

*Managing a Low-Island Ecosystem
in the Face of Sea Level Rise*

Florida Keys National Wildlife Refuges



Anne Morkill
Florida Keys National Wildlife Refuges Complex
U.S. Fish and Wildlife Service

What's at stake?



Federal Threatened & Endangered Species in the Florida Keys

Mammals

Key deer
Key Largo cotton mouse
Key Largo woodrat
Lower Keys marsh rabbit
Rice rat
West Indian manatee

Birds

Piping plover
Roseate tern
Red knot (C)

Reptiles

American crocodile
Eastern indigo snake
Green sea turtle
Hawksbill sea turtle
Leatherback sea turtle
Loggerhead sea turtle

Fish

Smalltooth sawfish
Key silverside (SSP)
Mangrove rivulus (SSP)

Invertebrates

Schaus swallowtail butterfly
Stock Island tree snail
Elkhorn coral
Staghorn coral
Bartram's hairstreak butterfly (C)
Florida leafwing butterfly (C)
Miami blue butterfly (C)

Plants

Garber's spurge
Key tree-cactus
Big Pine partridge pea (C)
Blodgett's silverbush (C)
Florida indigo (C)
Florida semaphore cactus (C)
Sand flax (C)
Wedge spurge (C)

(C) = USFWS Candidate for listing
(SSP) = NOAA Species of Special Concern

National Key Deer (1957)

Great White Heron NWR (1938)

Key West NWR (1908)

