

Coastal Land Cover Change

1996 to 2006
And Into the Future

Nate Herold

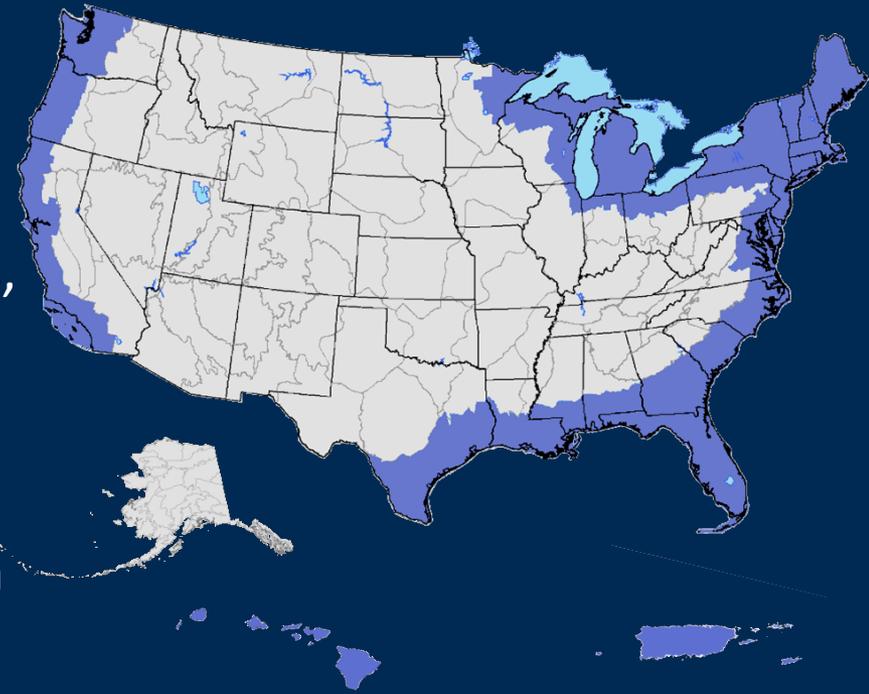
Nate.Herold@noaa.gov

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY



The Coastal Change Analysis Program (C-CAP)

- National coastal land cover and change mapping program
- Inventory of intertidal areas, wetlands, and adjacent upland, produced or updated every five years
- Consistent, accurate products through standard data and methods
- Coastal expression of the National Land Cover Database (NLCD)



“Designed to help improve understanding of linkages between land change and the environment”



Coastal Land Cover Classes

Developed

Developed, High Intensity
Developed, Medium Intensity
Developed, Low Intensity
Developed, Open Space

Agricultural

Cultivated Crops
Pasture/Hay

Rangeland

Grassland and Herbaceous
Scrub / Shrub

Forest Land

Deciduous Forest
Evergreen Forest

Mixed Forest

Barren Land

Barren Land
Unconsolidated Shore

Water

Open Water
Palustrine Aquatic Bed
Estuarine Aquatic Bed

Wetlands

Woody Wetlands

Palustrine Forested Wetland
Palustrine Scrub/Shrub Wetland
Estuarine Forested Wetland
Estuarine Scrub/Shrub Wetland

Herbaceous Wetlands

Palustrine Emergent Wetland
Estuarine Emergent Wetland

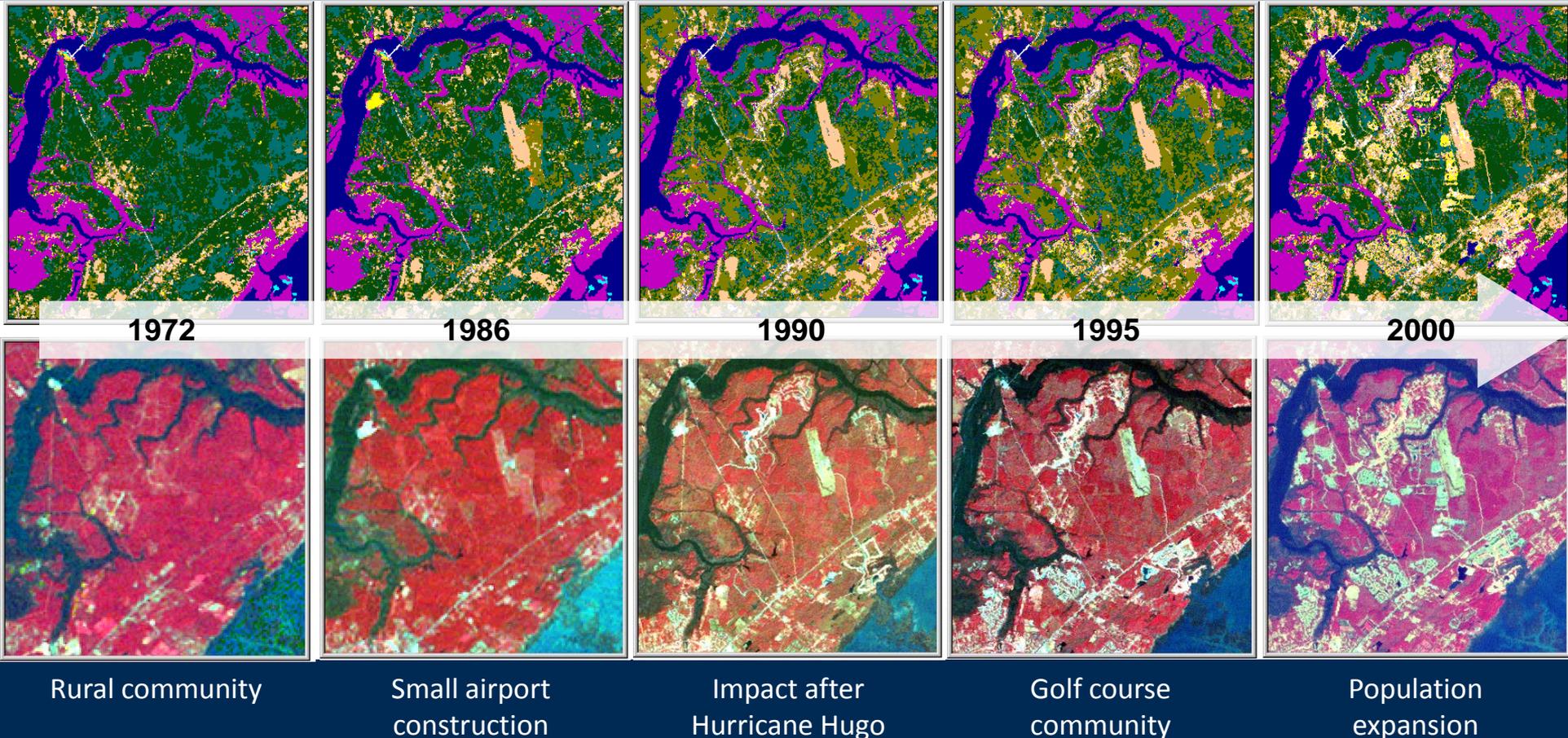
Perennial Ice/Snow

Alaska Only Classes*

Dwarf Scrub
Sedge/Herbaceous
Lichens
Moss

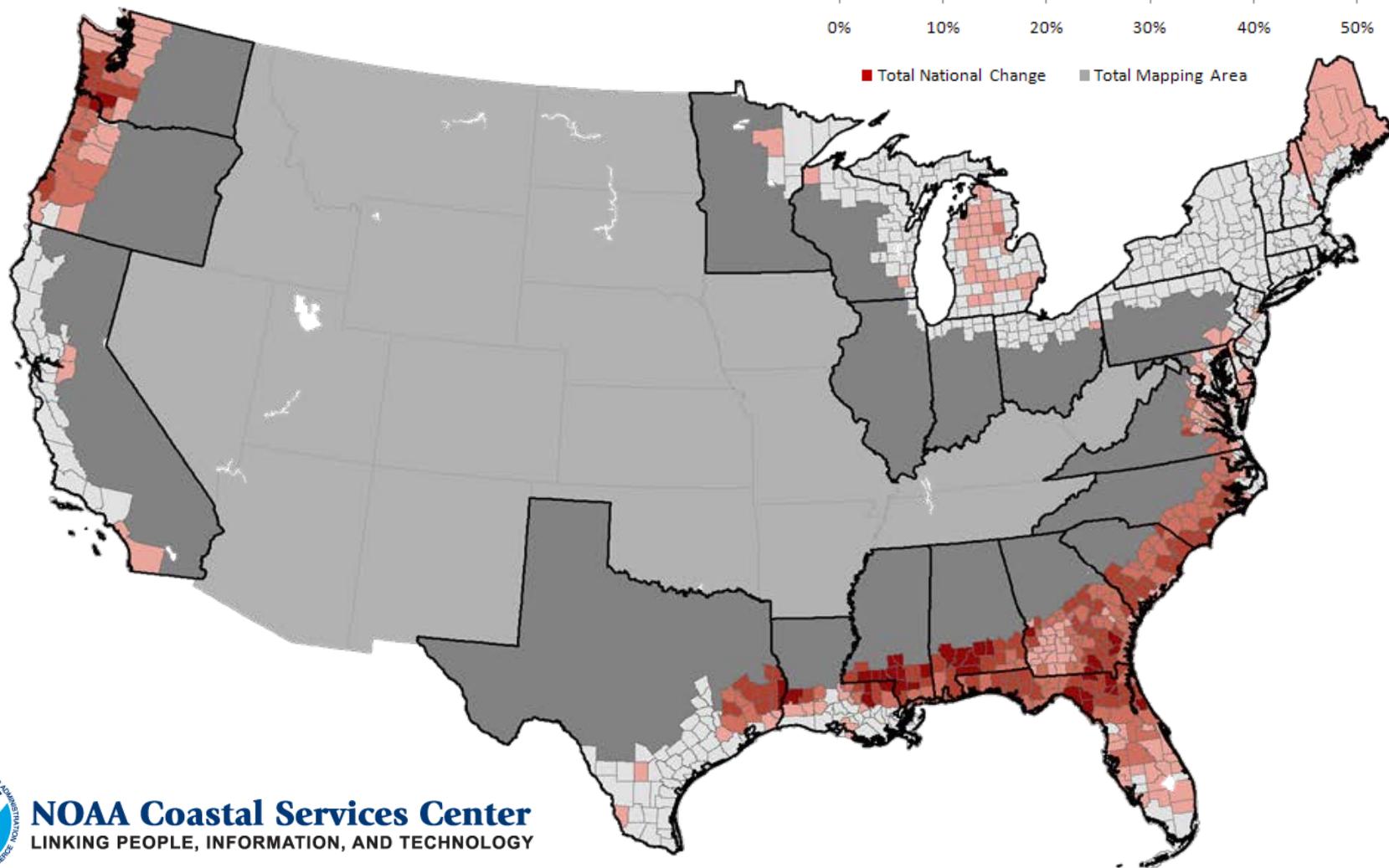
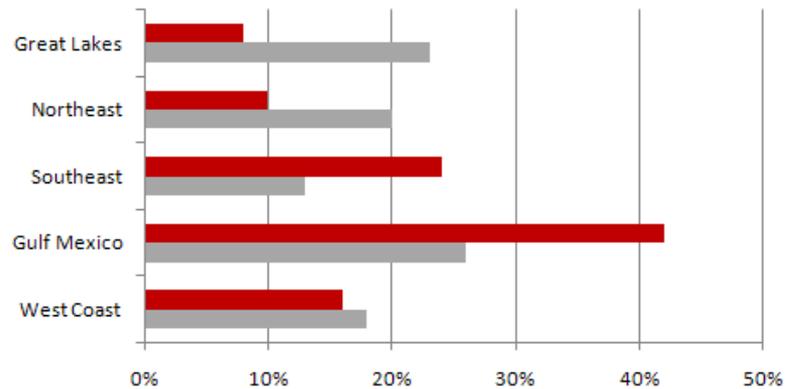
C-CAP Vision

To Monitor Coastal Changes on a Five-Year Repeat Cycle



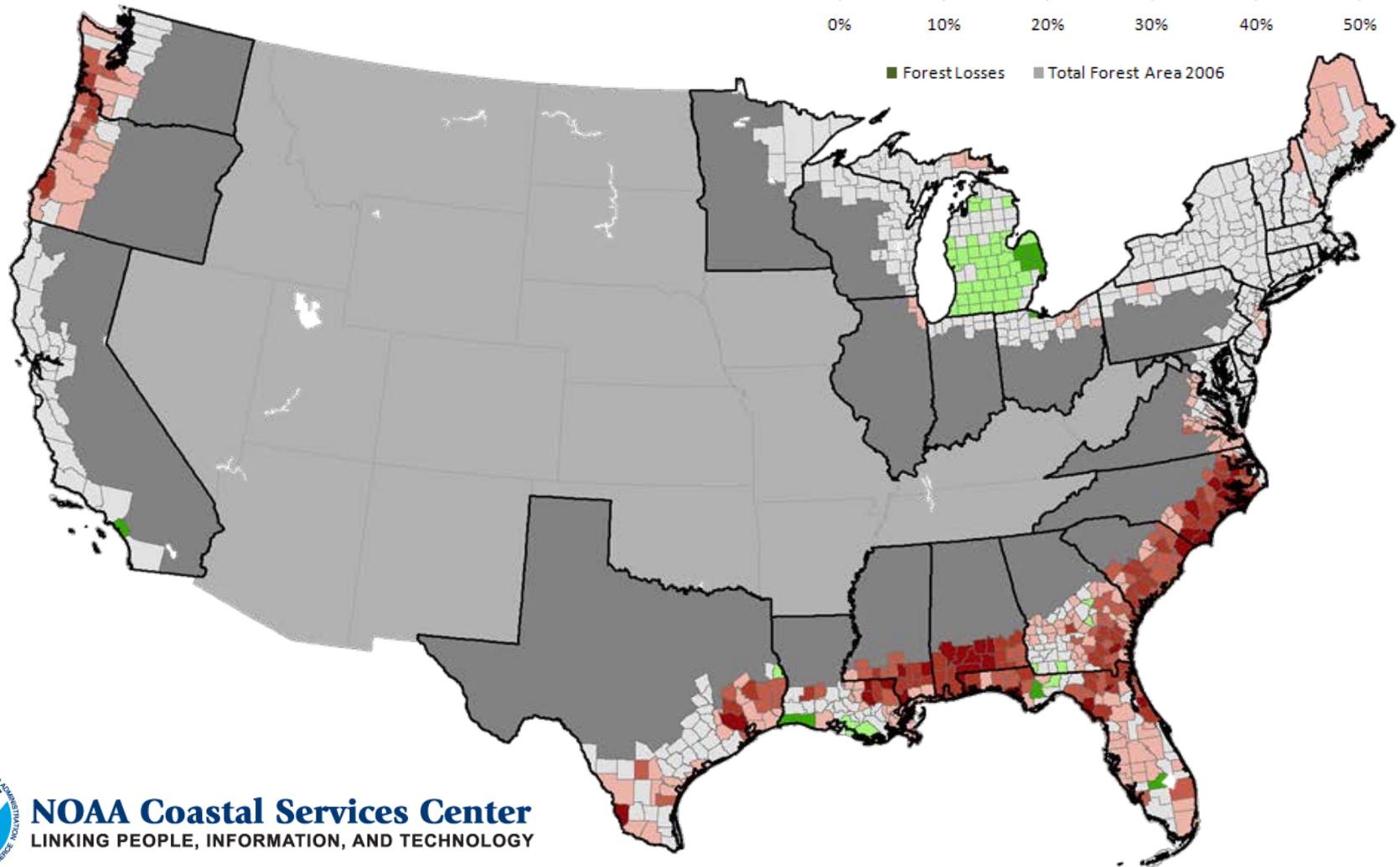
NOAA Coastal Services Center
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Total Change 1996 to 2006



NOAA Coastal Services Center
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Forest Change 1996 to 2006



NOAA Coastal Services Center
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C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

[Select State] [Select County]
Date Range: 1996 2001 2006

- General
- Developed
- Forests
- Wetlands

Select a state, county, and time frame above in order to visualize and explore observed land cover changes for your geography and time frame of interest.

Disclaimer

C-CAP Land Cover Atlas

This data was derived through NOAA's Coastal Change Analysis Program (C-CAP). C-CAP uses multiple dates of Landsat satellite imagery to produce nationally standardized land cover and land change information for the coastal regions of the U.S. These products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands. The goal is to monitor these habitats by updating the land cover maps every five years.

Notes and Limitations

While efforts have been made to ensure that data are accurate and reliable within the limits of current technology, C-CAP data sets are not jurisdictional or intended for use in litigation. These data are intended for use in identifying regional landscape patterns and major functional habitats. C-CAP is a national and regional data set that should be used only as a screening tool for very local or site-specific management decisions. Small features and changes should be verified with a higher resolution data source.

For more information about the Coastal Change Analysis Program, and to access C-CAP data visit:
www.csc.noaa.gov/landcover/atlas

Continue



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



[Select State] [Select County]
Date Range: 1996 2001 2006

- General
- Developed
- Forests
- Wetlands
- Search

Select a state, county, and time frame above in order to visualize and explore observed land cover changes for your geography and time frame of interest.



