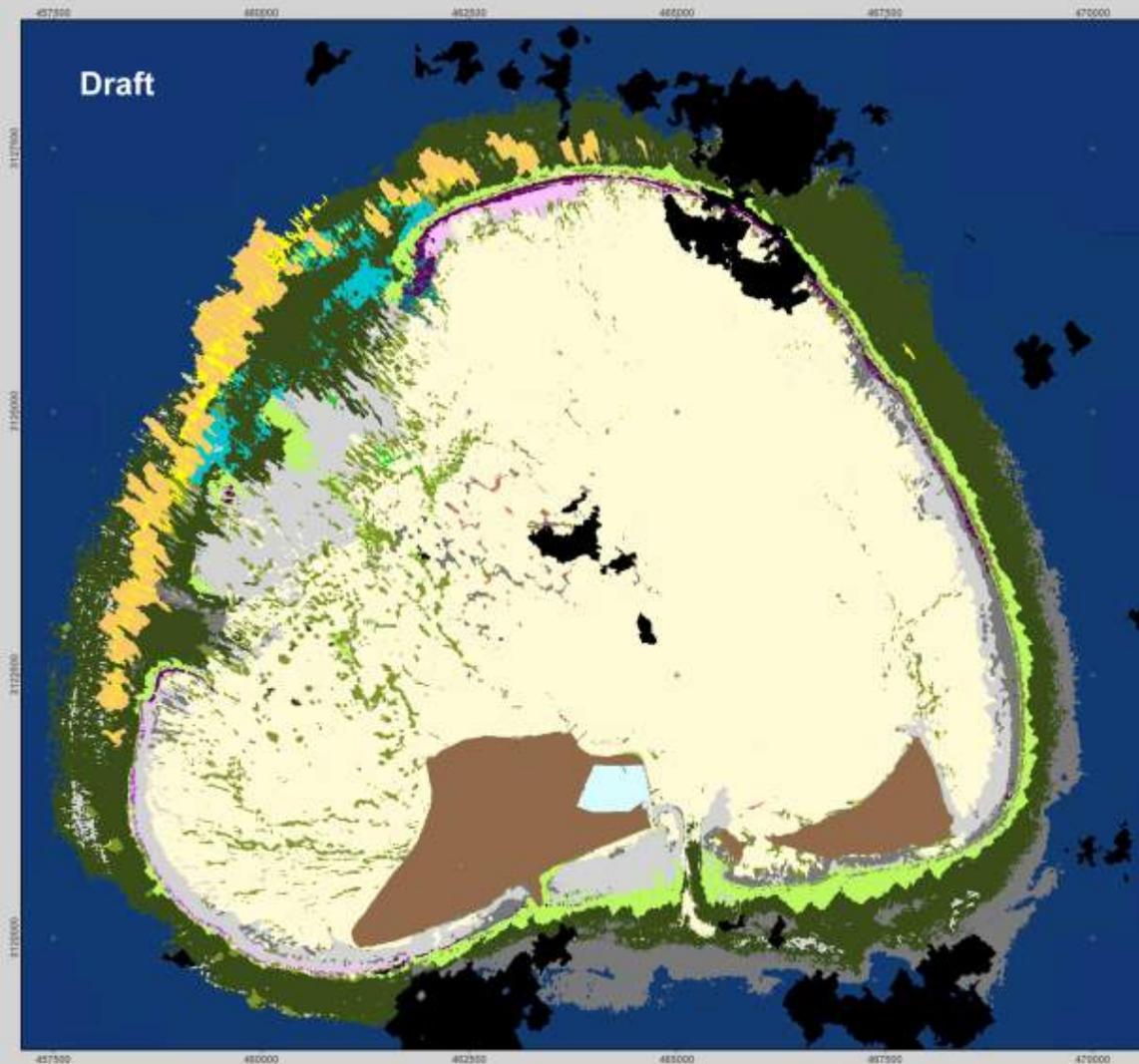


# Mapping Coral Reef Ecosystems: Molokai



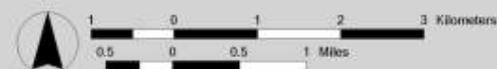


## Midway Islands - benthic habitats derived from IKONOS Imagery



### benthic classes

- corals and colonized hardbottom
- individual patch reef
- colonized pavement and rubble
- colonized pavement with sand channels
- encrusting coralline algae
- encrusting coralline algae - intertidal
- spur and groove
- pavement with dense algae
- pavement with sparse algae
- algal patch reef
- macroalgae
- uncolonized pavement with sand channels
- uncolonized pavement and rubble
- uncolonized hardbottom
- sand
- groove
- carbonate mud
- cobble with dense algae
- land
- deep water
- dredged channel
- no data