Marquesas

US 1

Big Pine Key

Sugarloaf Key

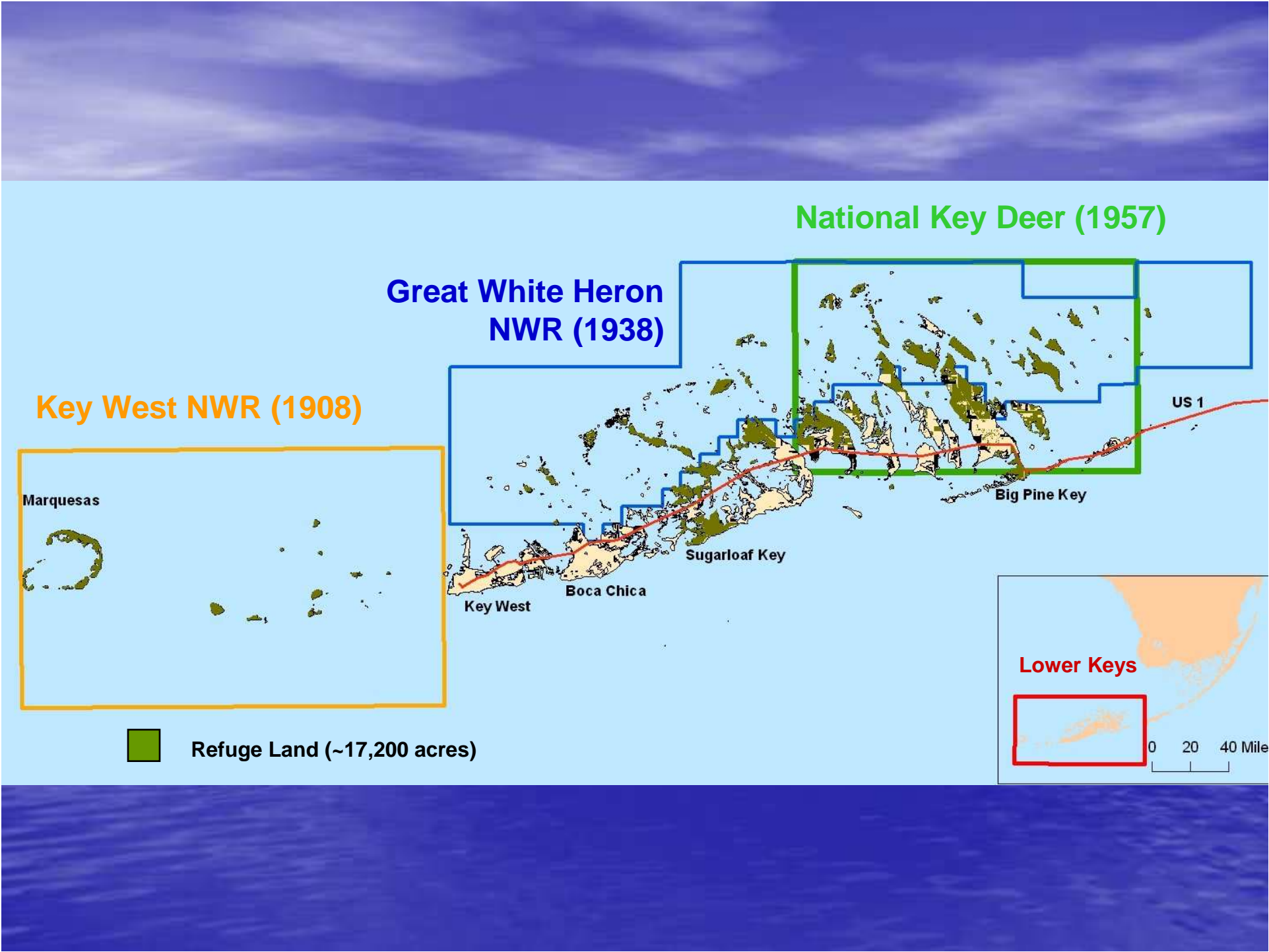
Boca Chica

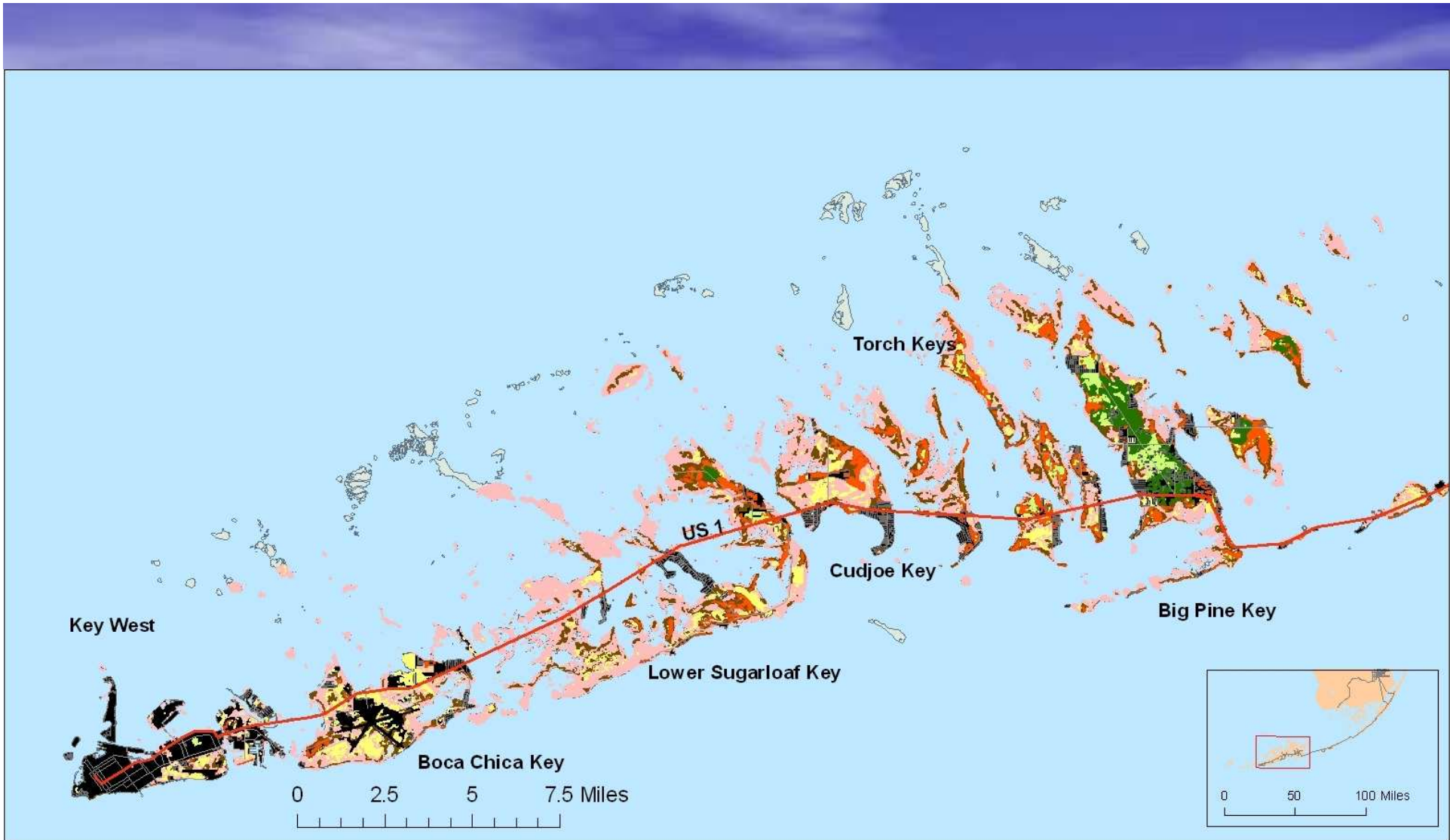
Key West






Lower Keys

Refuge Land (~17,200 acres)

0 20 40 Mile





- | | |
|--|---|