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



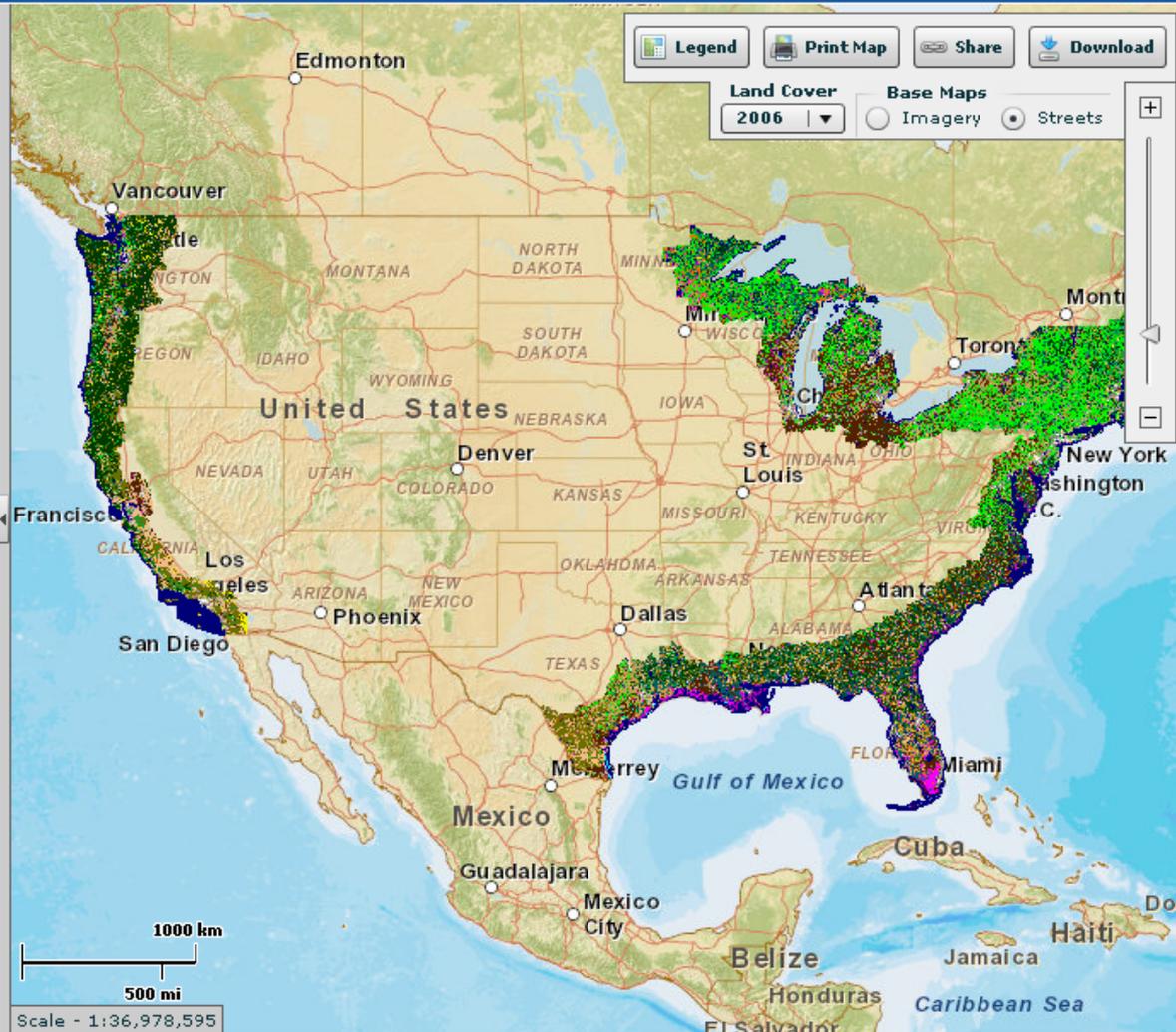
- [Select State]
- Massachusetts
 - Maryland
 - Maine
 - Michigan
 - Minnesota
 - Mississippi
 - North Carolina
 - New Hampshire
 - New Jersey
 - New York
 - Ohio
 - Oregon
 - Pennsylvania
 - Rhode Island
 - South Carolina
 - Texas
 - Virginia
 - Vermont
 - Washington
 - Wisconsin

[Select County]

2001 2006

Wetlands Search

time frame above in order
observed land cover changes
time frame of interest.



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



South Carolina

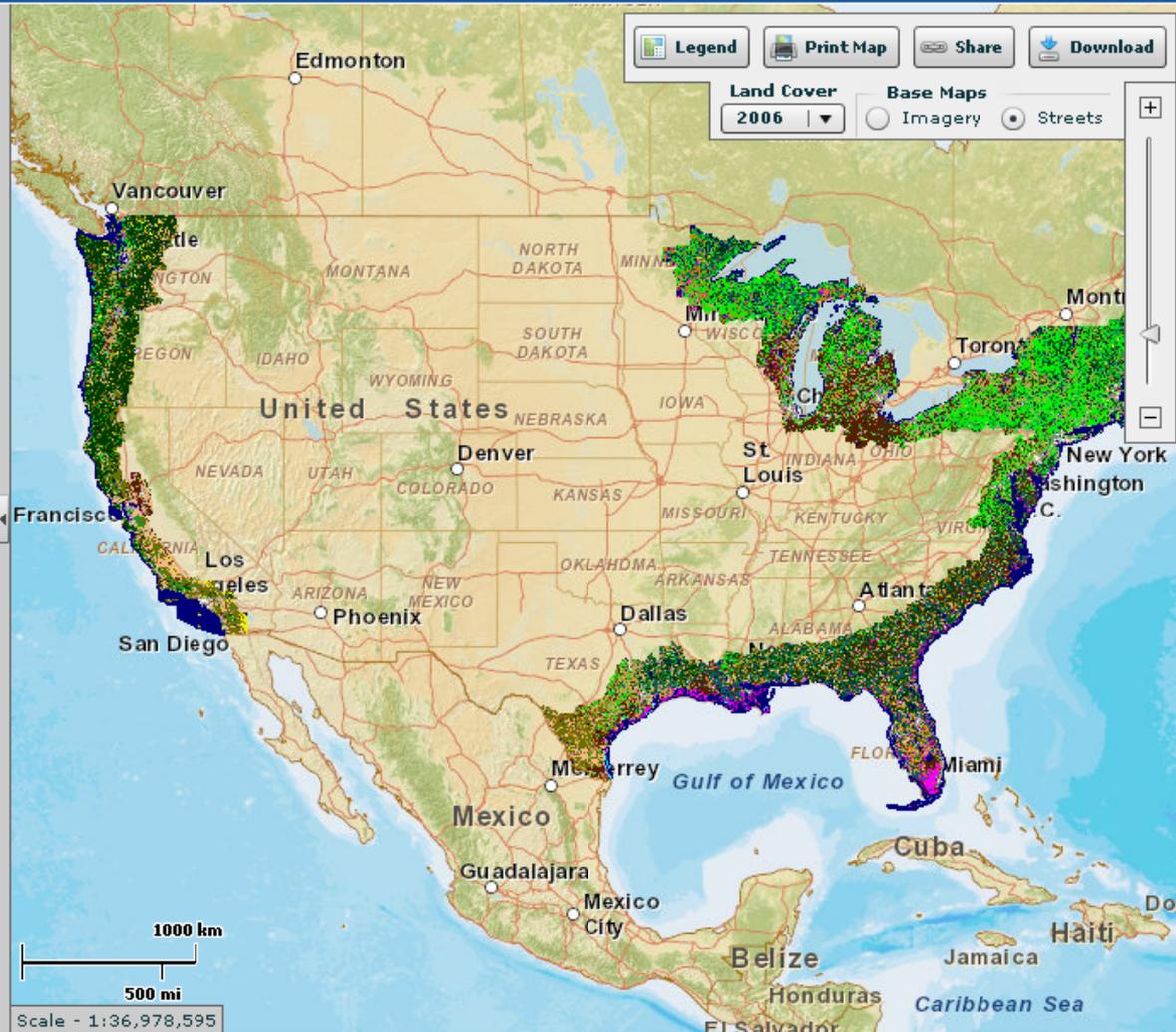
[Select County]

Date Range: 1996

General Developed Forest

Select a state, county, and date range to visualize and explore observations for your geography and time period.

- Aiken
- Allendale
- Bamberg
- Barnwell
- Beaufort
- Berkeley
- Calhoun
- Charleston
- Clarendon
- Colleton
- Darlington
- Dillon
- Dorchester
- Florence
- Georgetown
- Hampton
- Horry
- Jasper
- Lee
- Marion



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

Date Range: 1996 | 2001 | 2006

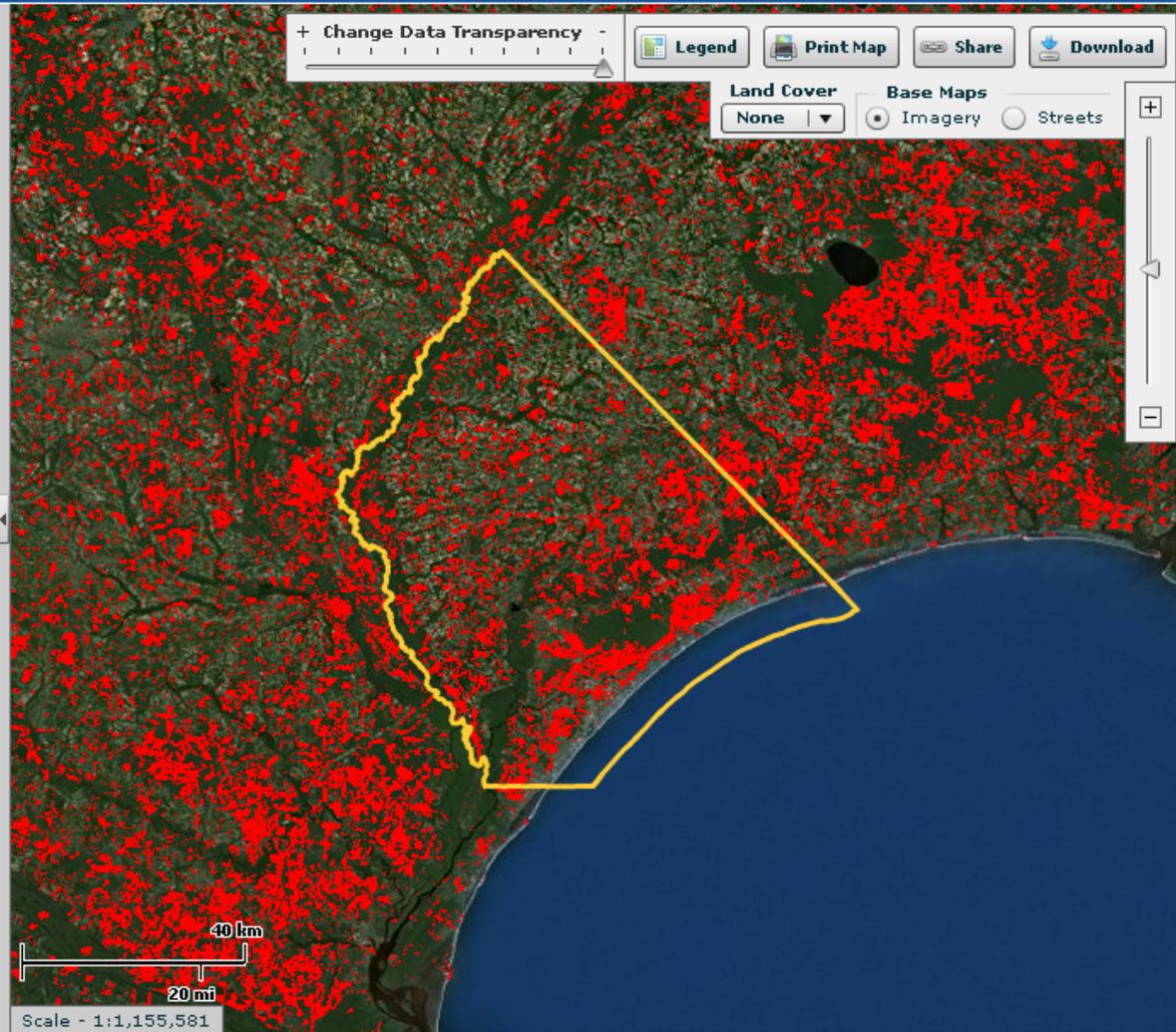
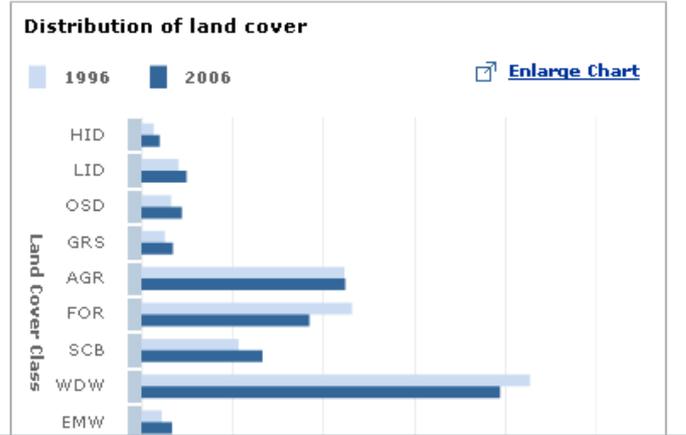
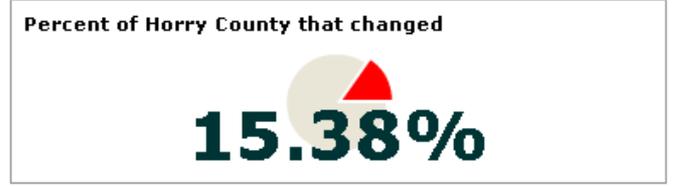
- General
- Developed
- Forests
- Wetlands
- Search

[General Statistics](#) | [\[Print Full County Report\]](#)

Horry County, South Carolina

1996 to 2006

What's on the map?
 All changes from 1996 and 2006



C-CAP Land Cover Atlas [v2 BETA]

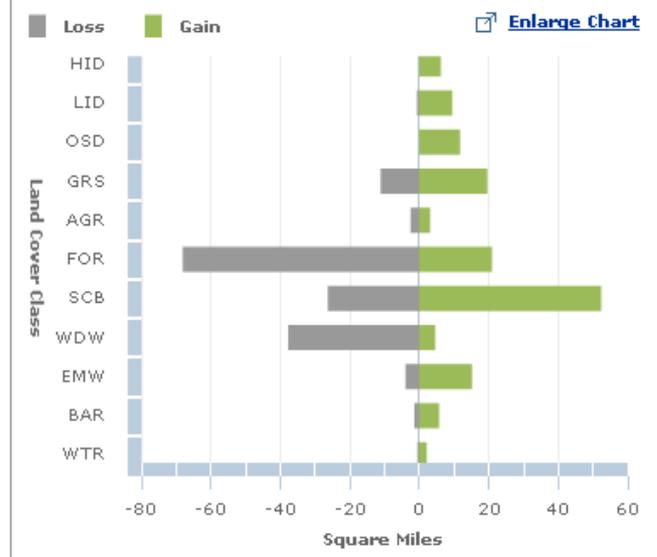
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

Date Range: 1996 | 2001 | 2006

- General
- Developed
- Forests
- Wetlands
- Search

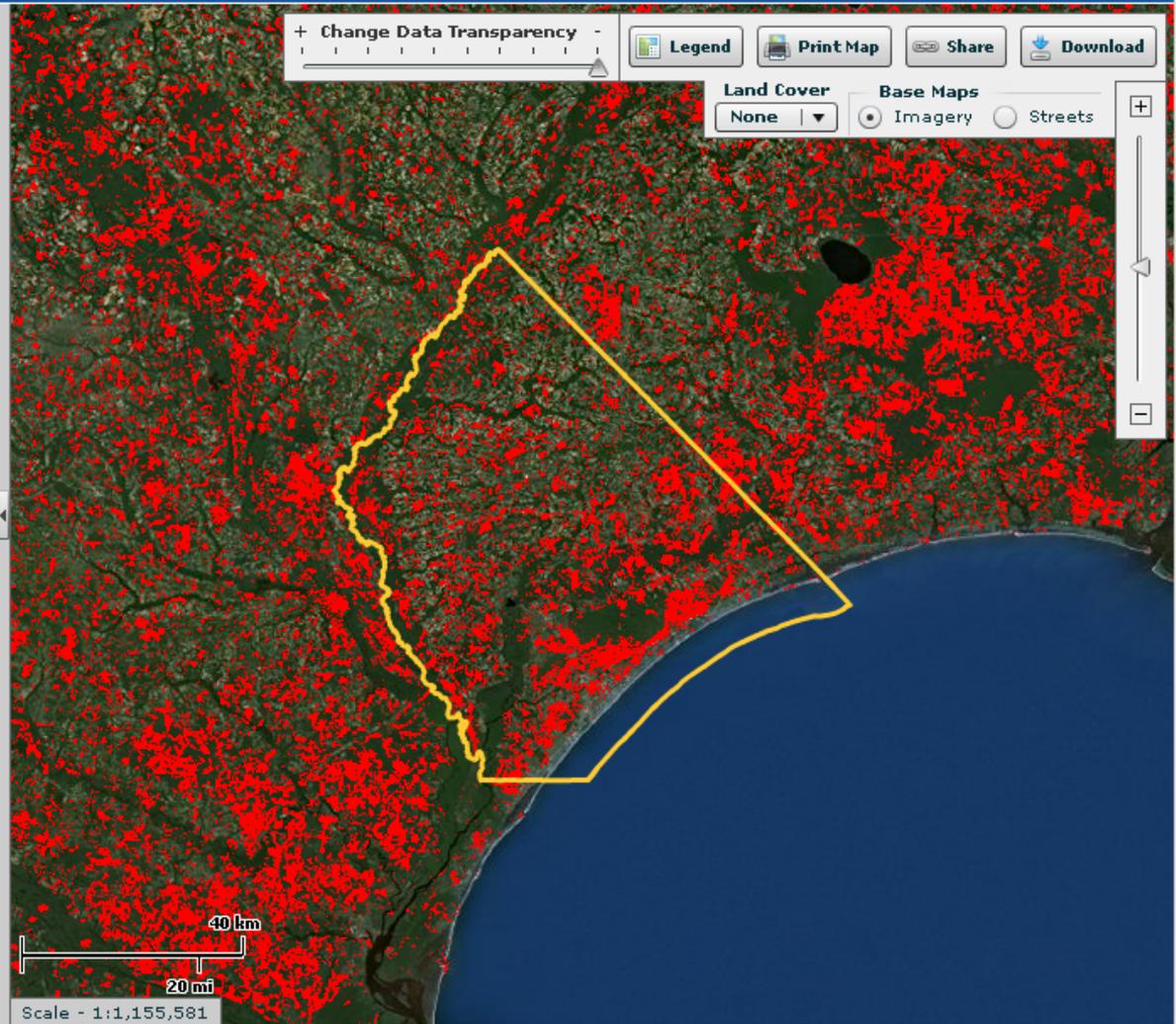
Distribution of change (losses and gains) by land cover



Land cover and change distribution

Distribution of land cover and change

Land Co	Area 1996	Area 2001	Area 2006	Area 2006	Net Change	Percent
HID	13.81	0.01	6.27	20.07	6.26	45.33%