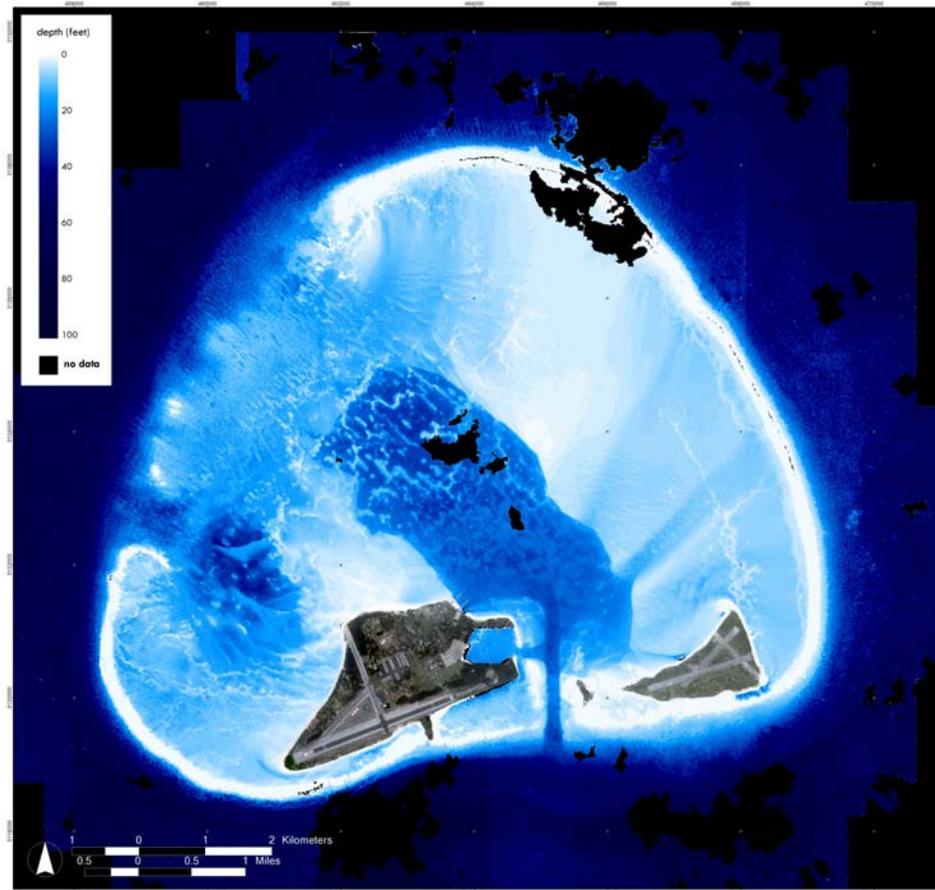
# Bathymetry Mapping



IKONOS True Color

**Multiple map products derived from IKONOS satellite imagery**