|  Buttonwood Transition Zone |  Hammock |
|  Developed Land |  Mangrove |
|  Freshwater Marsh |  Pine Rockland |
|  Saltwater Marsh |  US Highway 1 |



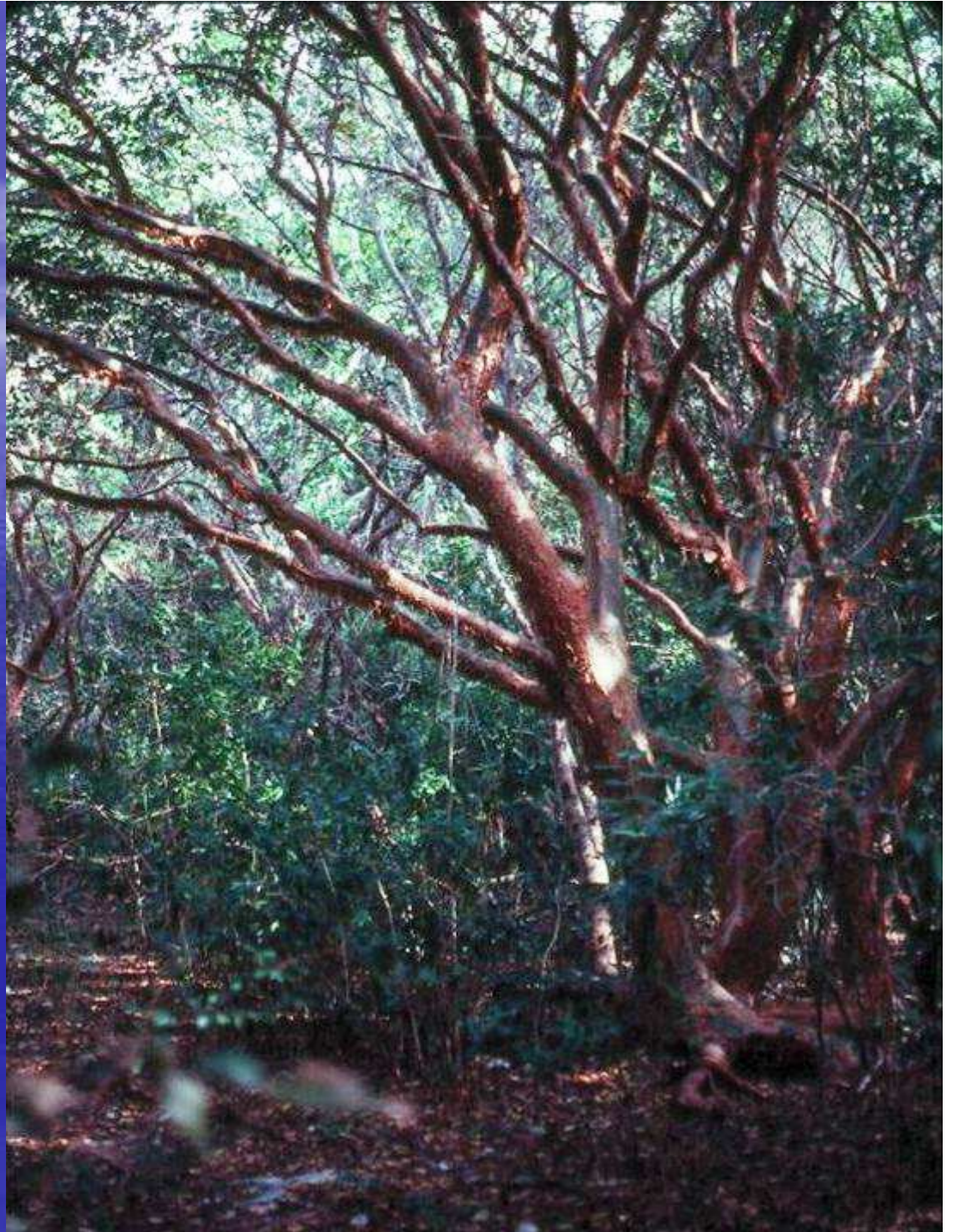
Lower Florida Keys National Wildlife Refuges Land Cover Types