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

Date Range: 1996 | 2001 | 2006

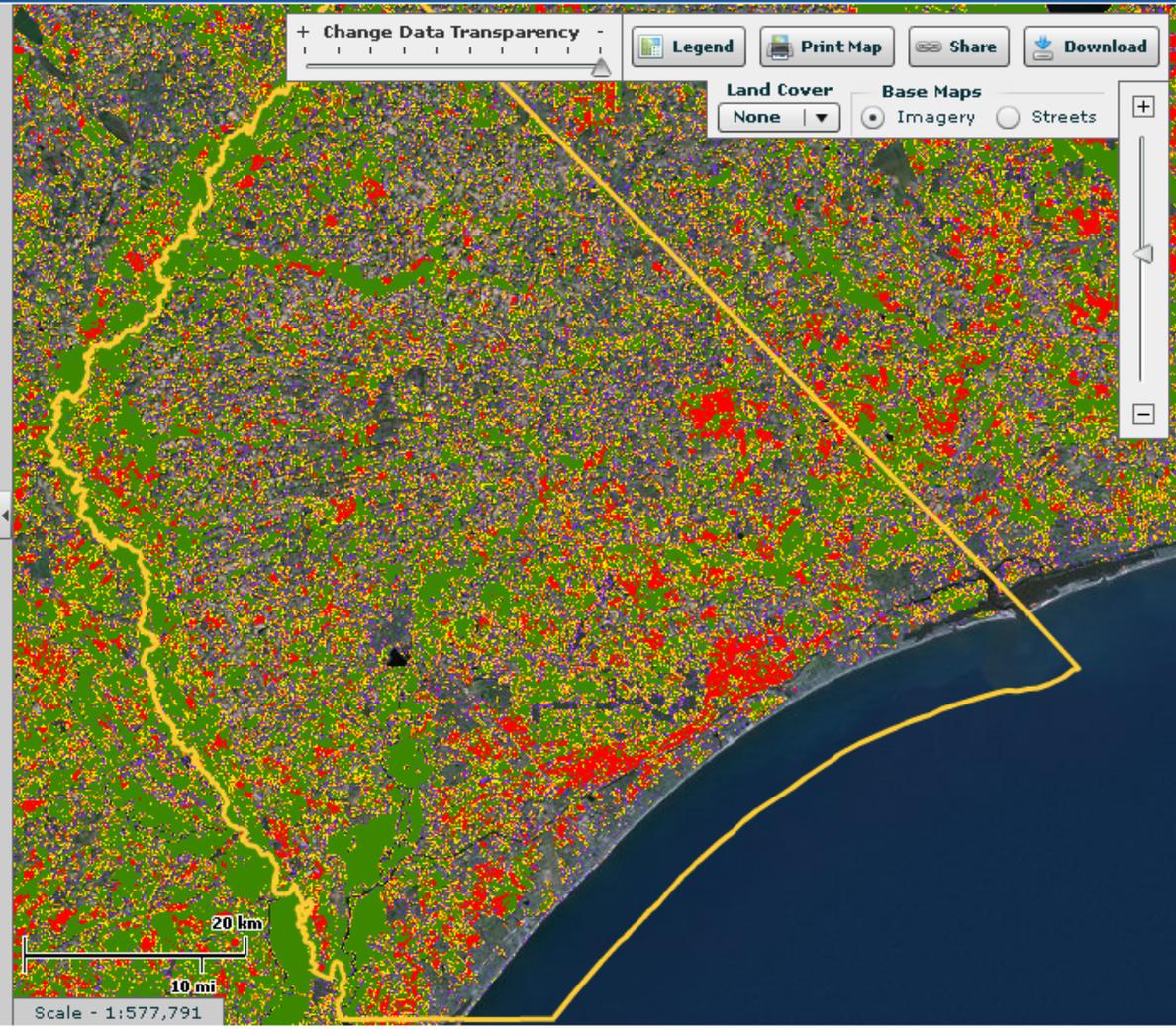
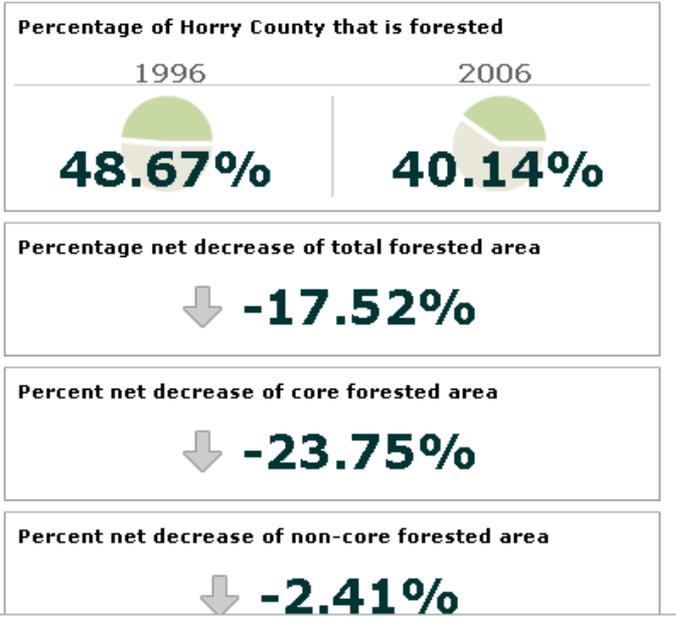
General | Developed | **Forests** | Wetlands | Search

Forest Statistics [Print Full County Report]

Horry County, South Carolina

1996 to 2006

What's on the map?
2006 forest fragmentation
[More about forest fragmentation...](#)



C-CAP Land Cover Atlas [v2 BETA]
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry
 Date Range: 1996 | 2001 | 2006

+ Change Data Transparency | Legend | Print Map | Share | Download
 Land Cover: None | Base Maps: Imagery | Streets

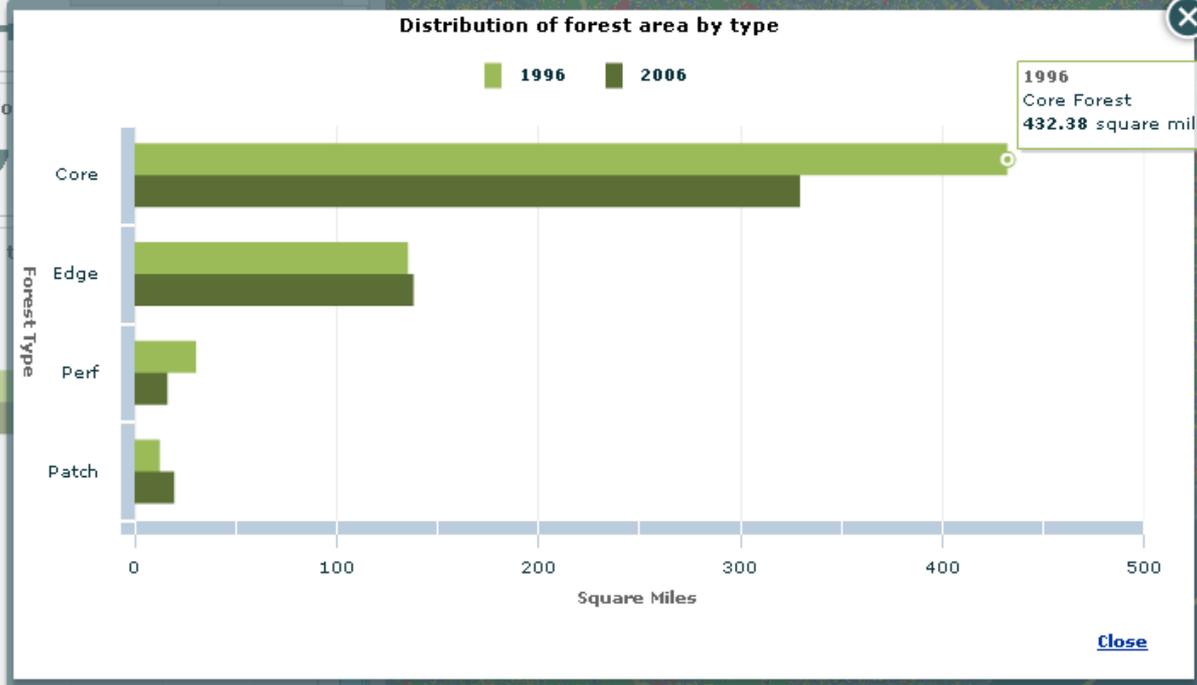
General | Developed | **Forests** | Wetlands | Search

Percentage increase of new forest area: **4.7%**

Distribution of forest area by type

1996 | 2006

Forest Type	1996 (Square Miles)	2006 (Square Miles)
Core	~432.38	~330
Edge	~140	~140
Perf	~40	~20
Patch	~20	~25



20 km | 10 mi
 Scale - 1:577,791

C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

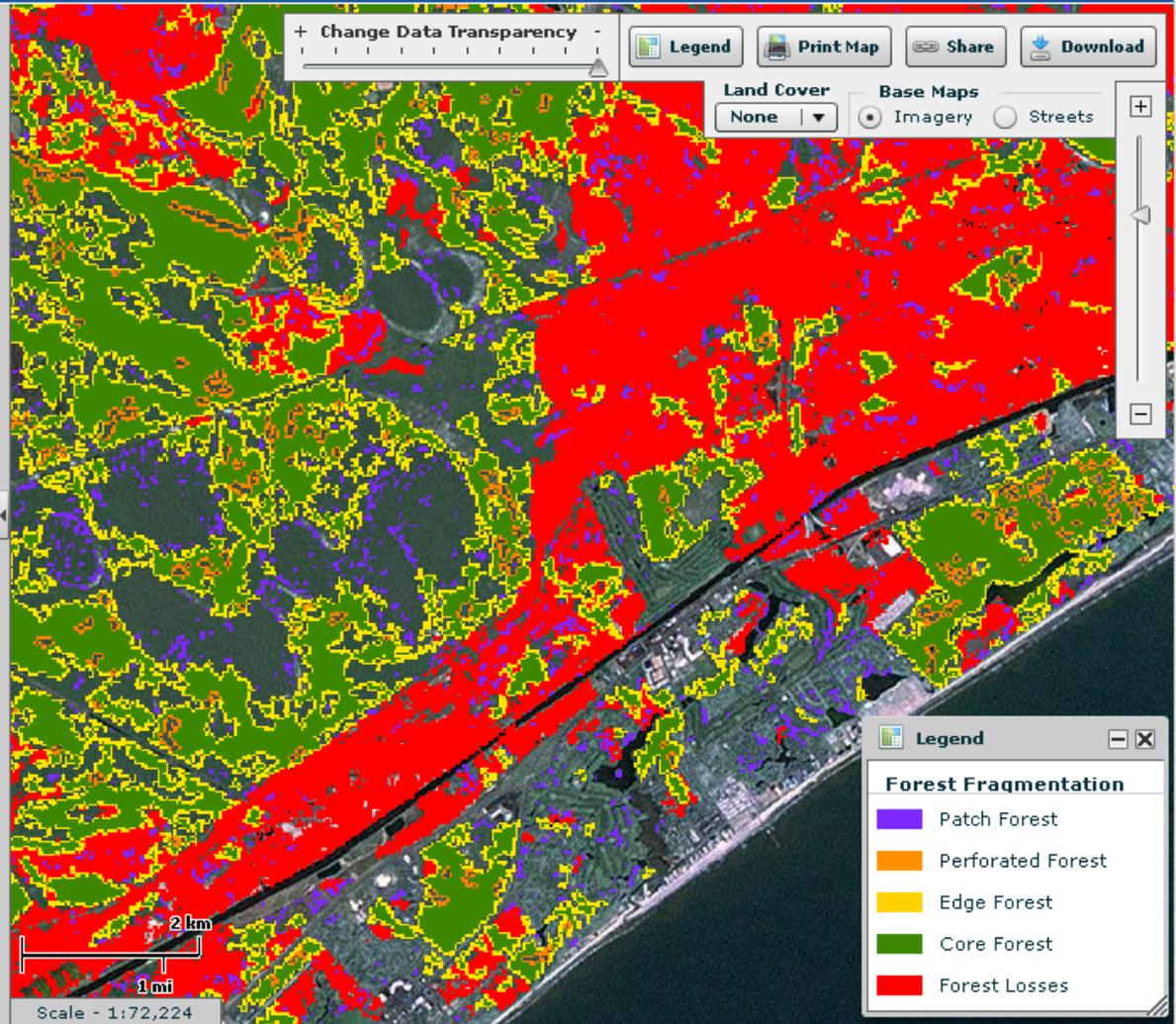
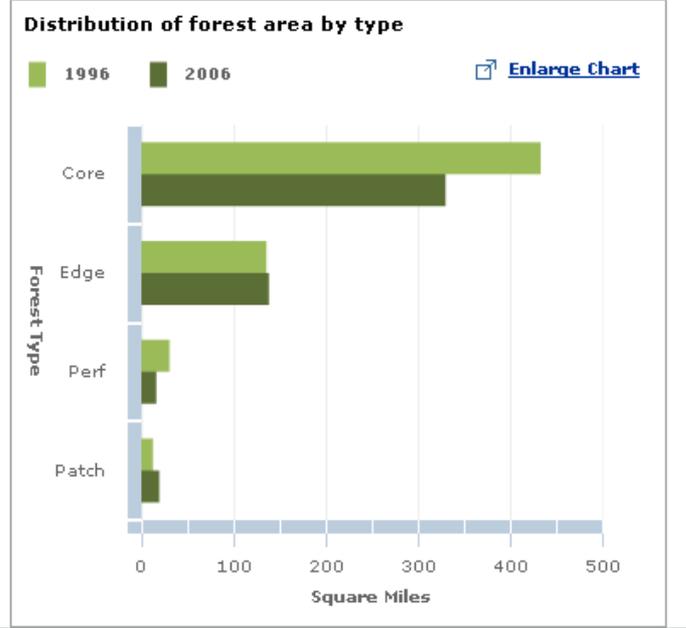
South Carolina | Horry

Date Range: 1996 | 2001 | 2006

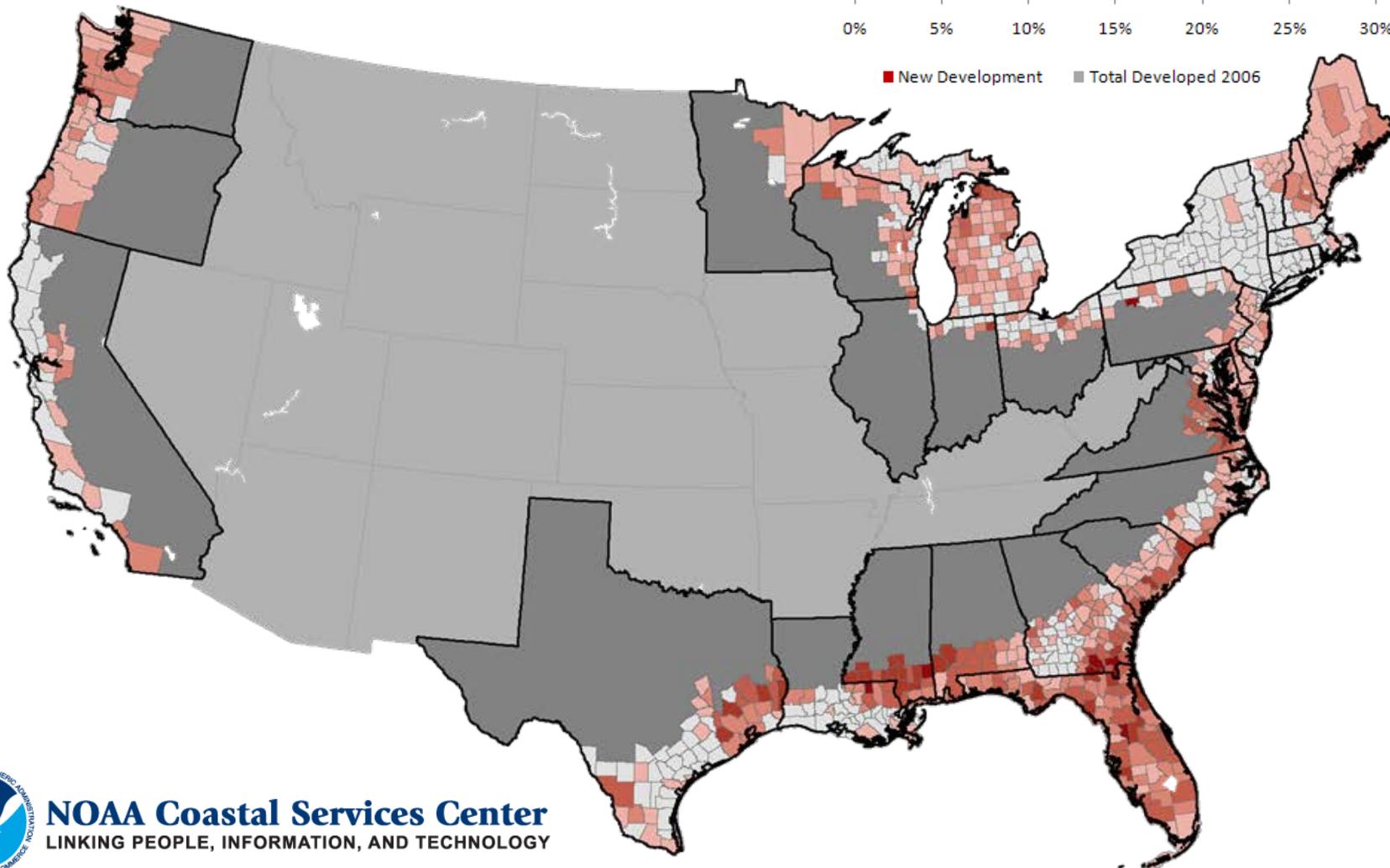
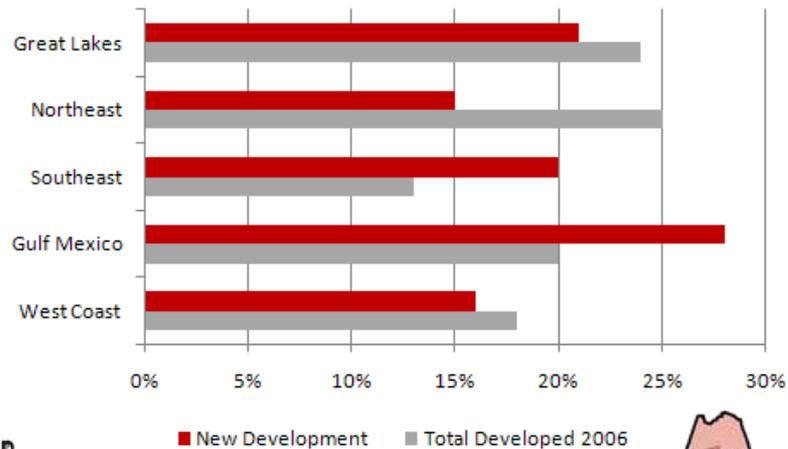
General | Developed | **Forests** | Wetlands | Search