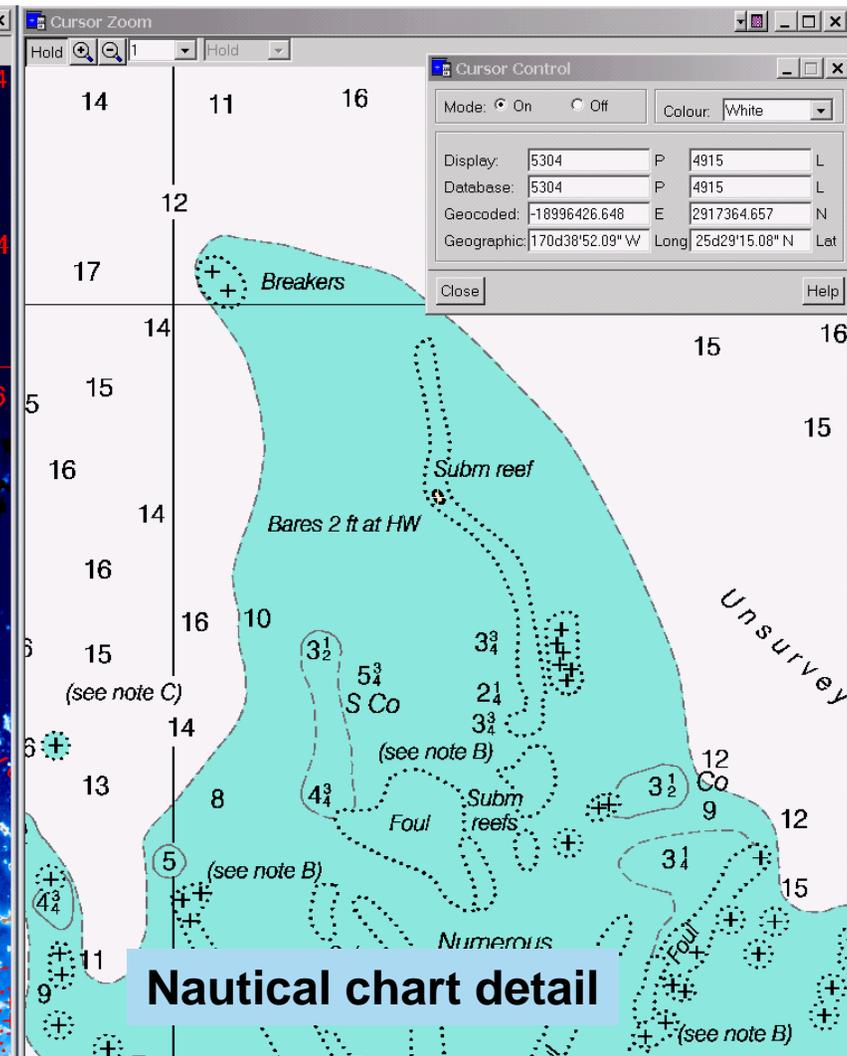
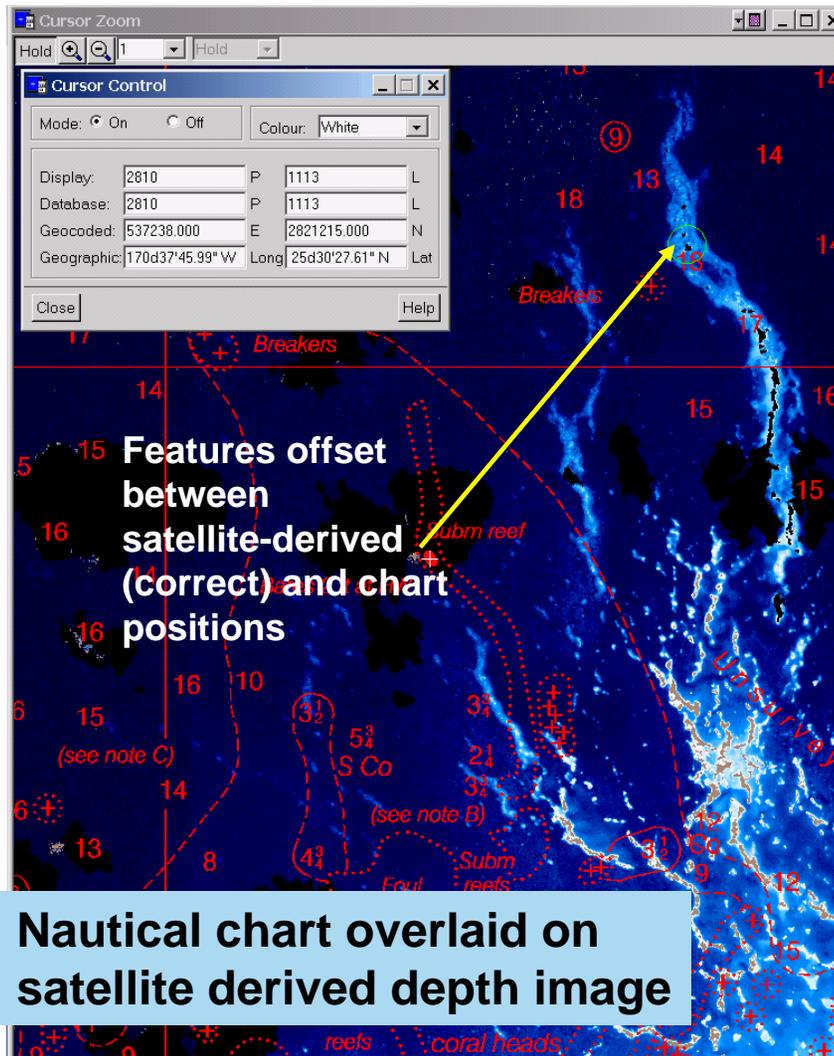
NOAA/NOIS CORAL REEF MAPPING PROGRAM  Midway islands - bathymetry derived from Ikonos imagery