COPYRIGHT 11 26 06 Paula Cannon

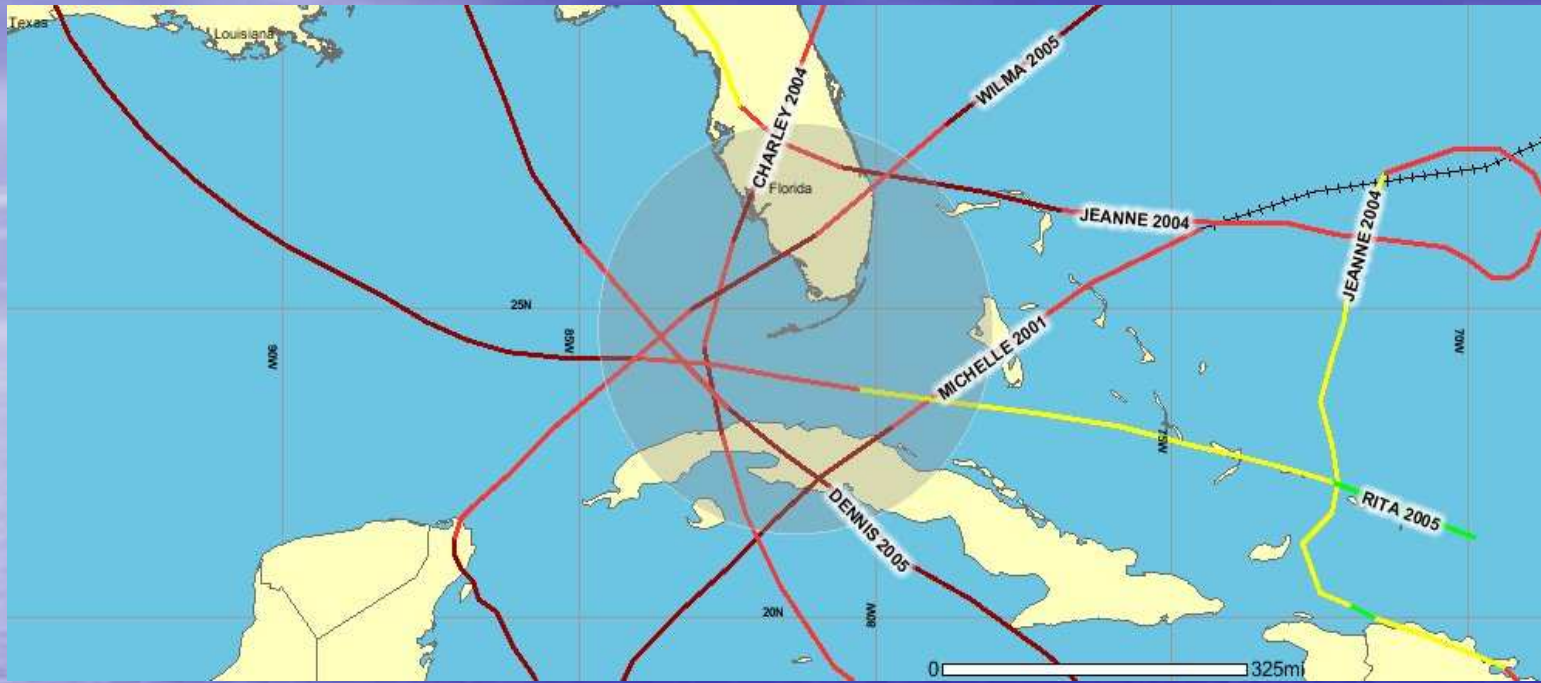












Little Crane Key



Boca Grande Key



3/21/05



Little Pine Key

2/22/07

Big Pine Key



11/10/05 West of 16th St.

11/10/05



3 24 06 from 16th st. across kdb facing W.