Percentage increase of new forested area

↑ 4.78%



Developed Change 1996 to 2006



C-CAP Land Cover Atlas [v2 BETA]
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

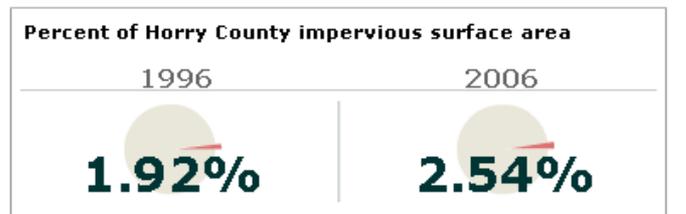
Date Range: 1996 | 2001 | 2006

General | **Developed** | Forests | Wetlands | Search

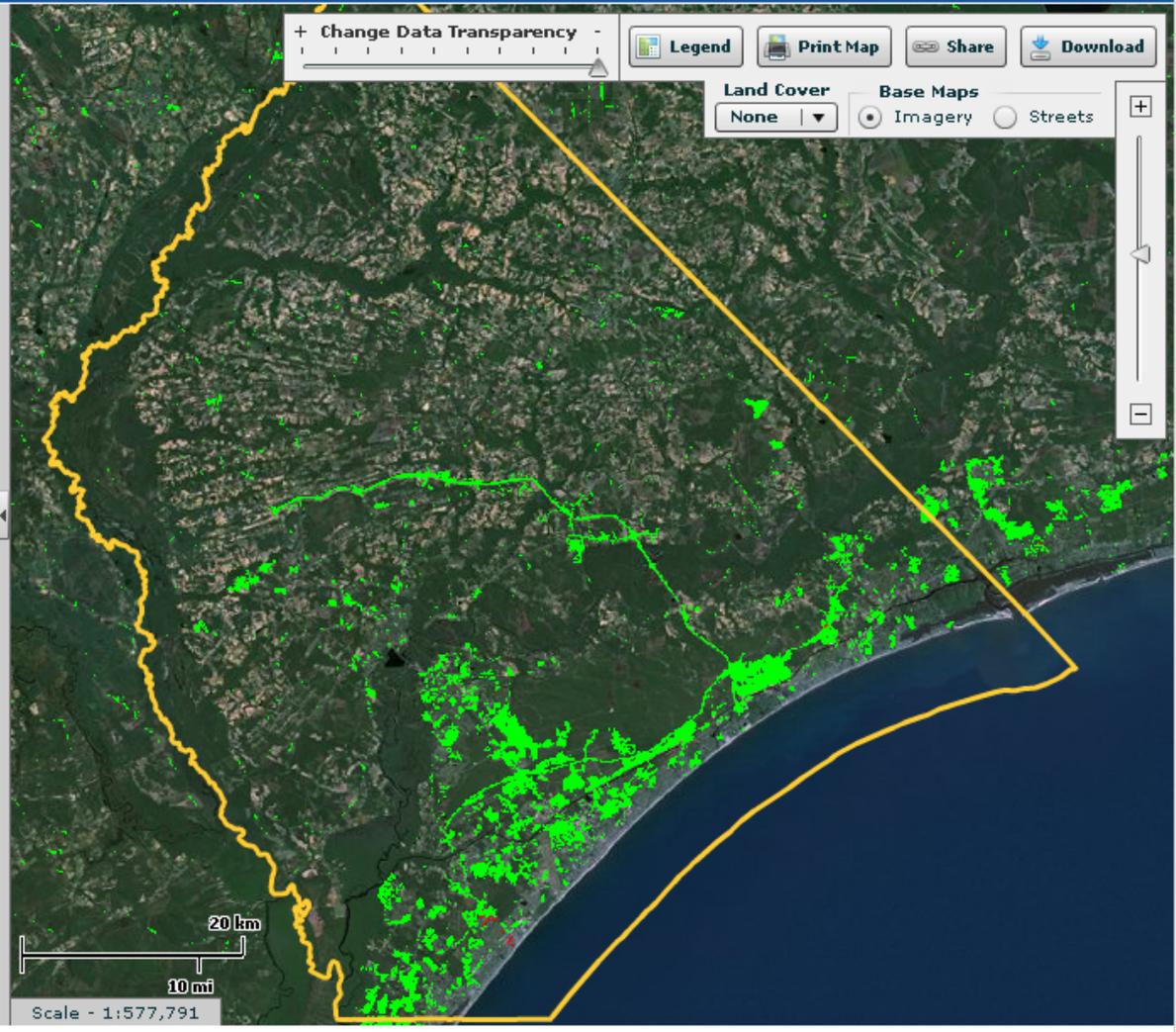
Developed Statistics [Print Full County Report]

Horry County, South Carolina
 1996 to 2006

What's on the map?
 Developed changes from 1996 to 2006
[More about developed changes...](#)



Percent net increase in impervious surface area



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

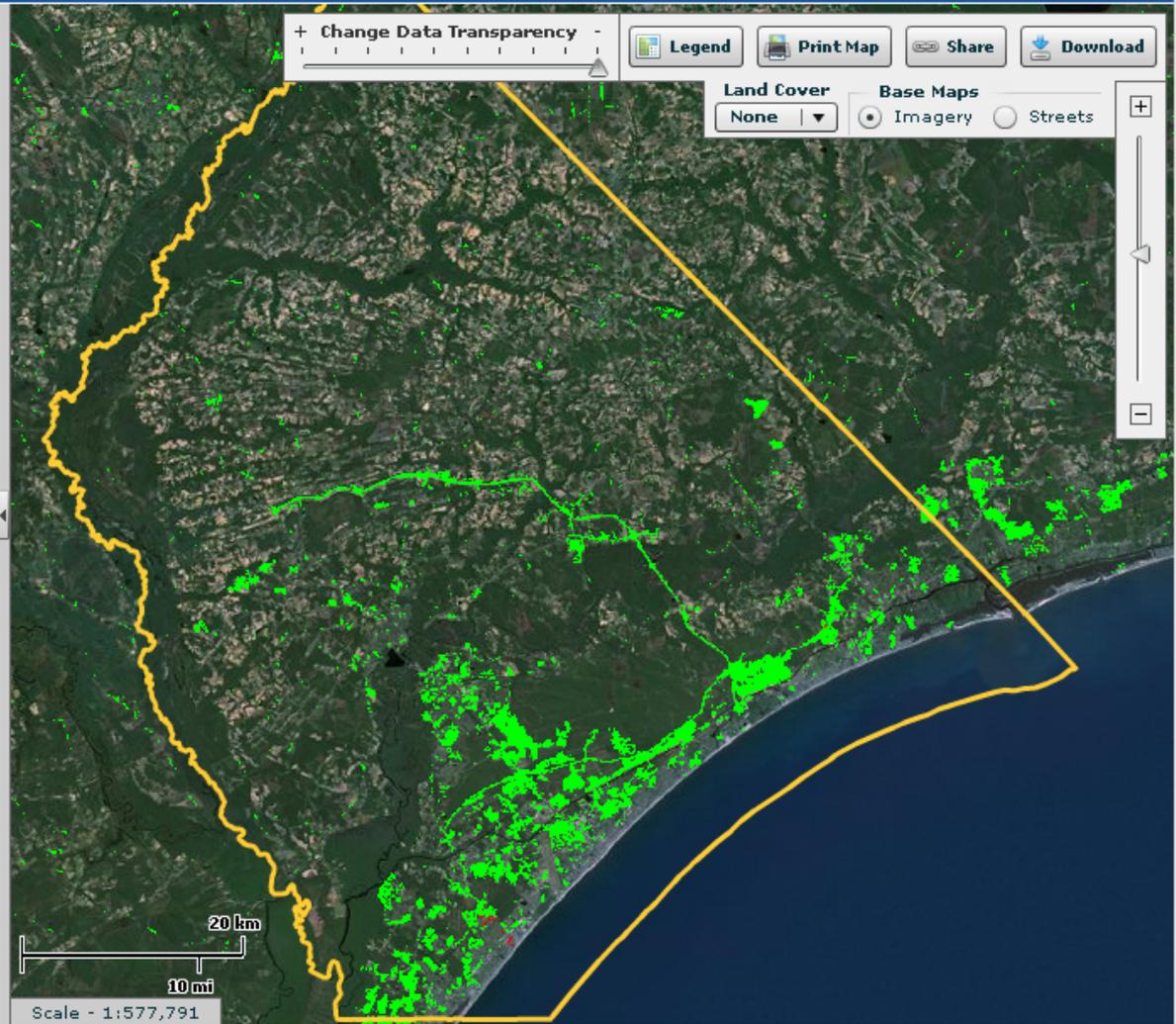
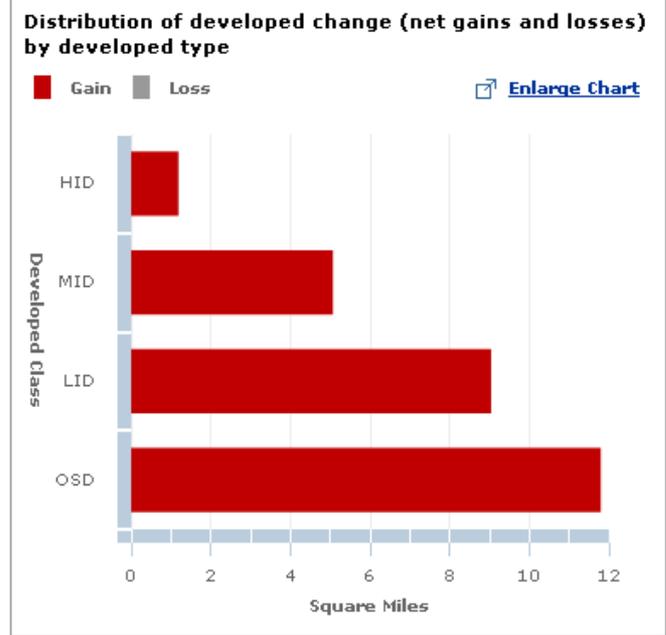
South Carolina | Horry

Date Range: 1996 | 2001 | 2006

General | **Developed** | Forests | Wetlands | Search

Percent net increase in impervious surface area

↑ **31.87%**



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

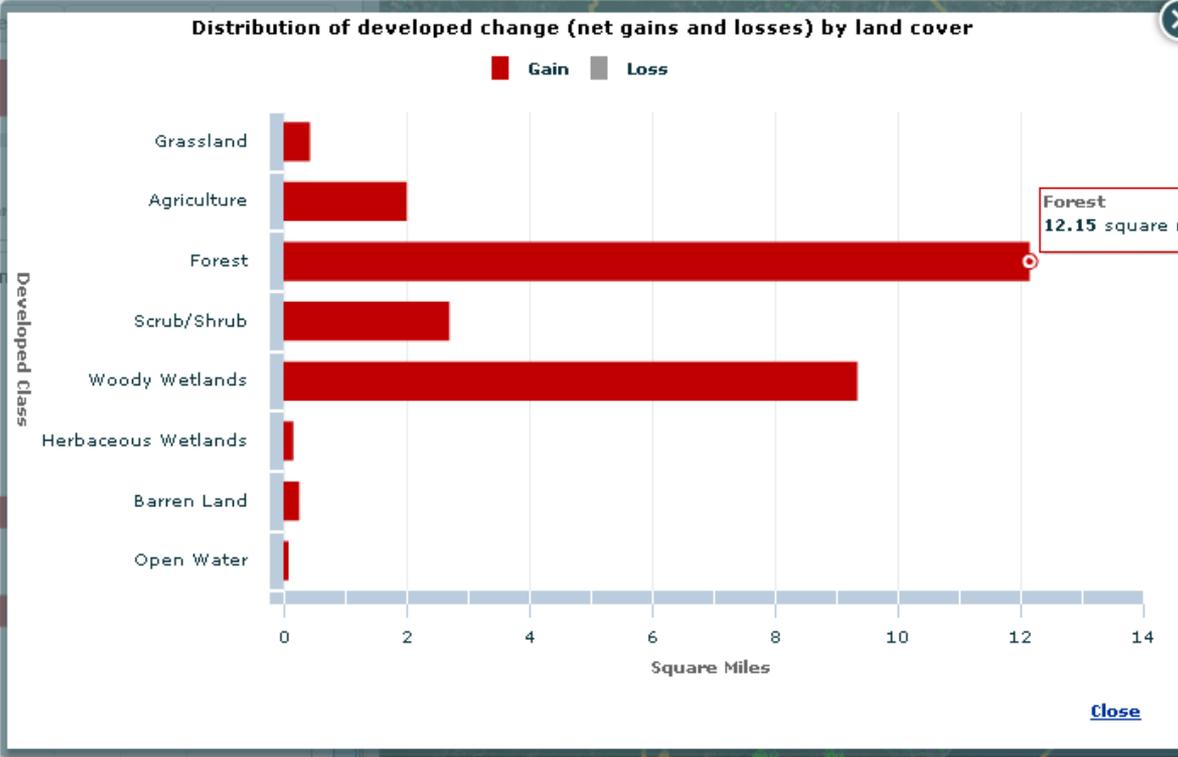
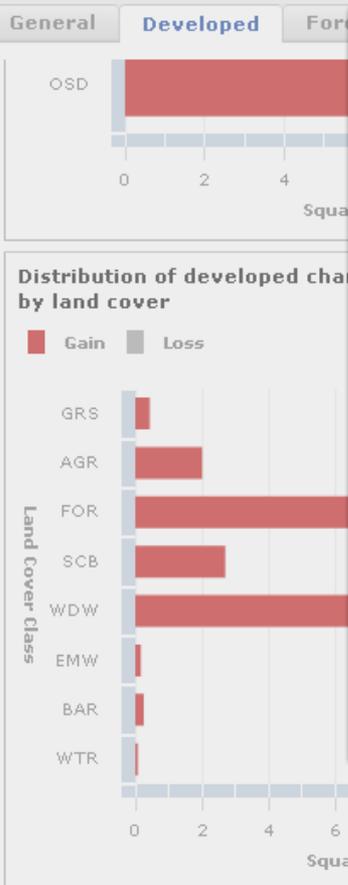
South Carolina | Horry