**NOAA goal relevance: Commerce and Transportation**



# Bathymetry Mapping





# Harmful Algal Bloom Forecast System, using SeaWiFS/Orbview-2



**Gulf of Mexico Harmful Algal Bloom Bulletin**  
 21 September 2004  
 National Ocean Service/NOCS and CSC  
 NESDIS/Coast Watch and NDBC  
 Last Update: September 17, 2004

**Analysis**  
**HAB Forecast:**

No harmful algal blooms have been found along Florida's coast. Recent tropical storms have caused sediment resuspension and non-harmful blooms, which may cause discolored water.

**Analysis:**

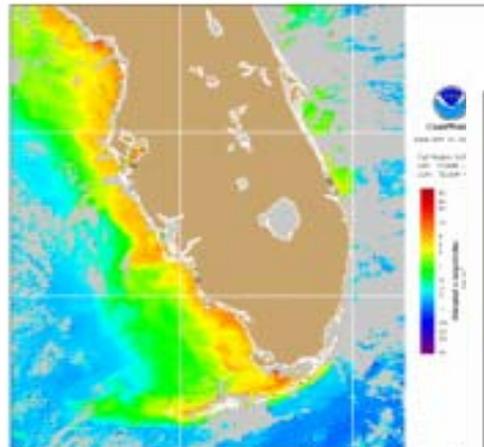
Samples taken last week from southwest Florida near Sarasota, Fort Meyers, and Naples showed no *Karenia brevis*. Imagery shows elevated chlorophyll along much of Florida's west coast; concentrations over 4 micrograms per liter off Cape San Blas and Cedar Key; over 5 micrograms per liter near Clearwater, Sarasota, Naples; and over 7 micrograms per liter Everglades City.

Winds have favored upwelling in southwest Florida for several days and are forecasted to continue for the rest of the week and through the weekend. These conditions are conducive to HAB formation, so this area should be monitored. Sampling here is recommended. Conditions in the panhandle don't favor HAB formation.