3/24/06



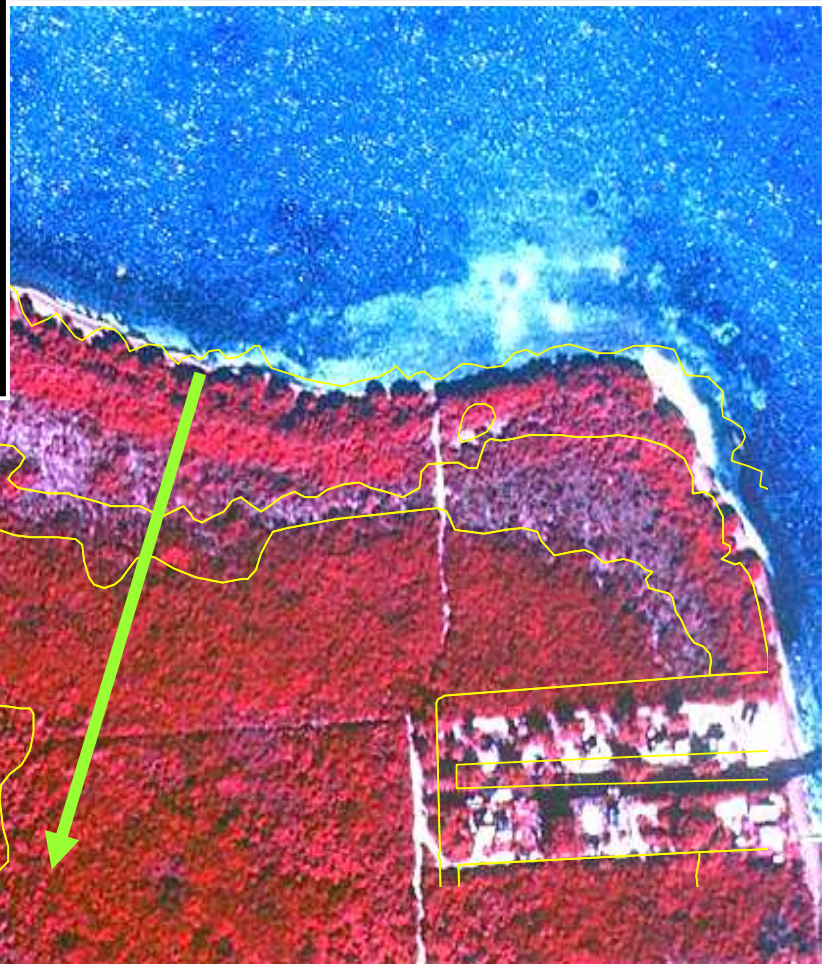
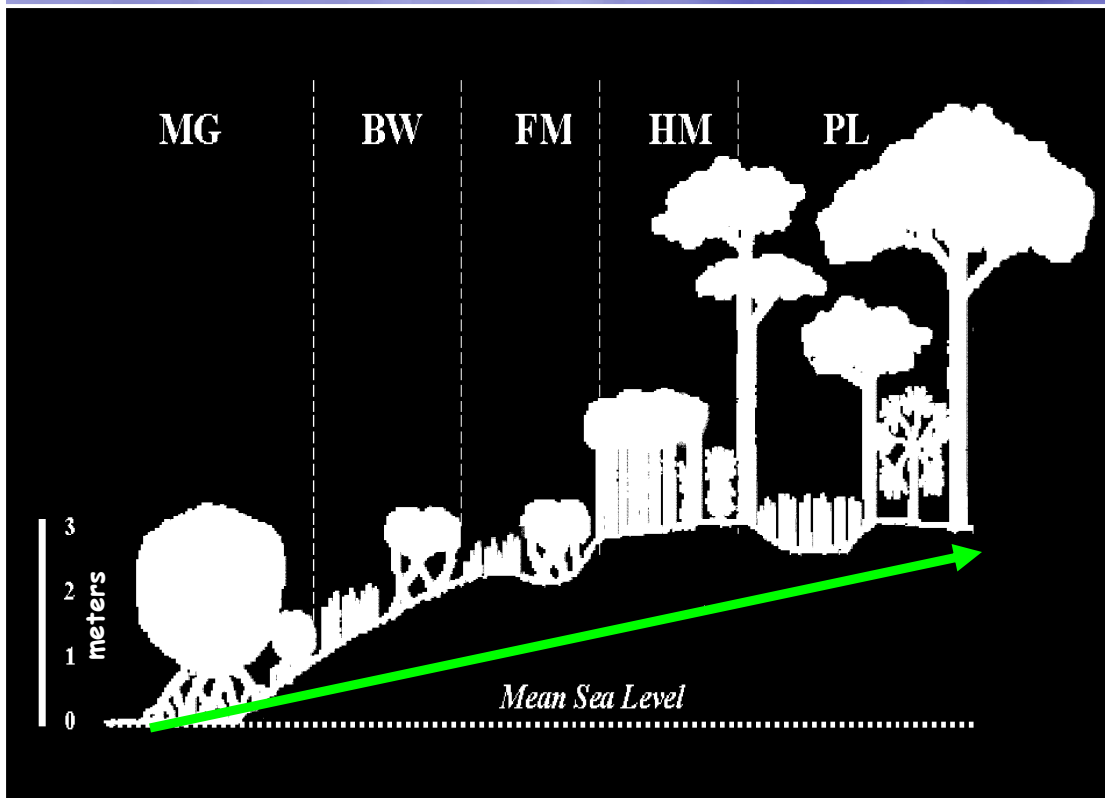
3 16 07 Across from 16st W