Date Range: 1996 | 2001 | 2006

+ Change Data Transparency

Legend | Print Map | Share | Download

Land Cover: None | Imagery | Streets

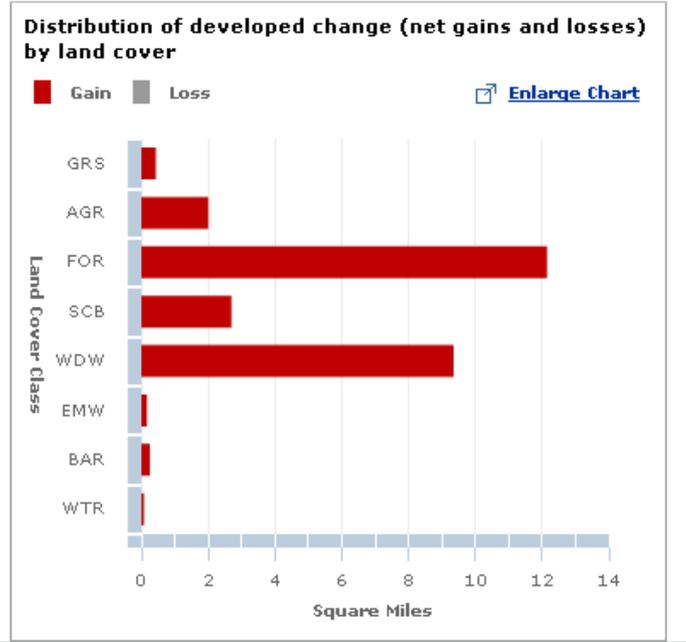


C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

Date Range: 1996 | 2001 | 2006

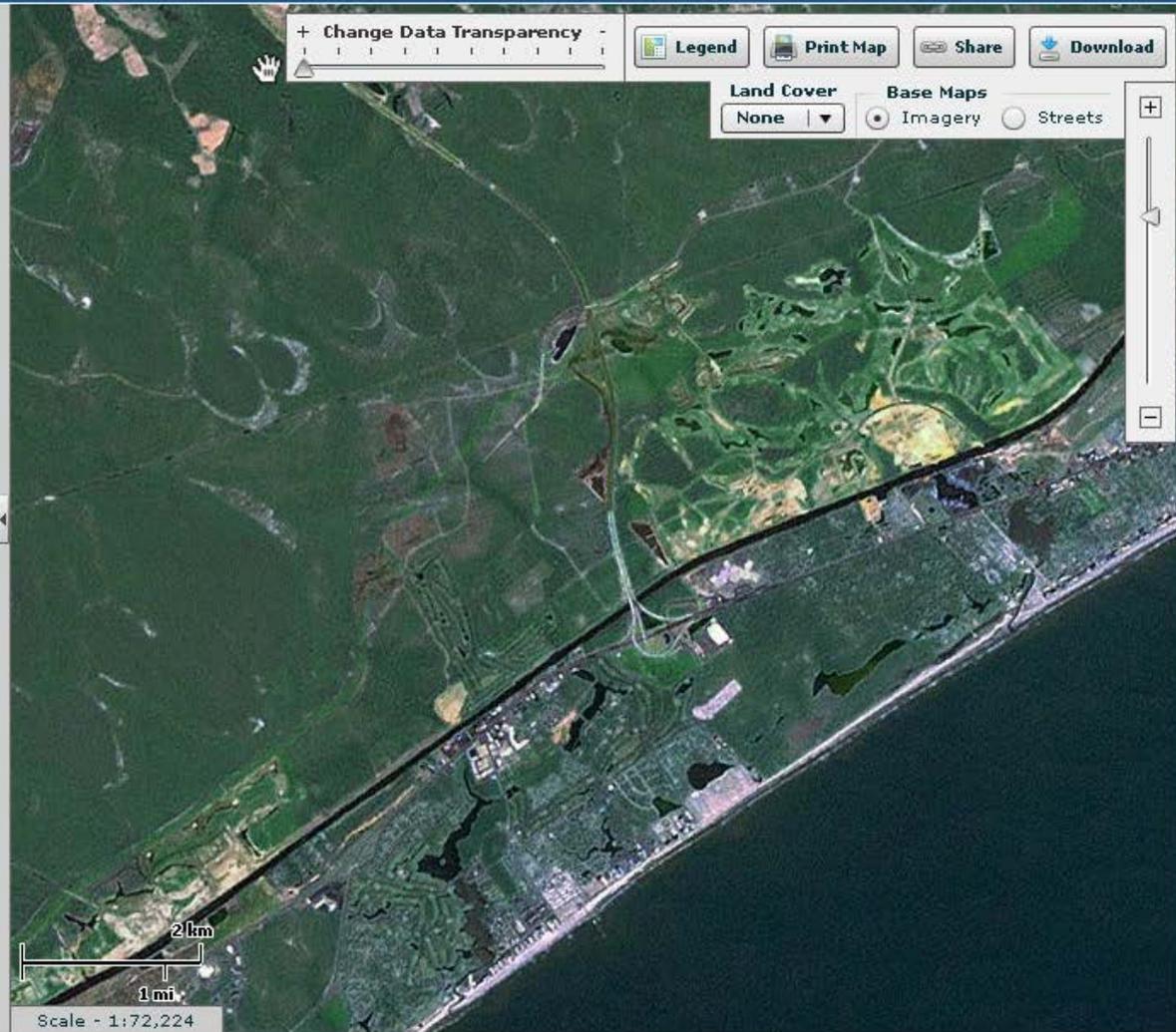
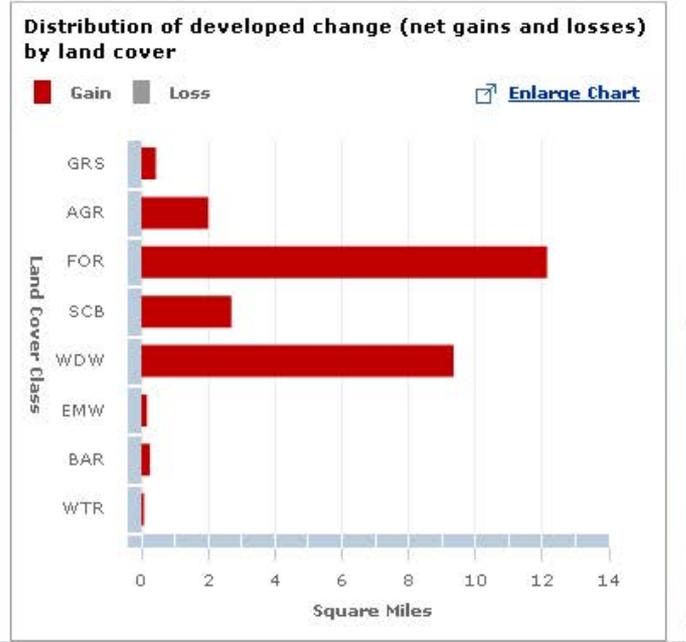


C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

South Carolina | Horry

Date Range: 1996 | 2001 | 2006



Search

Fly To Find Businesses Directions

Fly to e.g., New York, NY

plantation Myrtle Beach, SC

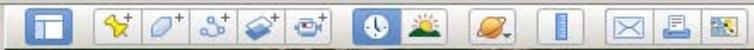
- kingston plantation Myrtle Beac...
- Myrtle Beach, SC

Places

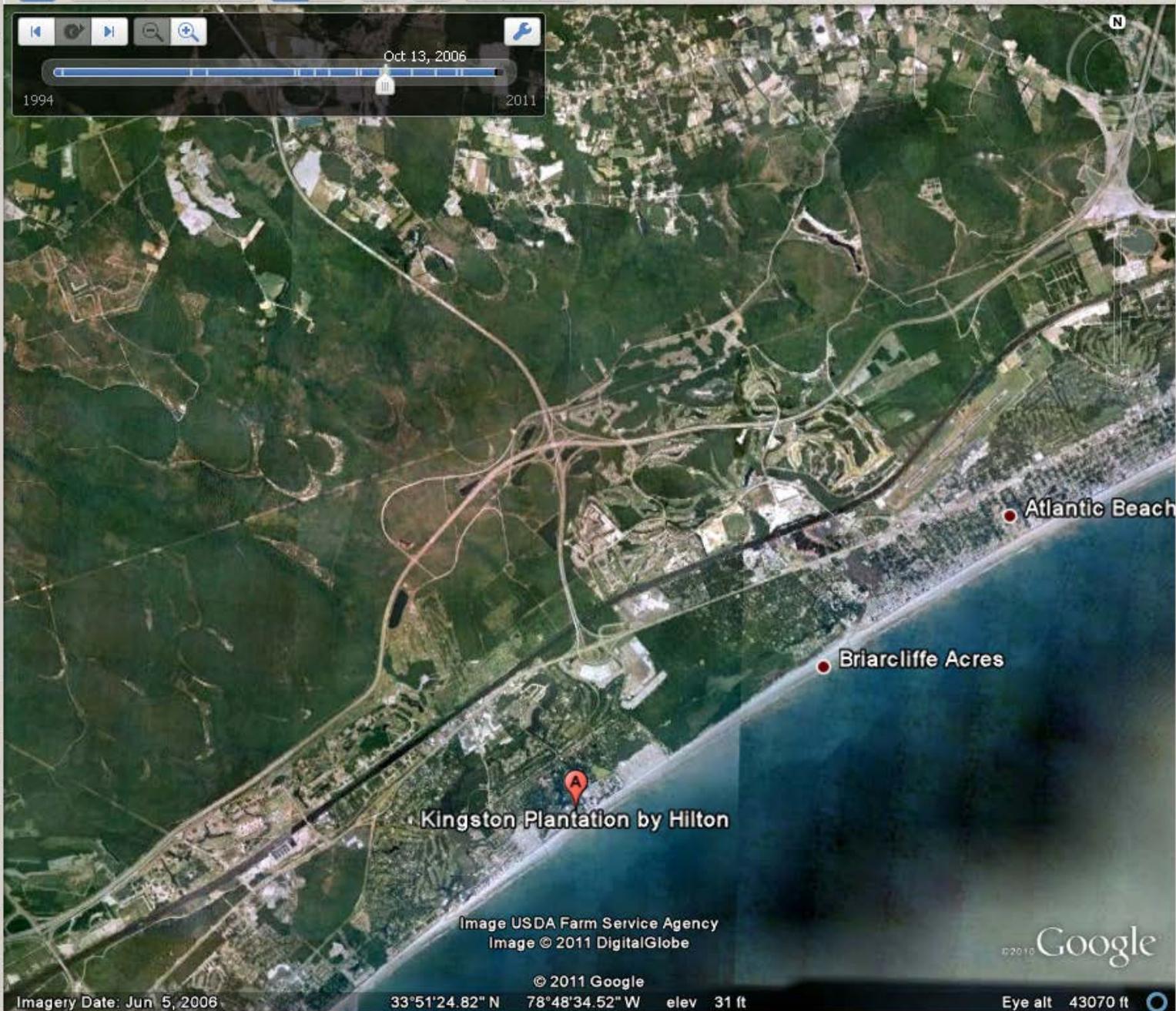
- My Places
- Sightseeing Tour
Make sure 3D Buildings layer is checked
- Temporary Places

Layers Earth Gallery >>

- kh.google.com
- Imagery
- Earth Pro (US)



Timeline interface showing a date slider from 1994 to 2011, with the current date set to Oct 13, 2006.



Kingston Plantation by Hilton

Briarcliffe Acres

Atlantic Beach

Image USDA Farm Service Agency
Image © 2011 DigitalGlobe

© 2011 Google

Imagery Date: Jun 5, 2006 33°51'24.82" N 78°48'34.52" W elev 31 ft

Google

Eye alt 43070 ft

Search

Fly To Find Businesses Directions

Fly to e.g., New York, NY

plantation Myrtle Beach, SC

- kingston plantation Myrtle Beac...
- Myrtle Beach, SC

Places

- My Places
- Sightseeing Tour
- Temporary Places

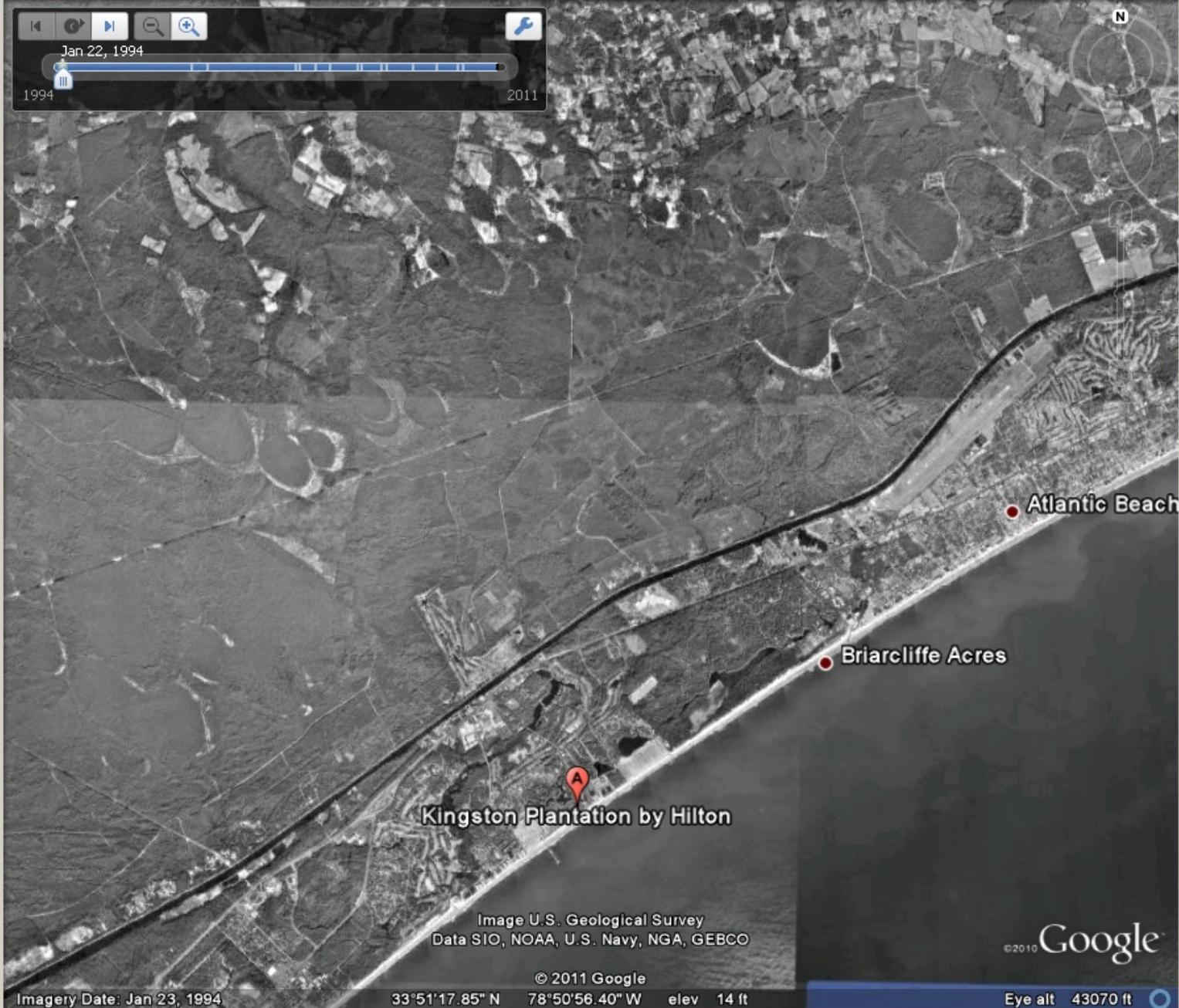
Layers Earth Gallery

- kh.google.com
- Imagery
- Earth Pro (US)



Jan 22, 1994

1994 2011



Kingston Plantation by Hilton

Briarcliffe Acres

Atlantic Beach

Image U.S. Geological Survey Data SIO, NOAA, U.S. Navy, NGA, GEBCO

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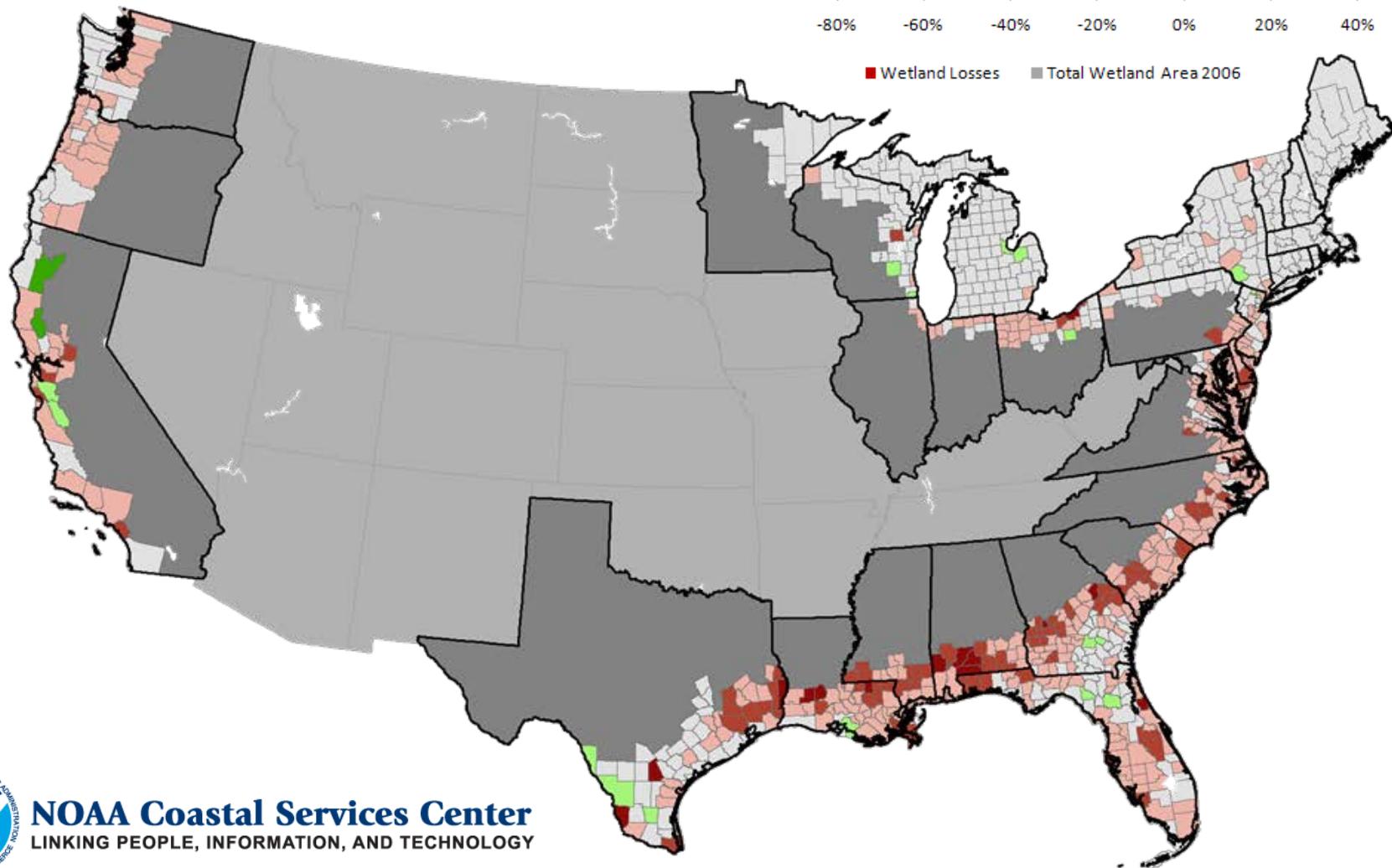
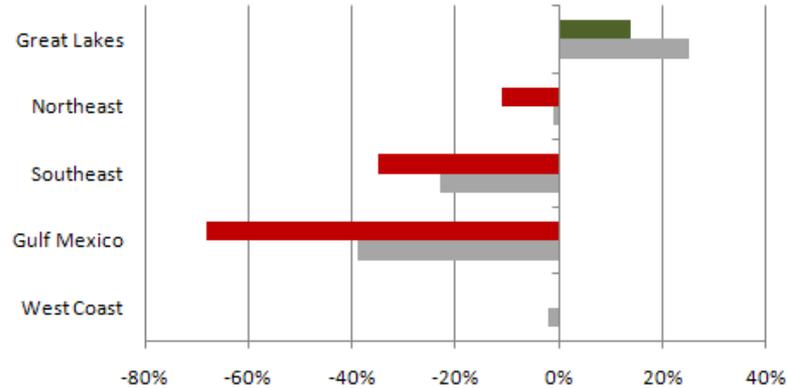
Imagery Date: Jan 23, 1994

33°51'17.85" N 78°50'56.40" W elev 14 ft

Google

Eye alt 43070 ft

Wetland Change 1996 to 2006



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

[Select State] [Select County]

- Alabama
- California
- Connecticut
- Delaware
- Florida
- Georgia
- Illinois
- Indiana
- Louisiana
- Massachusetts
- Maryland
- Maine
- Michigan
- Minnesota
- Mississippi
- North Carolina
- New Hampshire
- New Jersey
- New York
- Ohio

2001 2006

Wetlands Search

time frame above in order observed land cover changes and time frame of interest.



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan [v]
Date Range: 1996
General Developed Forest

Select a state, county, and date range to visualize and explore observations for your geography and time period.