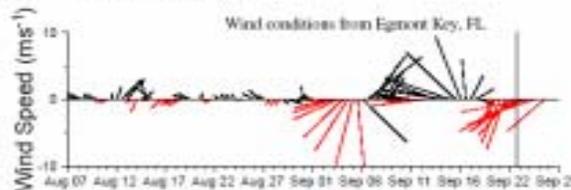
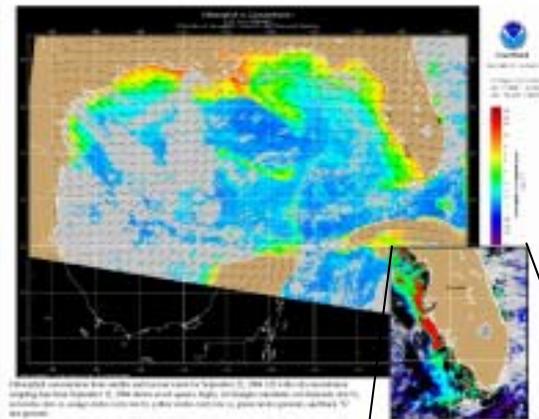
**Broader State:**

Please note the following restrictions on all SeaWiFS imagery derived from CoastWatch:

1. These data are restricted to civil marine applications only; i.e., federal, state, and local government use/distribution is permitted.
2. Distribution for military, or commercial purposes is NOT permitted.
3. There are restrictions on Internet/Web/public posting of these data.
4. Image products may be published in newspapers. Any other publishing arrangements must receive Debriefing approval via the CoastWatch Program.

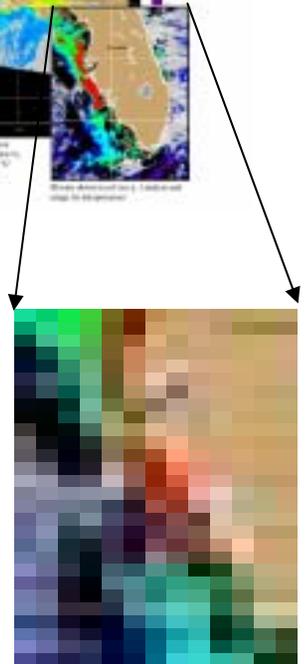


Chlorophyll concentration from satellite, with possible HAB areas. Station sampling data from September 12, 2004 shown as red squares (if trends), red circles (low a), orange circles (very low b), yellow (present), and black "X" (not present).



Wind speed and direction are averaged over 12 hours from measurements made on buoys. Length of line indicates speed, angle indicates direction. Red indicates that the wind direction favors upwelling near the coast. Values to the left of the dotted vertical line are measured values; values to the right are forecasts.