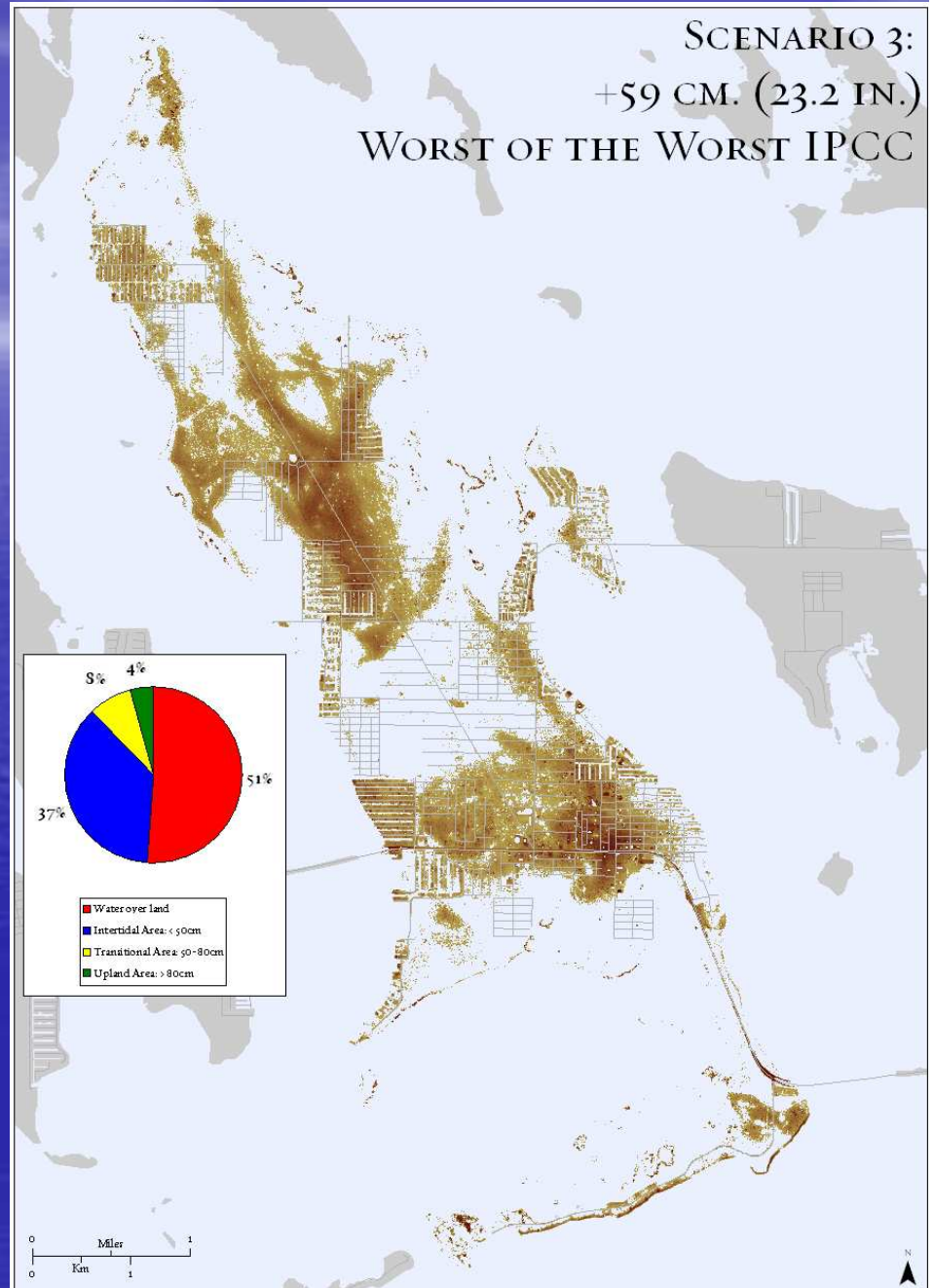
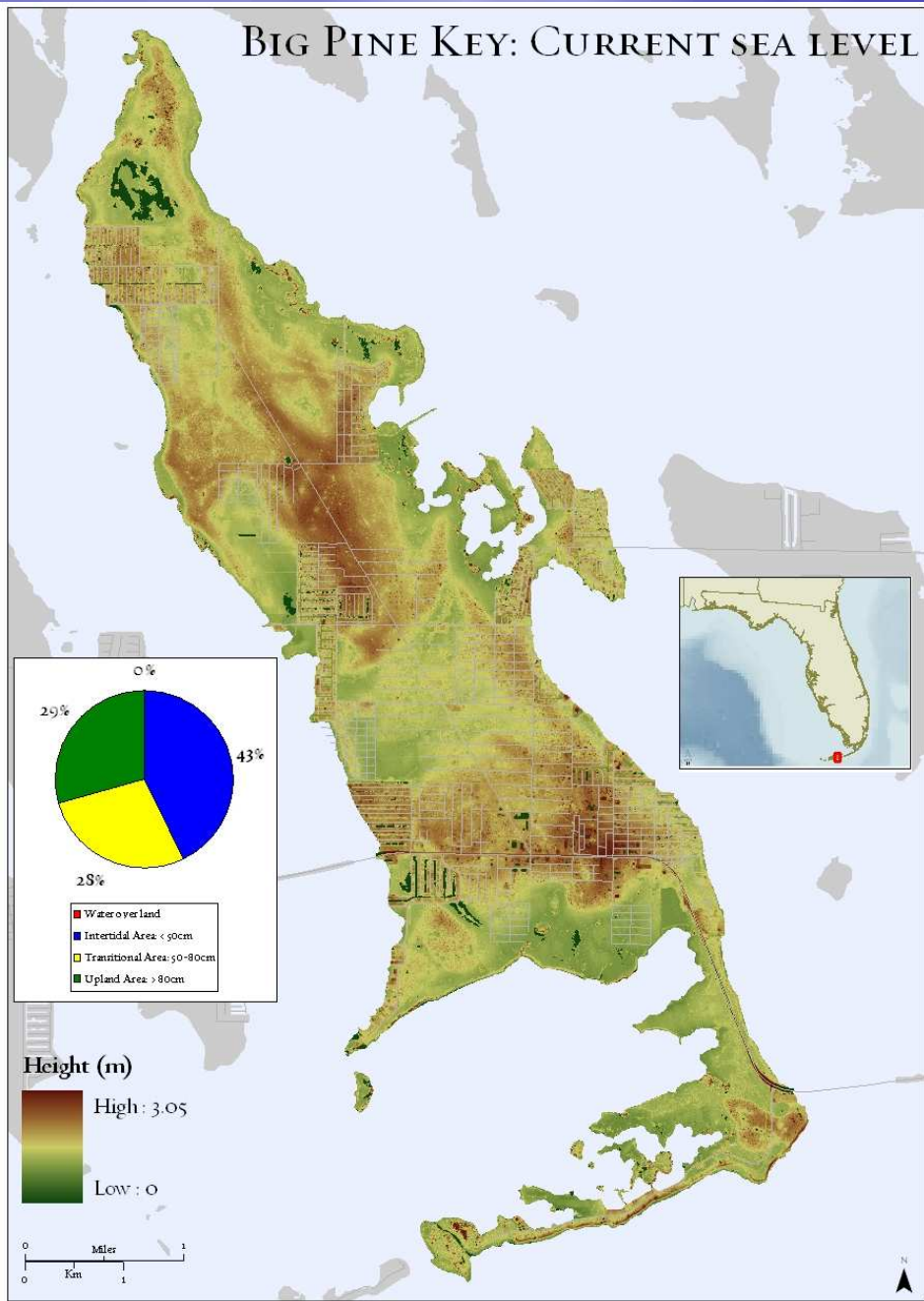
3/16/07