- [Select County]
- Oceana
- Ogemaw
- Ontonagon
- Osceola
- Oscoda
- Otsego
- Ottawa
- Presque Isle
- Roscommon
- Saginaw
- Sanilac
- Schoolcraft
- Shiawassee
- St. Clair
- St. Joseph
- Tuscola
- Van Buren
- Washtenaw
- Wayne
- Wexford



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan | Tuscola

Date Range: 1996 | 2001 | 2006

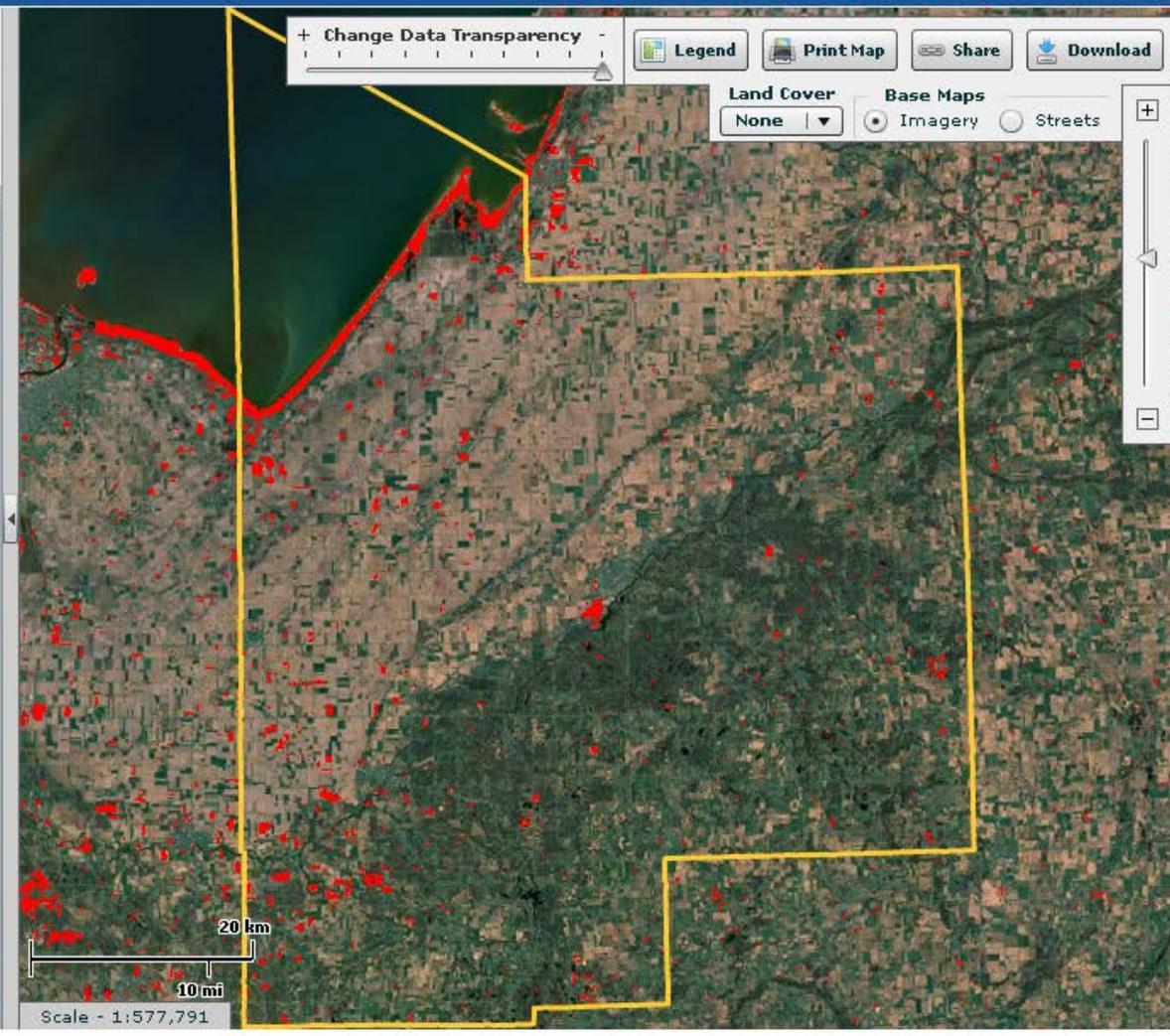
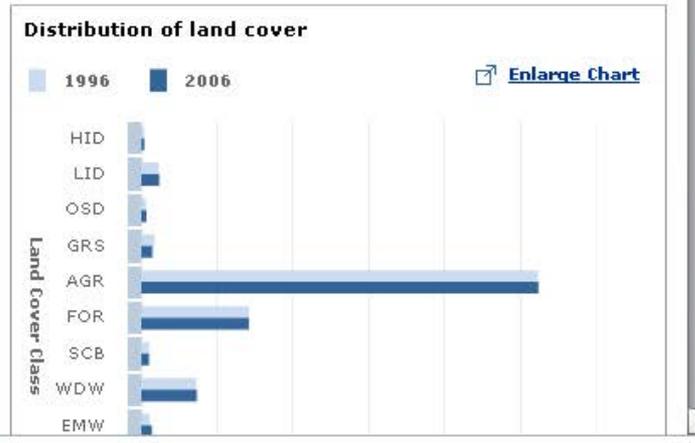
General | Developed | Forests | Wetlands | Search

General Statistics [Print Full County Report]

Tuscola County, Michigan

1996 to 2006

What's on the map?
 All changes from 1996 and 2006



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan Tuscola

Date Range: 1996 2001 2006

Change Data Transparency

Legend Print Map Share Download

General Developed

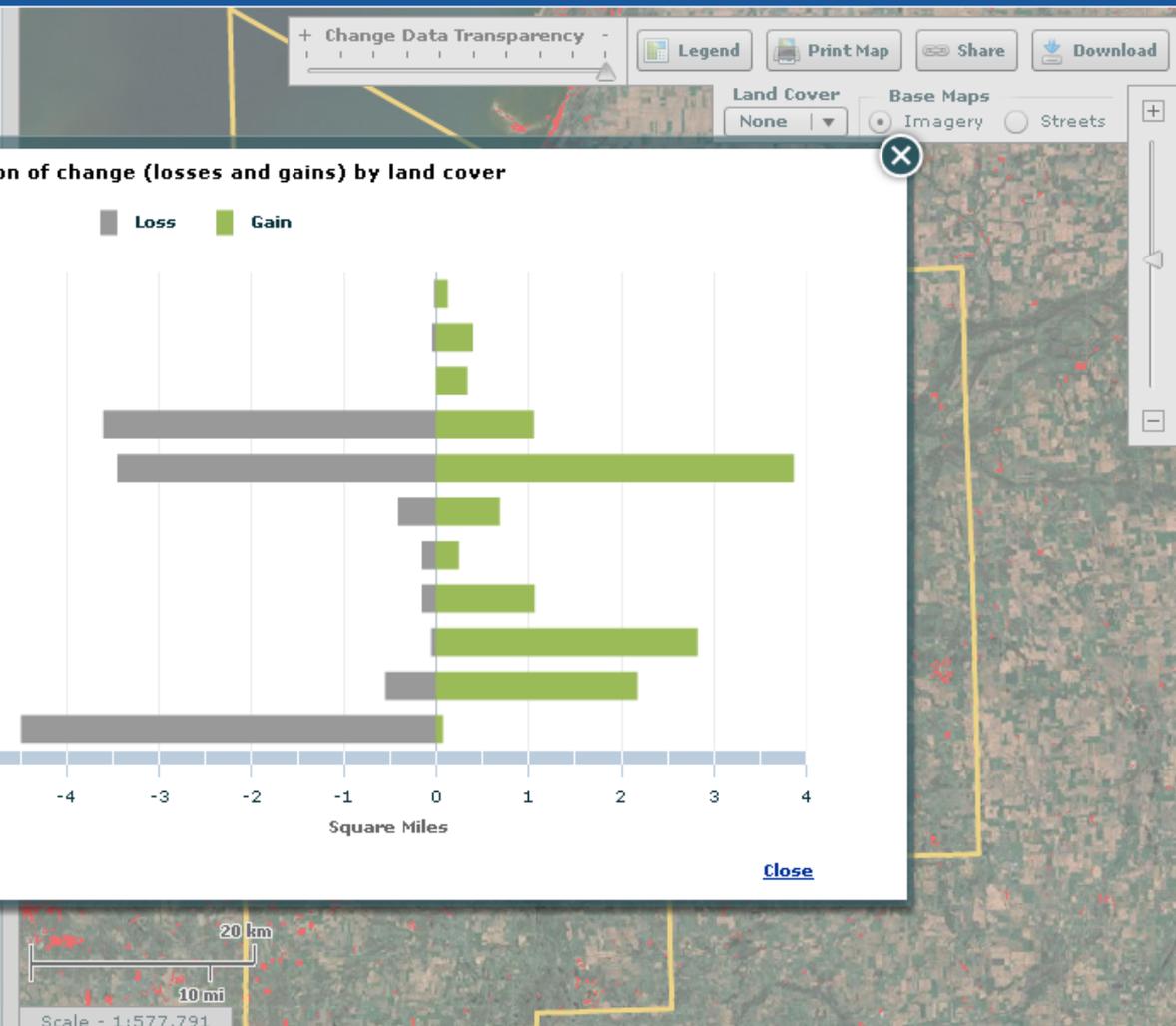
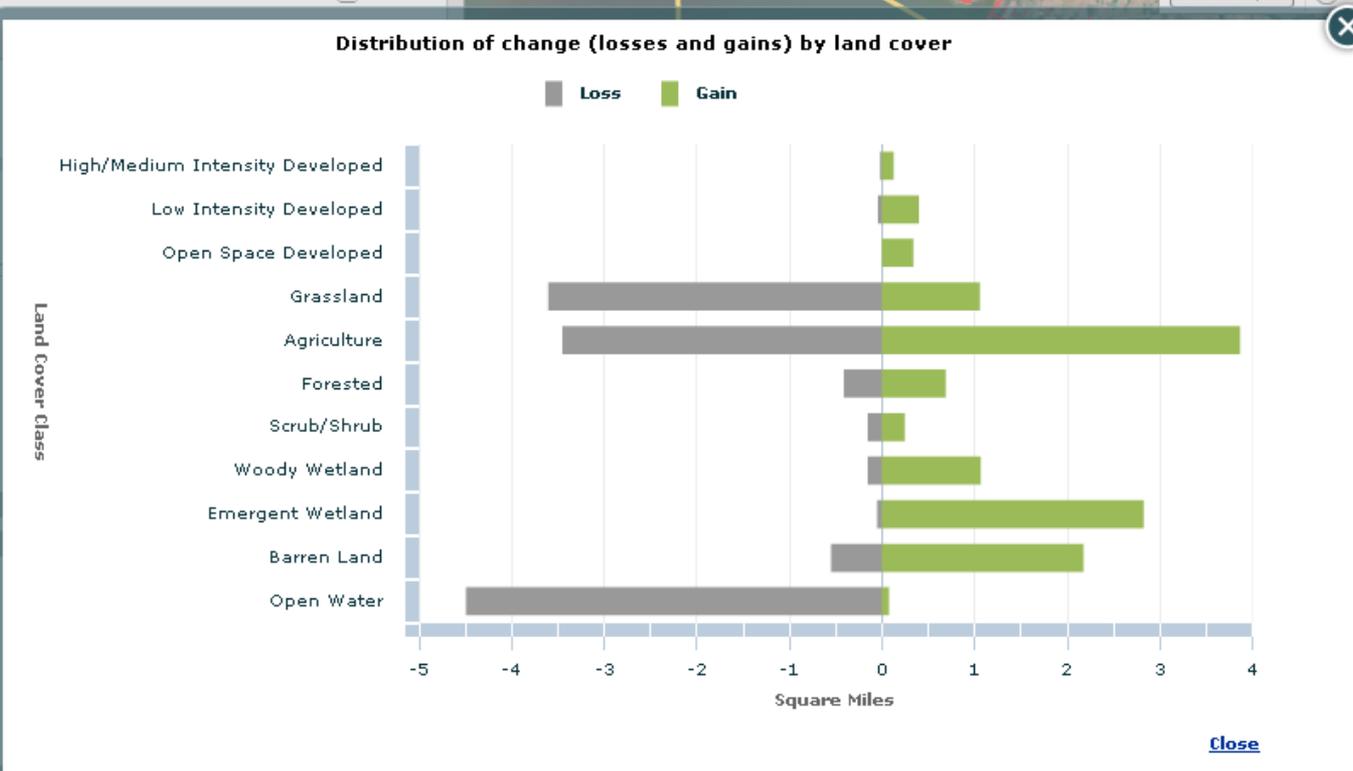
BAR WTR

Distribution of change

Loss Gain

HID LID OSD GRS AGR FOR SCB WDW EMW BAR WTR

Square Miles



C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan | Tuscola
Date Range: 1996 | 2001 | 2006
General | Developed | Forests | **Wetlands** | Search

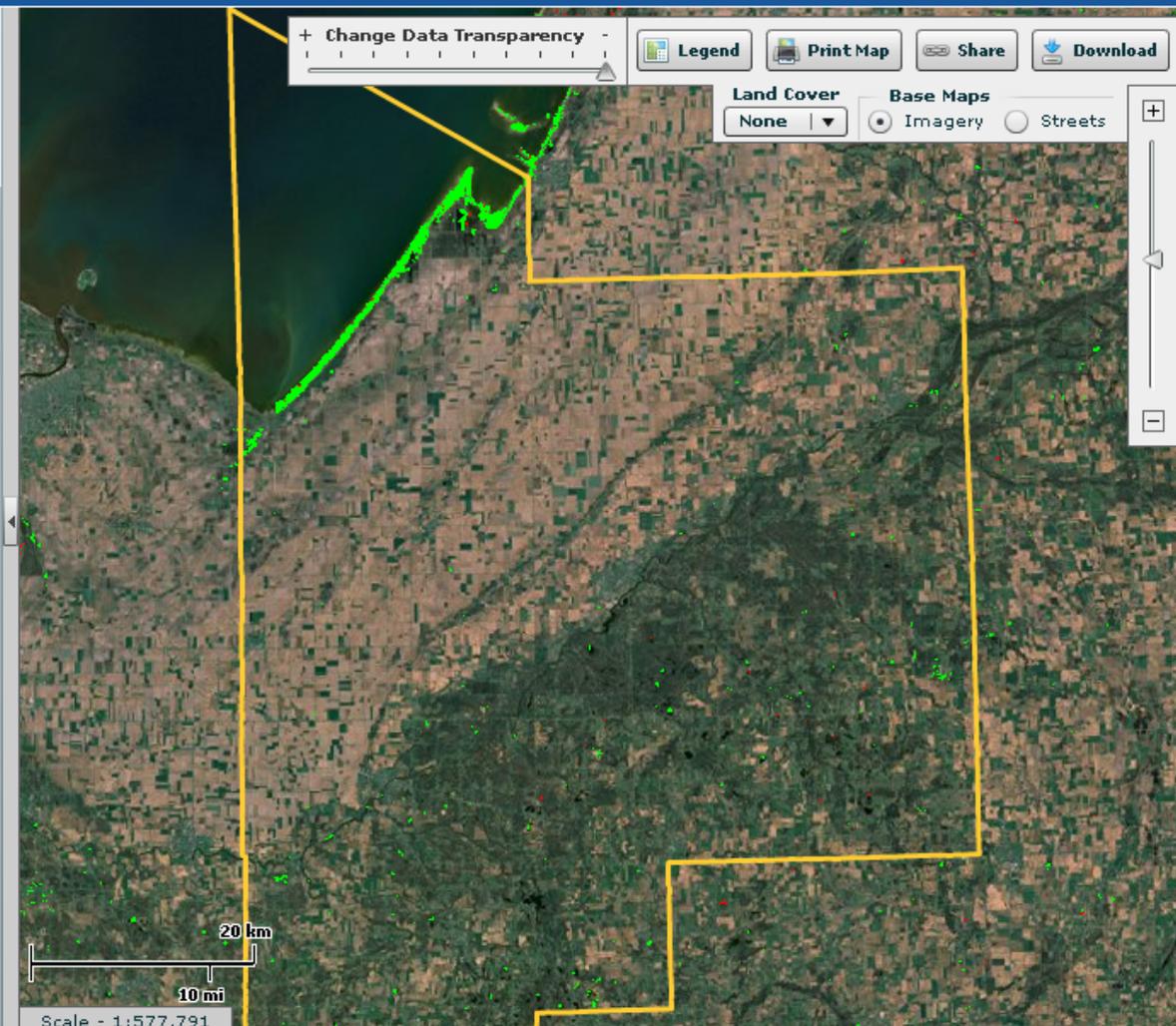
Wetlands Statistics [Print Full County Report]
Tuscola County, Michigan
1996 to 2006
What's on the map?
Wetland changes from 1996 to 2006
[More about wetlands change...](#)