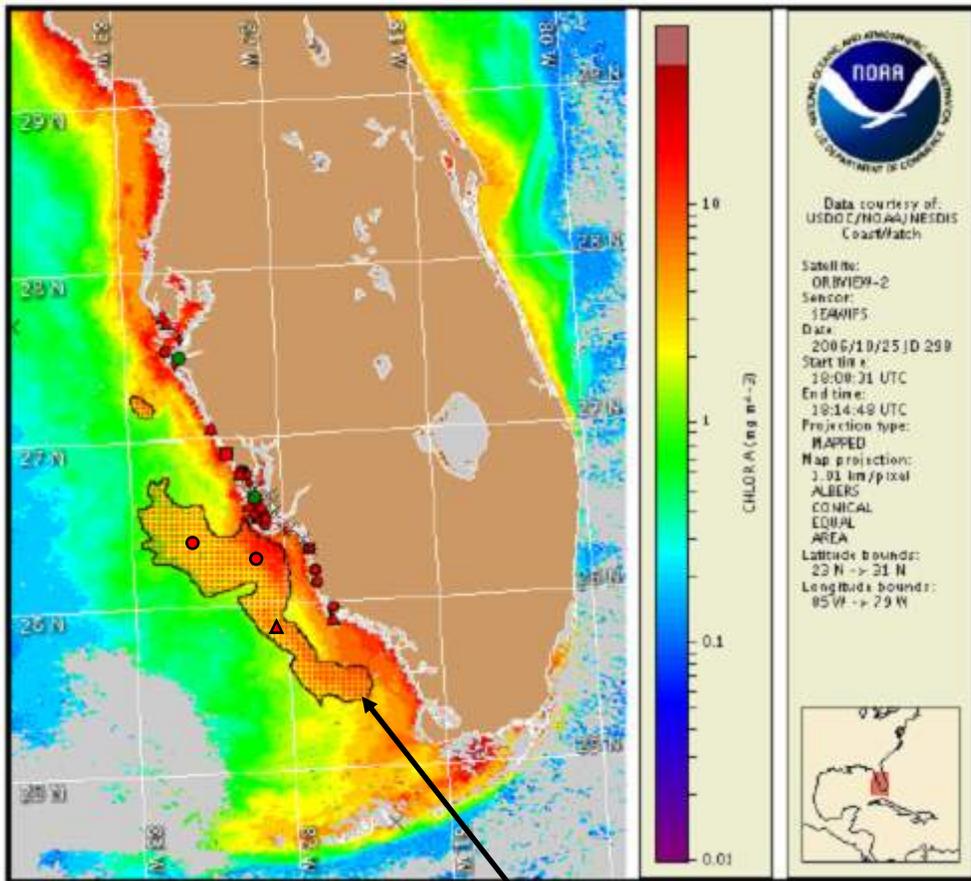
Southwest Florida: Winds have been northeasterly for the past few days, and are forecasted to shift to easterly then northeasterly over the next couple of days. The NWS Marine Forecast calls for westerly winds until Thursday, then northeasterly winds over the weekend. Florida Panhandle: Winds have been northeasterly for the past few days, and are forecasted to become easterly for the next couple of days.



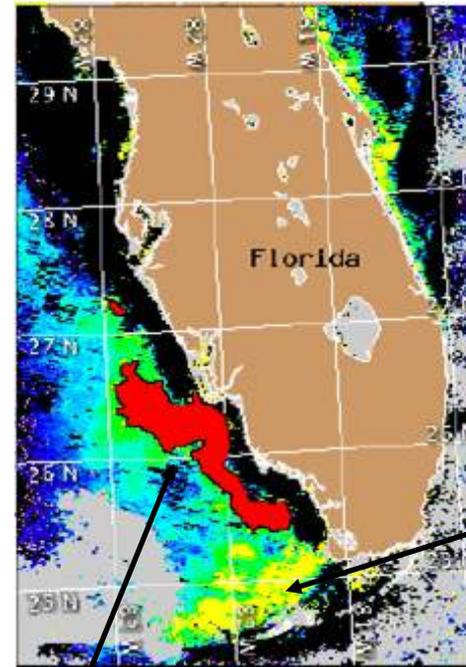
**NOAA goal relevance: Ecosystem**



# Chlorophyll Anomaly



confirmed *K. brevis* bloom



Bloom not verified as a HAB



# Shoreline Mapping

- A congressional mandate to conduct remote sensing surveys of coastal regions of the United States and its possessions for demarcating the nation's legal coastline.
- NOAA's Coastal Mapping Program (CMP) Supports:
  - NOAA's Nautical Charting Program
  - Coastal Managers
  - GIS Users, Analysts
- **CMP Goal:** Provide the Nation With Accurate, Consistent, Up-to-Date National Shoreline
- **Sources**
  - High Resolution Satellites, Digital Cameras, Film Photography, Lidar, Hyperspectral, Thermal