Photo set courtesy of Paula Cannon

Wilma Key (2007)

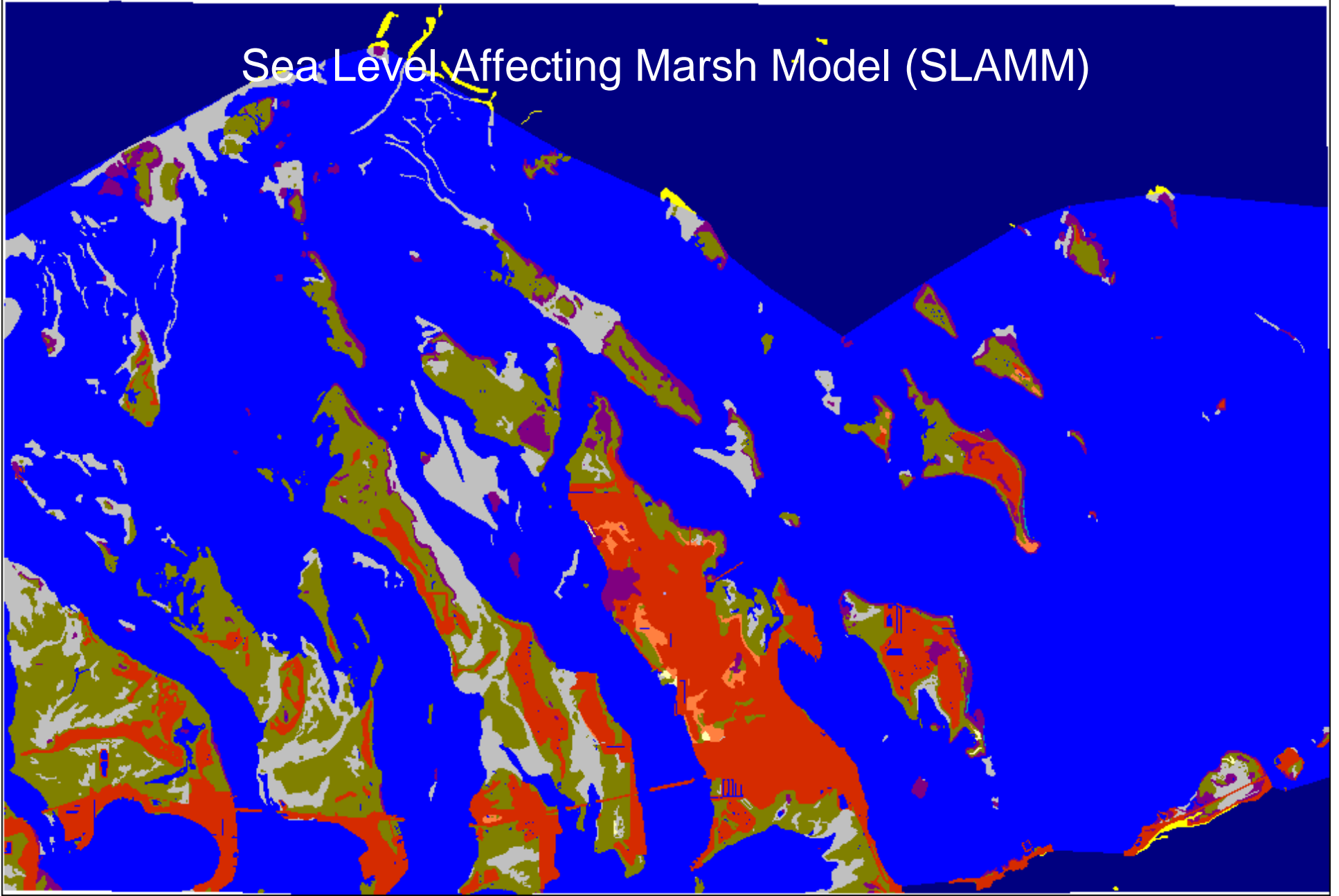






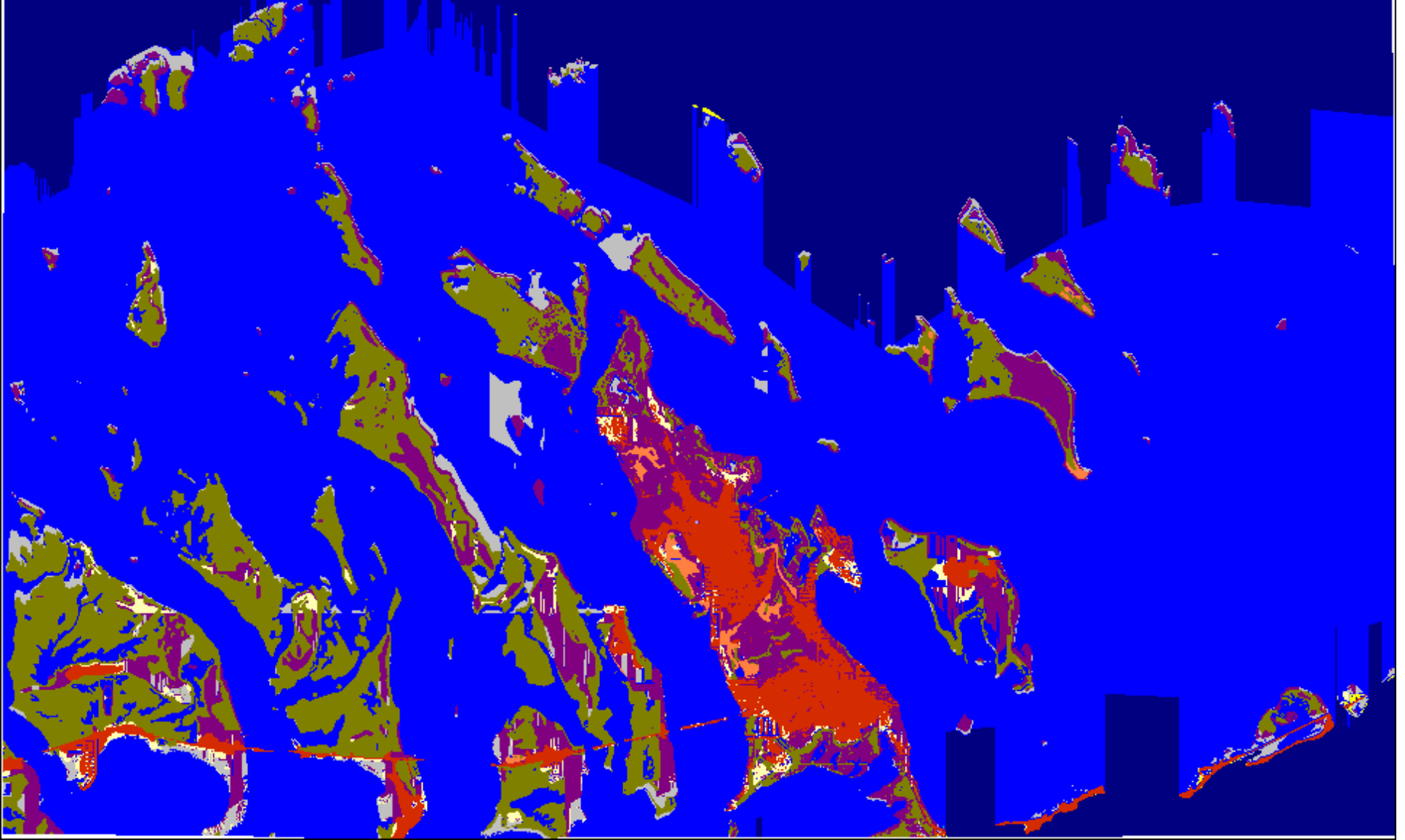
Courtesy of Chris Bergh, The Nature Conservancy

Sea Level Affecting Marsh Model (SLAMM)



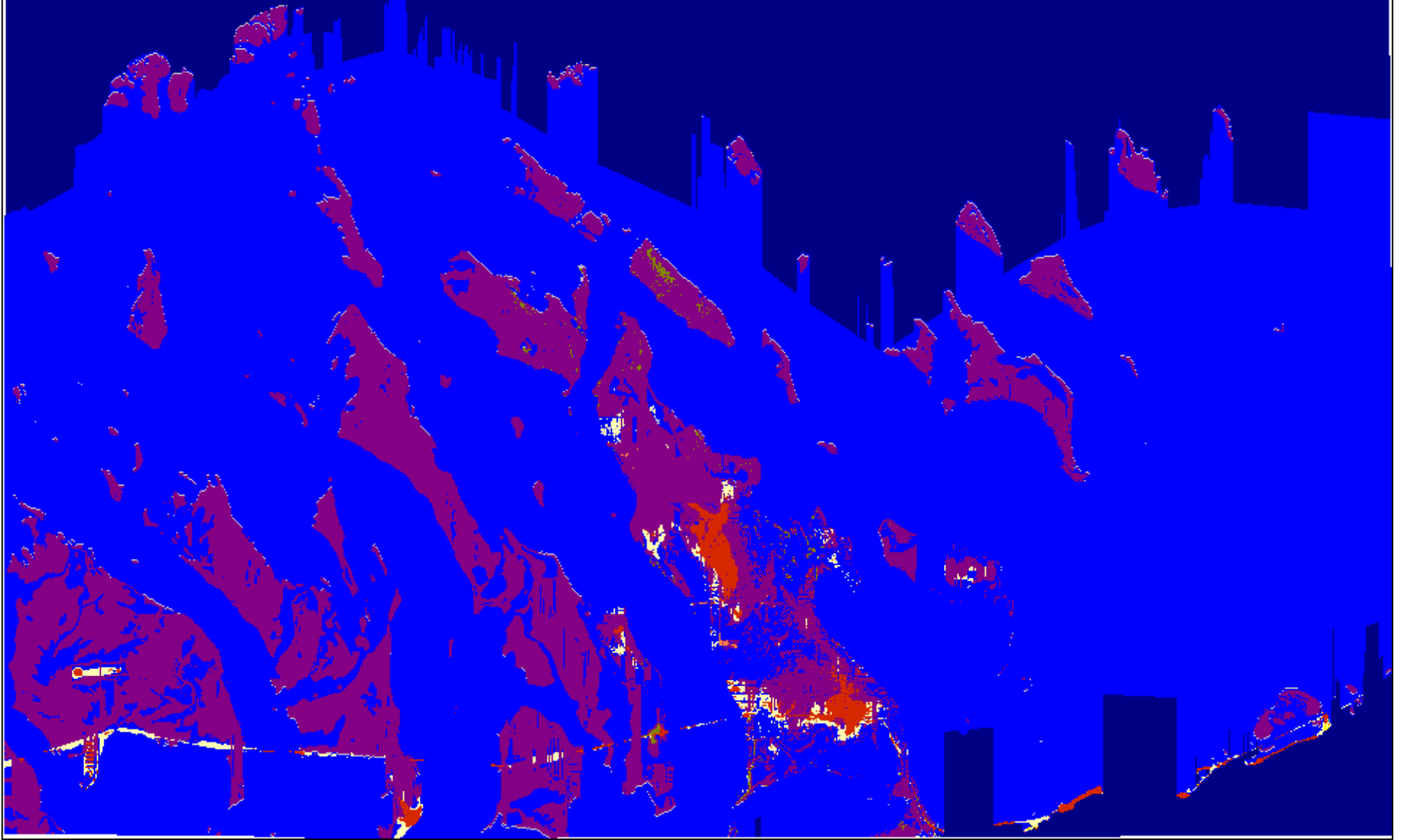
National Key Deer Refuge, Current Condition