Percent net increase of total wetlands
↑ 4.68%

Percent net increase of freshwater (palustrine) wetlands
↑ 4.41%

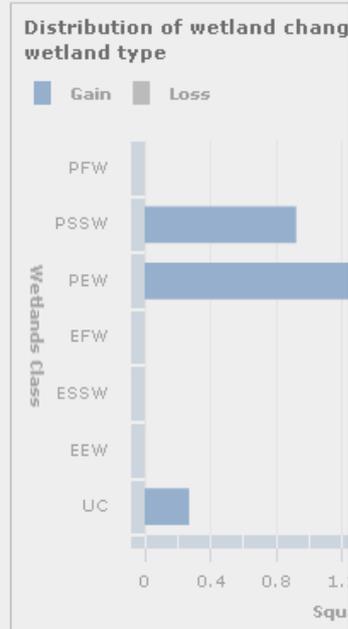
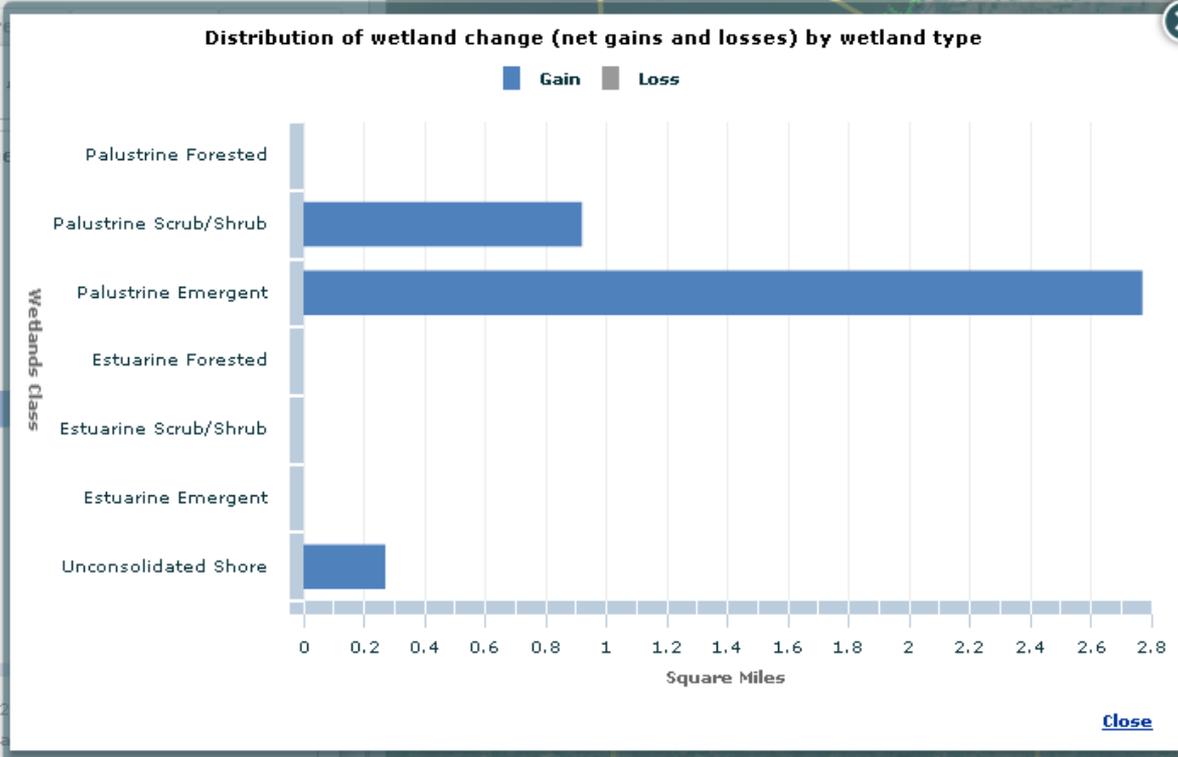
Percent net change of saltwater (estuarine) wetlands



C-CAP Land Cover Atlas [v2 BETA]
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan | Tuscola
 Date Range: 1996 | 2001 | 2006

+ Change Data Transparency
 Legend | Print Map | Share | Download
 Land Cover: None | Base Maps: Imagery | Streets



20 km | 10 mi
 Scale - 1:577,791

C-CAP Land Cover Atlas [v2 BETA]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Michigan | Tuscola

Date Range: 1996 | 2001 | 2006

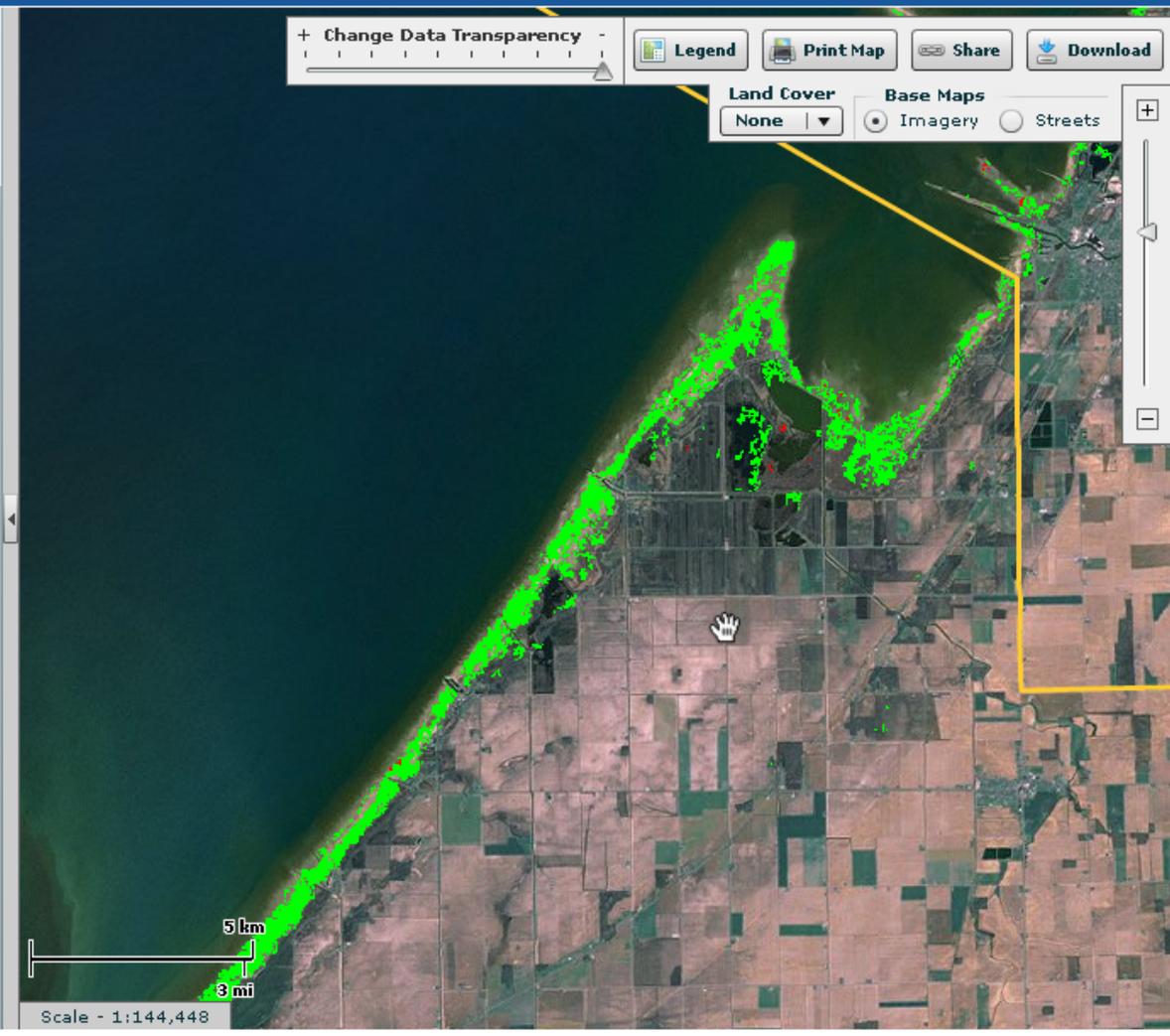
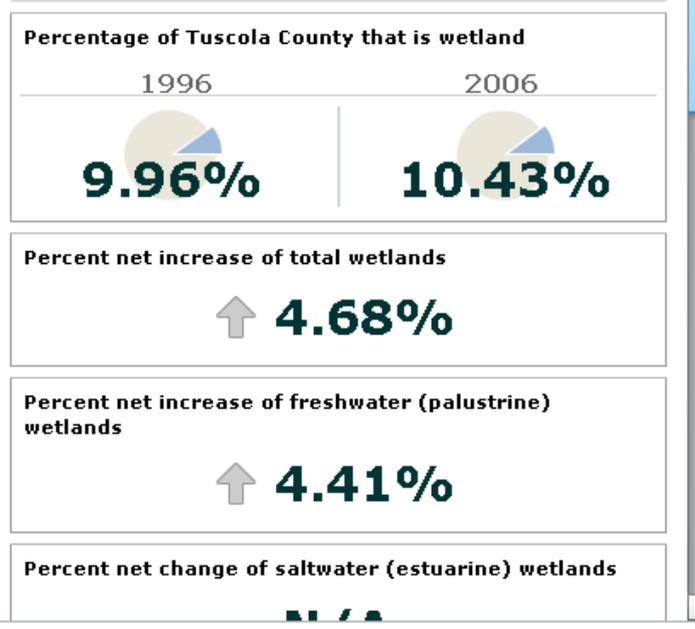
General | Developed | Forests | **Wetlands** | Search

Wetlands Statistics [Print Full County Report]

Tuscola County, Michigan

1996 to 2006

What's on the map?
 Wetland changes from 1996 to 2006
[More about wetlands change...](#)



Search

Fly To Find Businesses Directions

Fly to e.g., Tokyo, Japan

Search input field with magnifying glass icon

Places Add Content

- Legend: Status Map [Click for information!](#)
- Legend: Wetland Types [Click for information!](#)
- Temporary Places
- Michigan Land Cover
 - Land Cover Dates
 - 1996
 - 2001
 - 2006
 - Legend
 - Logo

Layers

- kh.google.com
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 - Places
 - Panoramio Photos
 - Roads
 - 3D Buildings
 - Ocean
 - Street View
 - Weather
 - Gallery
 - Global Awareness
 - More
 - Terrain



Mar 27, 1999

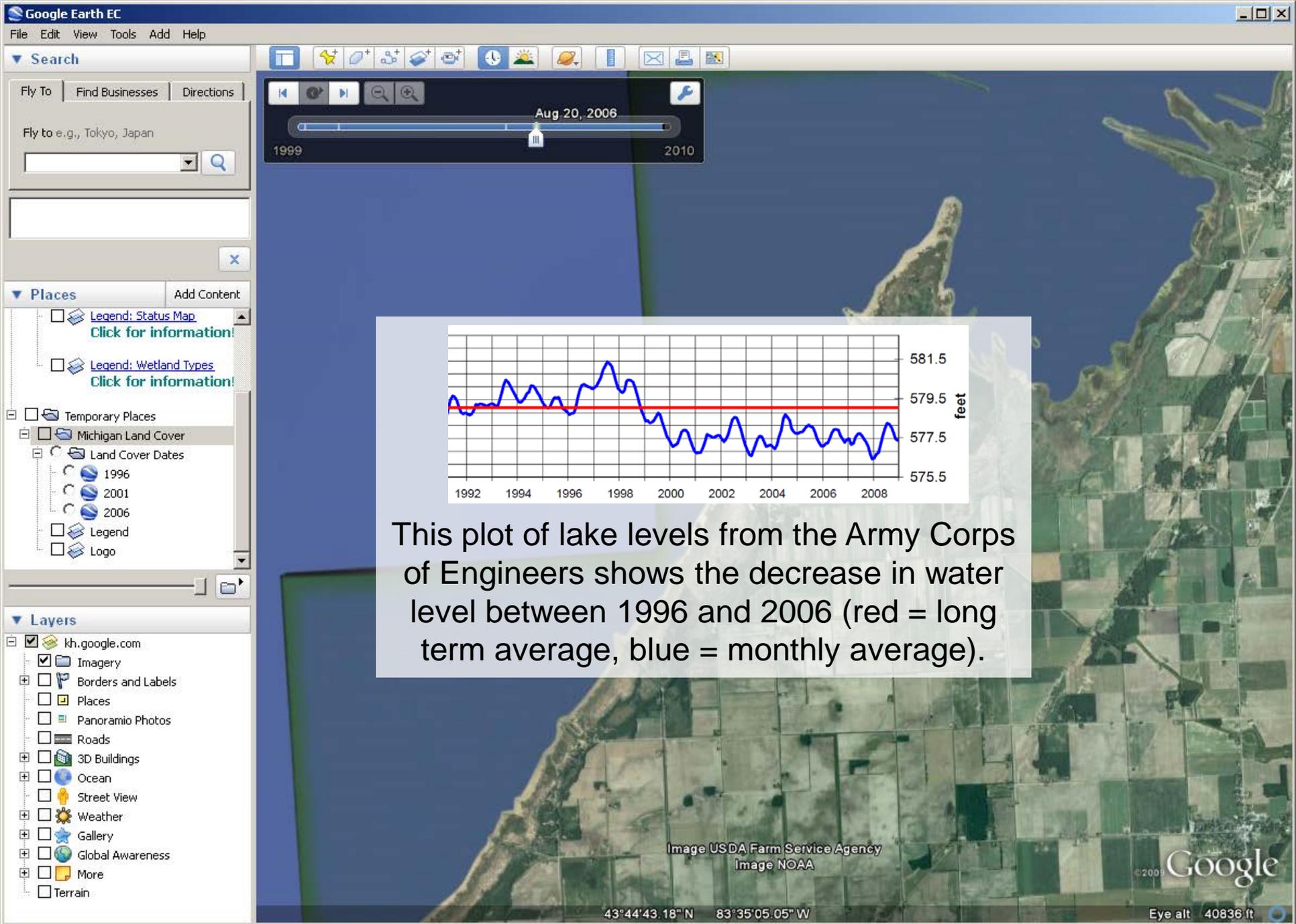


Image U.S. Geological Survey
Image NOAA

© 2009 Google

43°43'44.57" N 83°30'27.27" W

Eye alt 40836 ft



Search

Fly To Find Businesses Directions

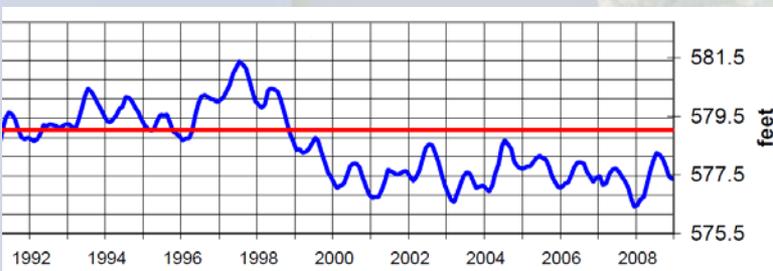
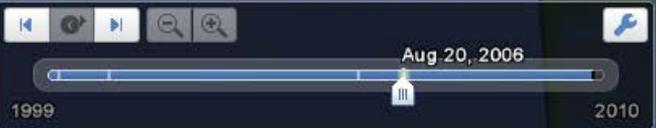
Fly to e.g., Tokyo, Japan

Places Add Content

- Legend: Status Map [Click for information!](#)
- Legend: Wetland Types [Click for information!](#)
- Temporary Places
- Michigan Land Cover
 - Land Cover Dates
 - 1996
 - 2001
 - 2006
 - Legend
 - Logo

Layers

- kh.google.com
 - Imagery
 - Borders and Labels
 - Places
 - Panoramio Photos
 - Roads
 - 3D Buildings
 - Ocean
 - Street View
 - Weather
 - Gallery
 - Global Awareness
 - More
 - Terrain



This plot of lake levels from the Army Corps of Engineers shows the decrease in water level between 1996 and 2006 (red = long term average, blue = monthly average).

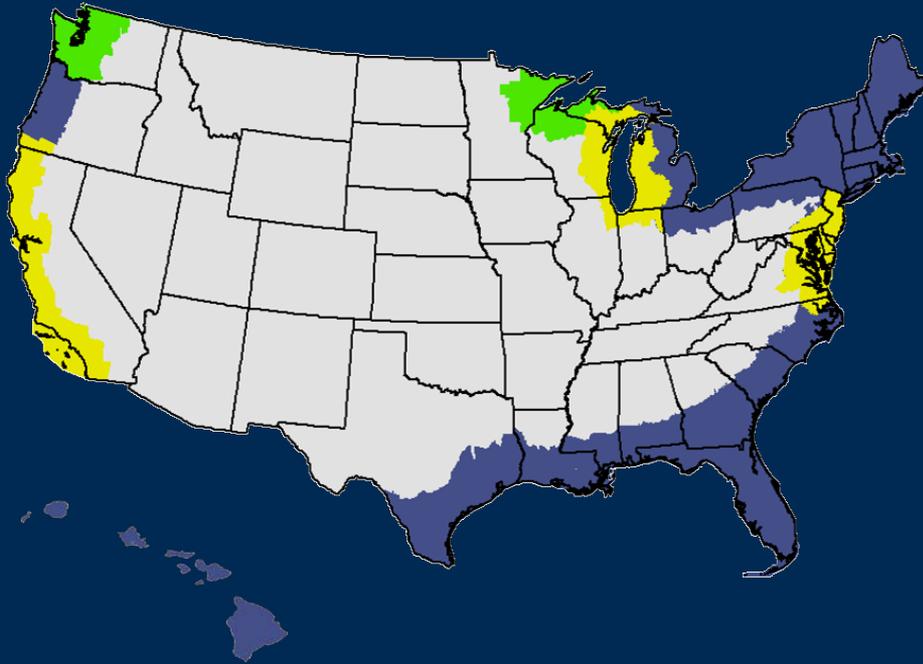
Image USDA Farm Service Agency
Image NOAA