**NOAA goal relevance: Commerce and Transportation**

# Shoreline Mapping

## CSCAP: Coast and Shoreline Change Analysis Program

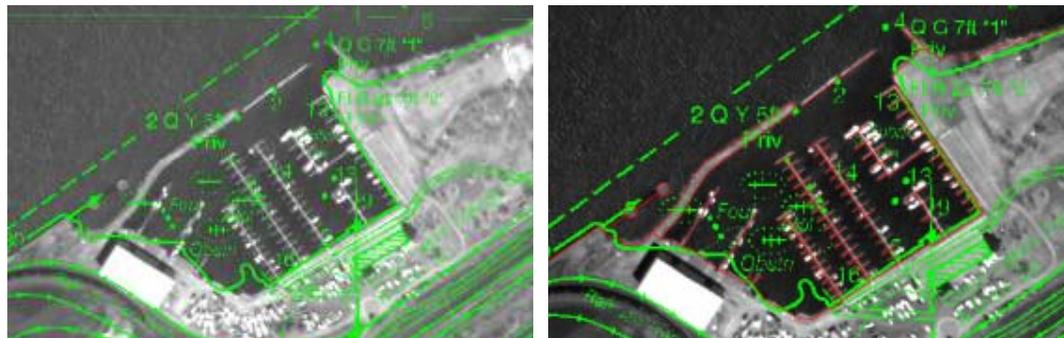
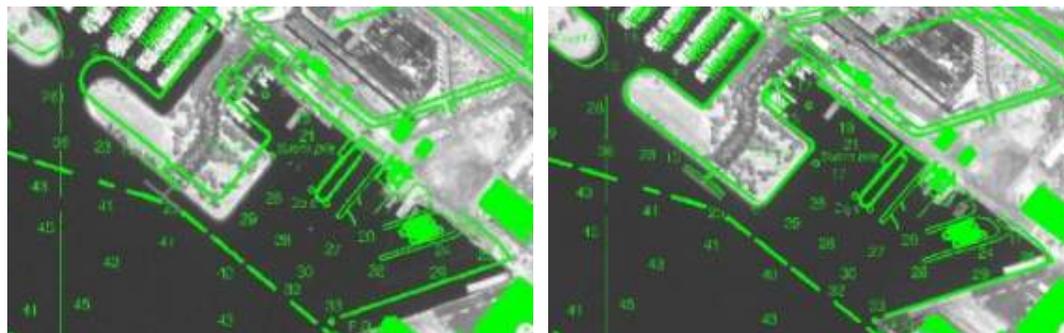
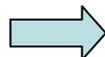
- **Project goal**
  - Analysis of 175 port areas in the U.S. and its territories for changes to shoreline and critical infrastructure. Significant changes in shoreline and port infrastructure are identified, and updates to charts are recommended.
  - Annual Goal: Update 12% of the shoreline in these port areas, or 21 of the 175 port areas.
- **Sources**
  - High Resolution Satellites, Digital Cameras, Film Photography



# Shoreline Mapping CSCAP

Satellite Imagery

Georeference to meet accuracy needs



Updated as needed

## Emergency Response Efforts



Remotely sensed data is acquired to support NOAA's homeland security and emergency response requirements.

NOAA maintains the capability to provide tools, technology, and expertise in a timely and efficient manner.

The remotely sensed data collected is disseminated to federal, state, and local government agencies as well as the general public to facilitate support efforts.

## Emergency Response Support

### *Debris Estimation*





# **NOAA's Use of High-Resolution Imagery**

- **Coastal wetlands mapping**
- **Coastal land cover mapping**
- **Benthic habitat mapping**
- **Imagery collection and support for coastal programs**
- **Shoreline mapping**
- **Emergency response efforts**



# For more information

Stephen White

[stephen.a.white@noaa.gov](mailto:stephen.a.white@noaa.gov)

[www.noaa.gov](http://www.noaa.gov)

[www.nos.noaa.gov](http://www.nos.noaa.gov)