© 2009 Google

43°44'43.18" N 83°35'05.05" W

Eye alt 40836 ft

2011 C-CAP Update Plans



-  Funded
-  Planned
-  Not Currently Funded

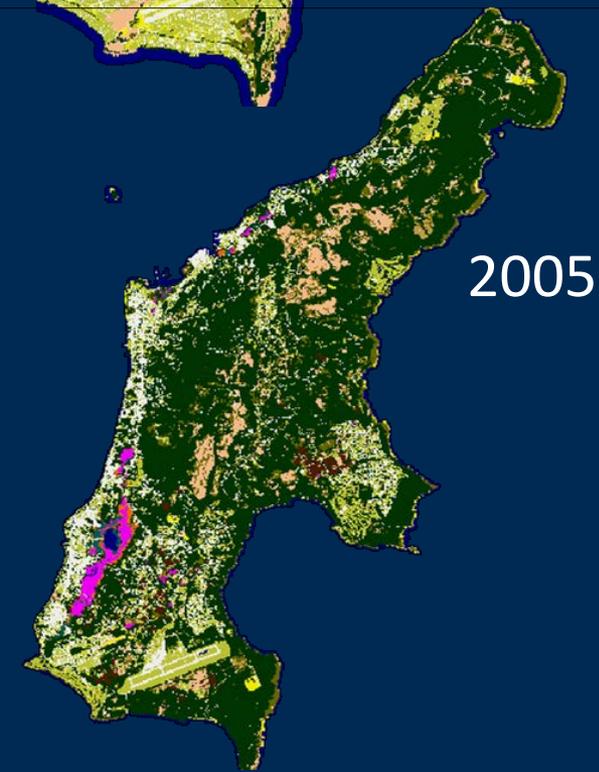
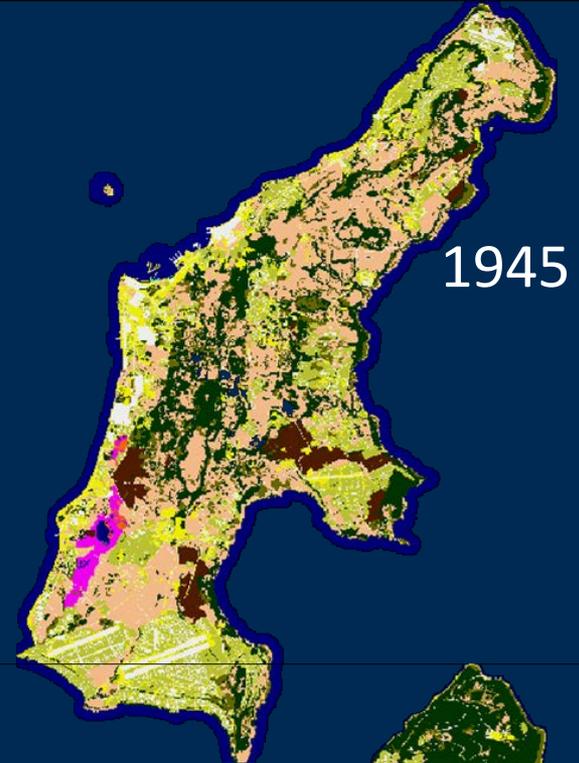
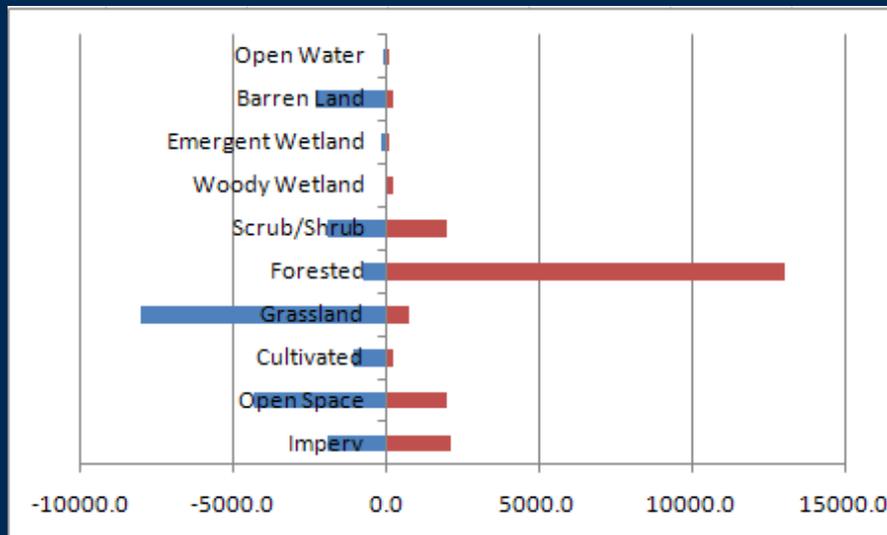
- **Currently Funded**
 - Phase I (will be complete by Sept)
 - Mid-Atlantic
 - Lake Michigan Basin
 - Phase II (will be complete by Dec)
 - Coastal California
- **Awaiting External Funding**
 - Lake Superior Basin
 - Coastal Washington
- **Remaining area updates dependant upon future funding (including FY 2011 budget)**



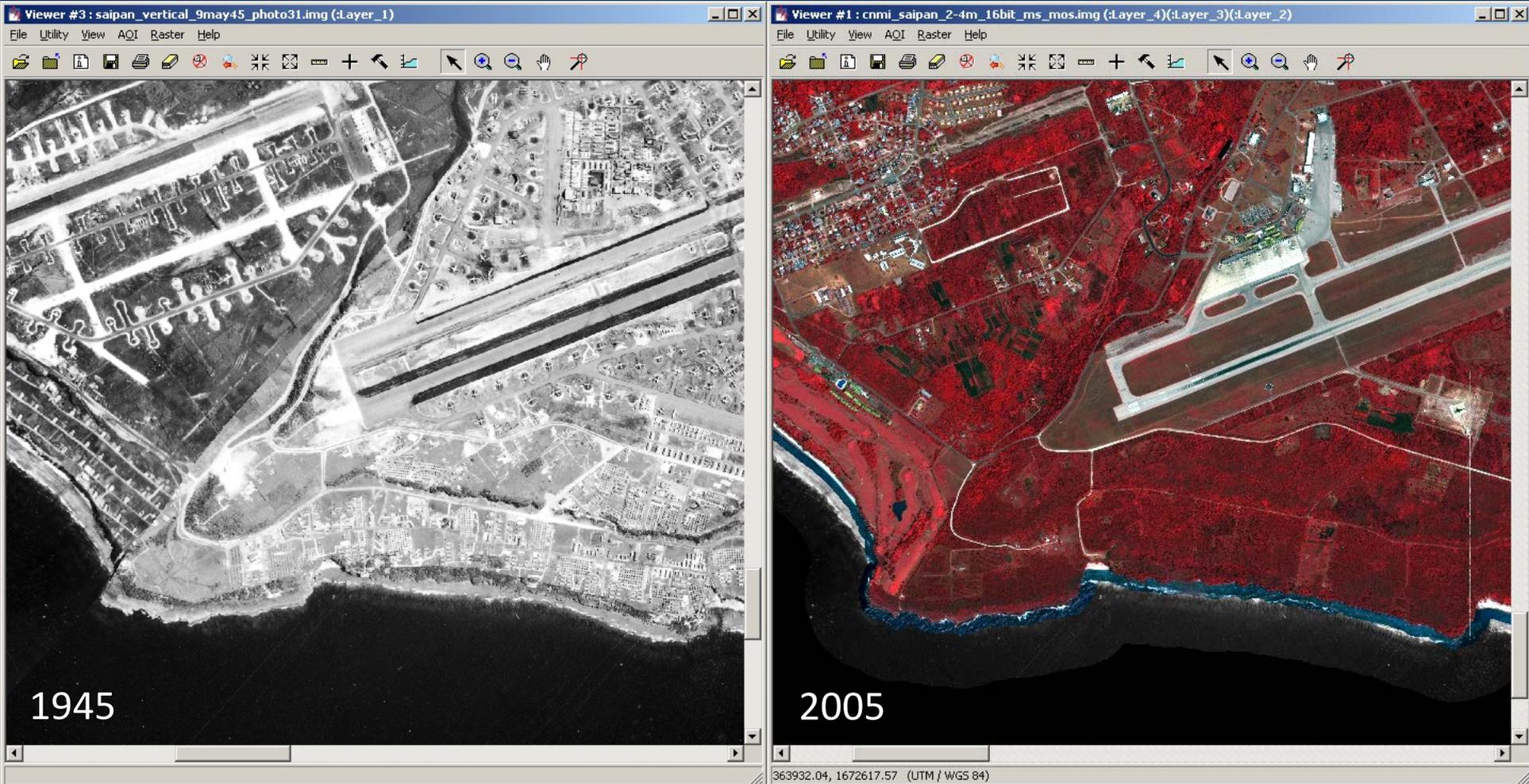
Saipan Historic Change

1945 to 2005 (60 years)

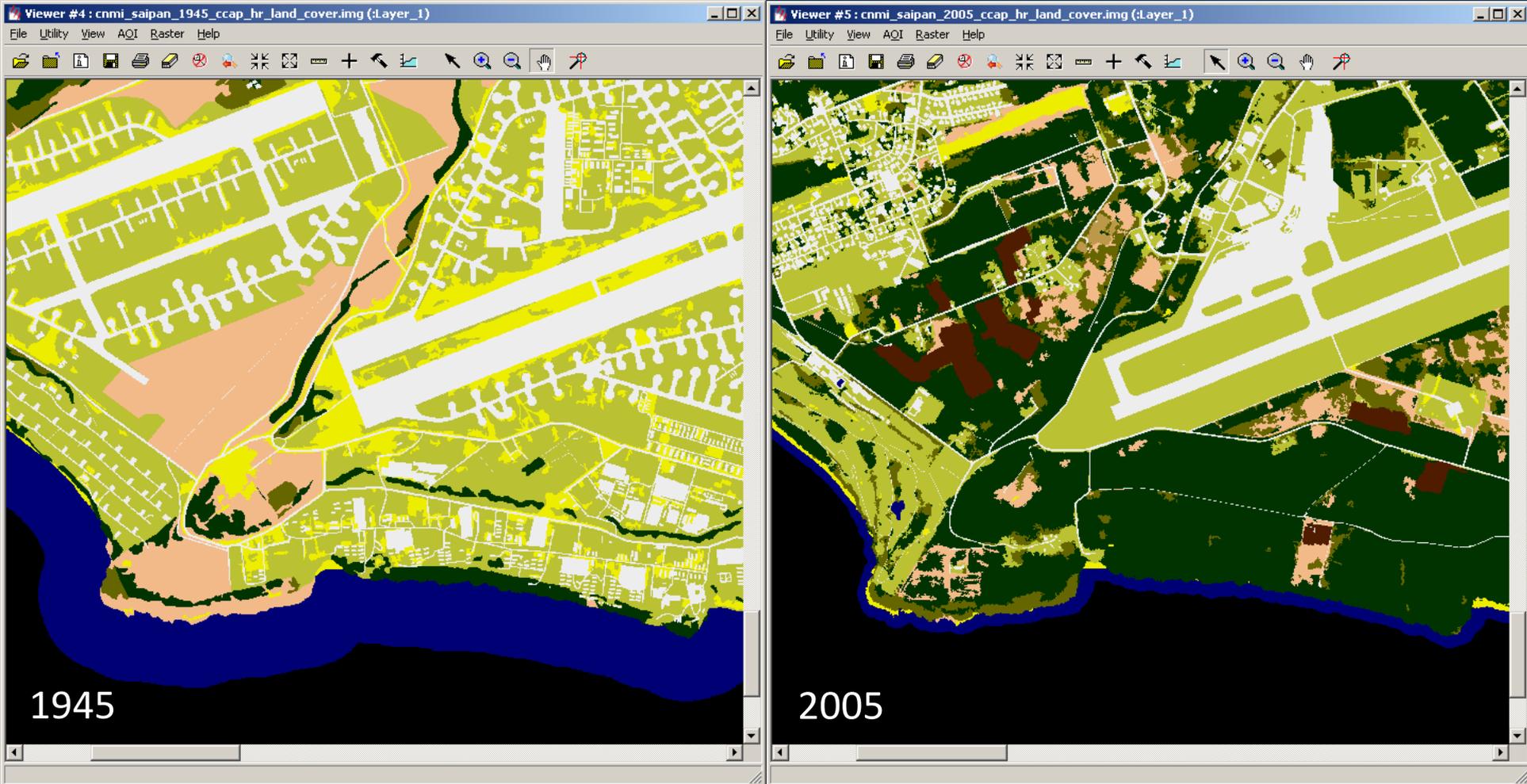
- Based on historical aerial photography and Quickbird data
- Almost 60 percent of the island changed
- Little net change in total developed area
Net loss (open space developed)
Distribution drastically different
- Large amounts of forest regrowth

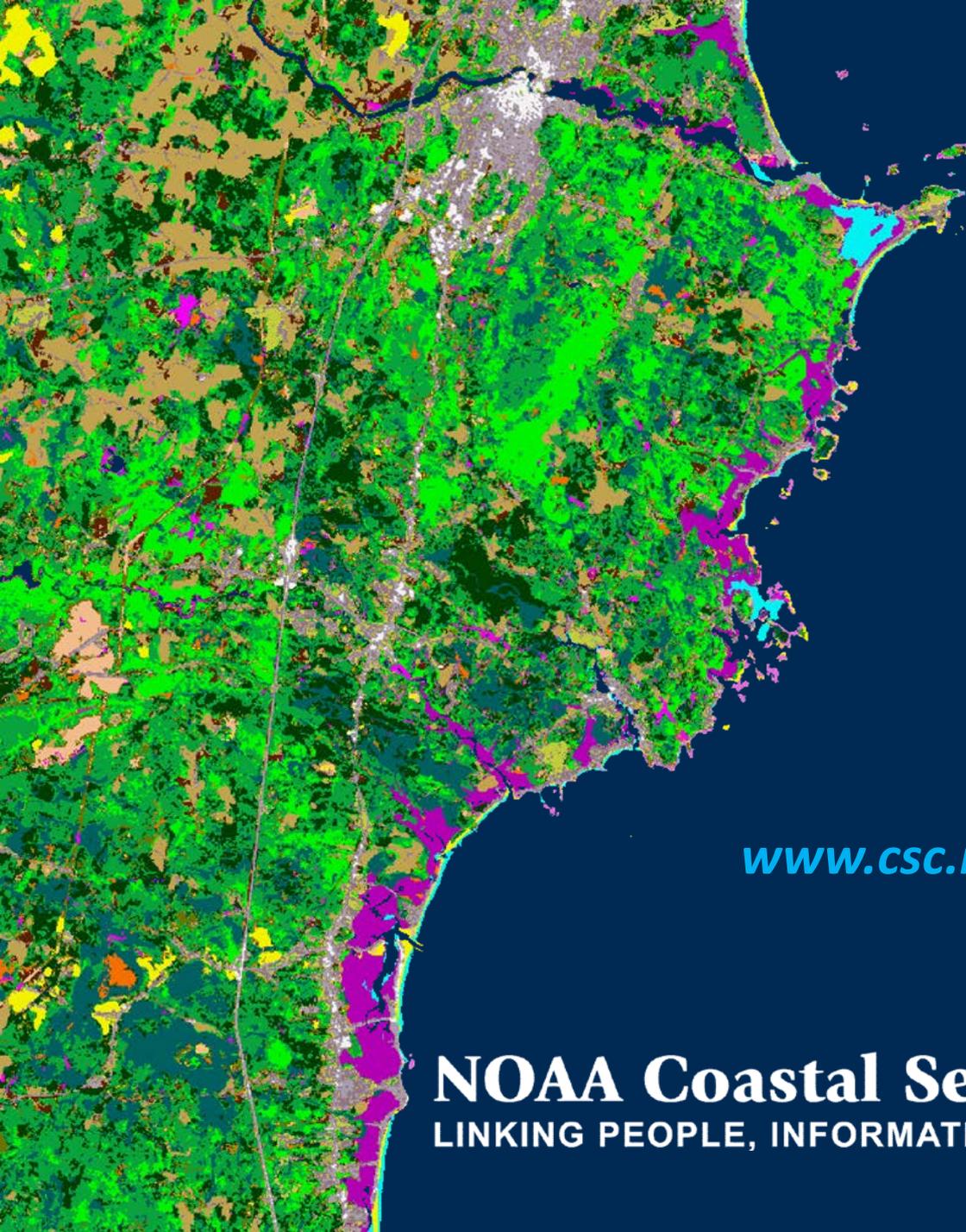


Saipan Historic Change



Saipan Historic Change





Questions?

Nate Herold

National C-CAP Coordinator

(843) 740-1183

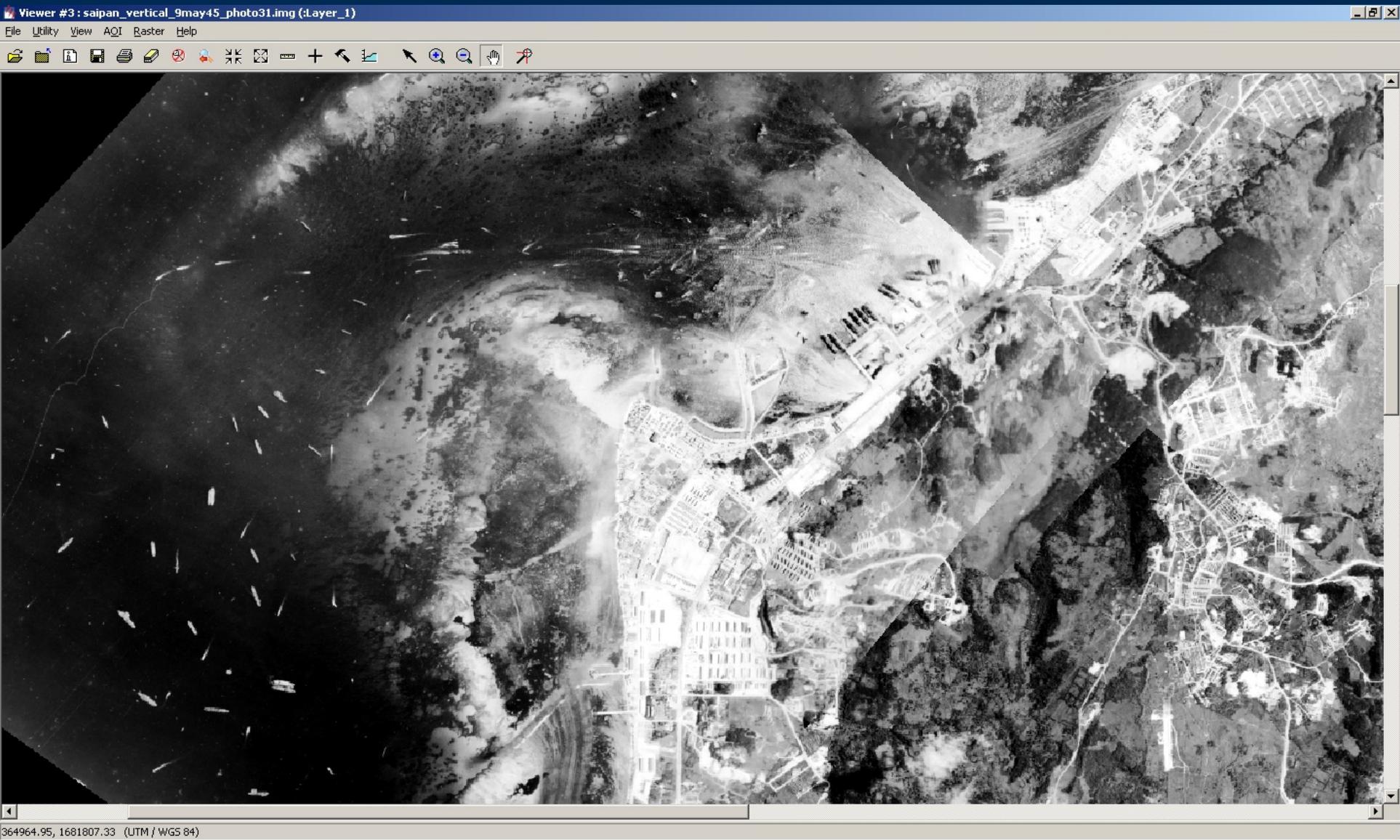
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www.csc.noaa.gov/landcover

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY



1945 Historic Aerial Imagery



1945 Historic Aerial Imagery