Sea Level Affecting Marsh Model (SLAMM)



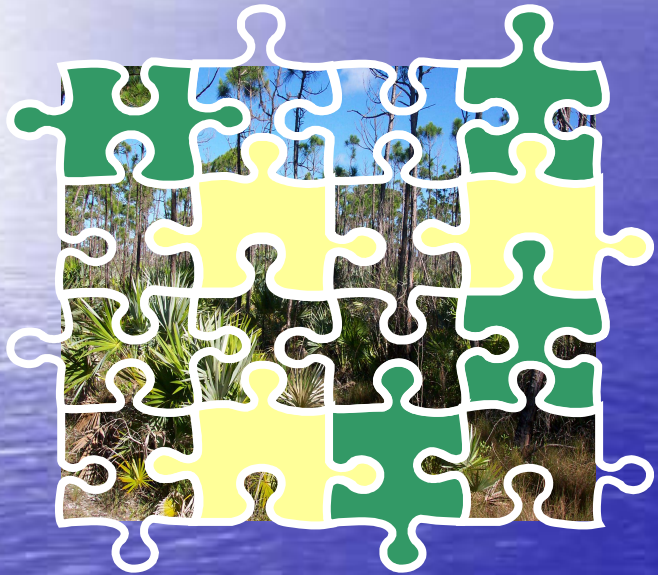
National Key Deer Refuge, ~0.5 m SLR by 2100

Sea Level Affecting Marsh Model (SLAMM)



National Key Deer Refuge, 1 m SLR by 2100

Managing a Low-Island Ecosystem in the Face of Sea Level Rise



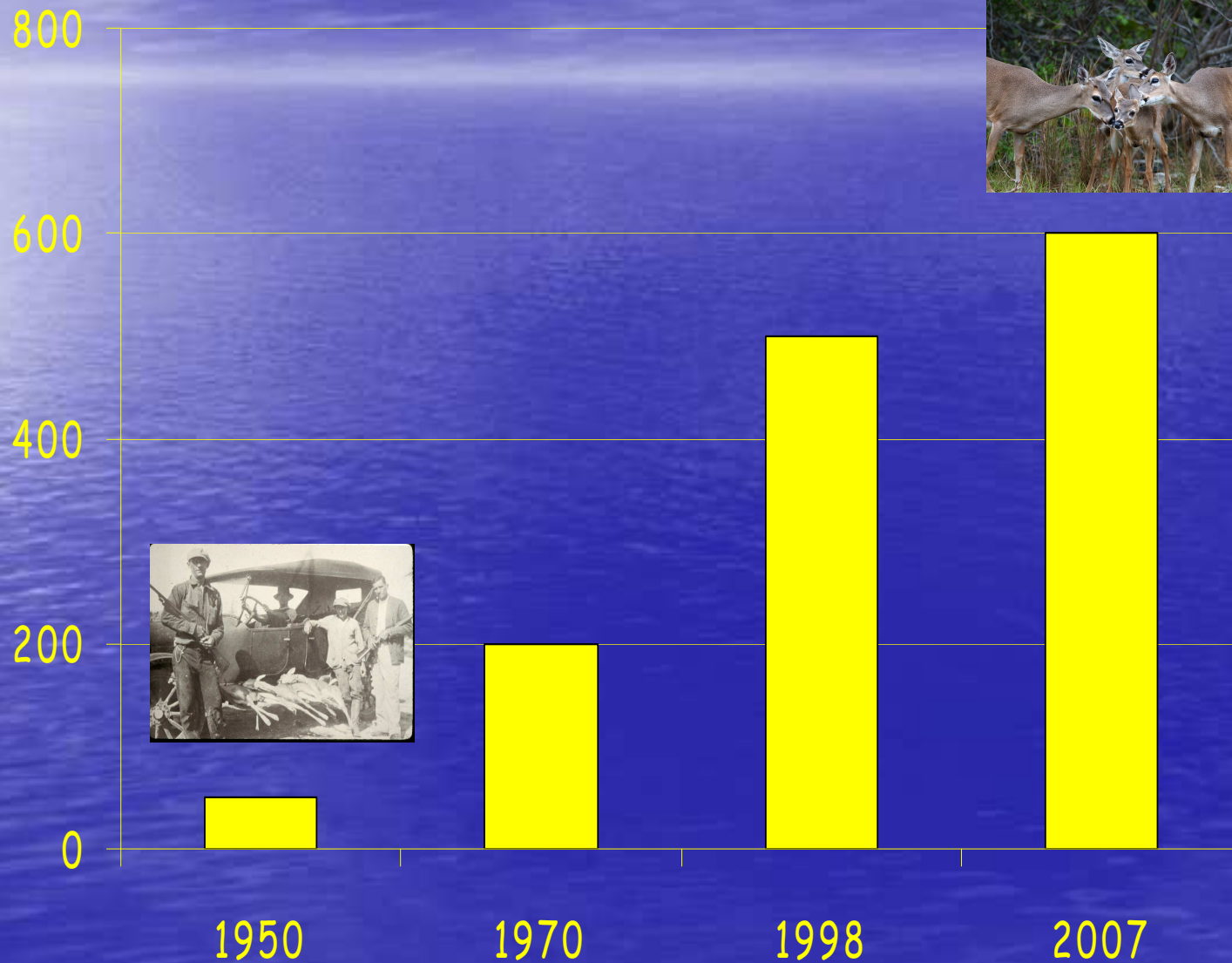
Traditional refuge management:

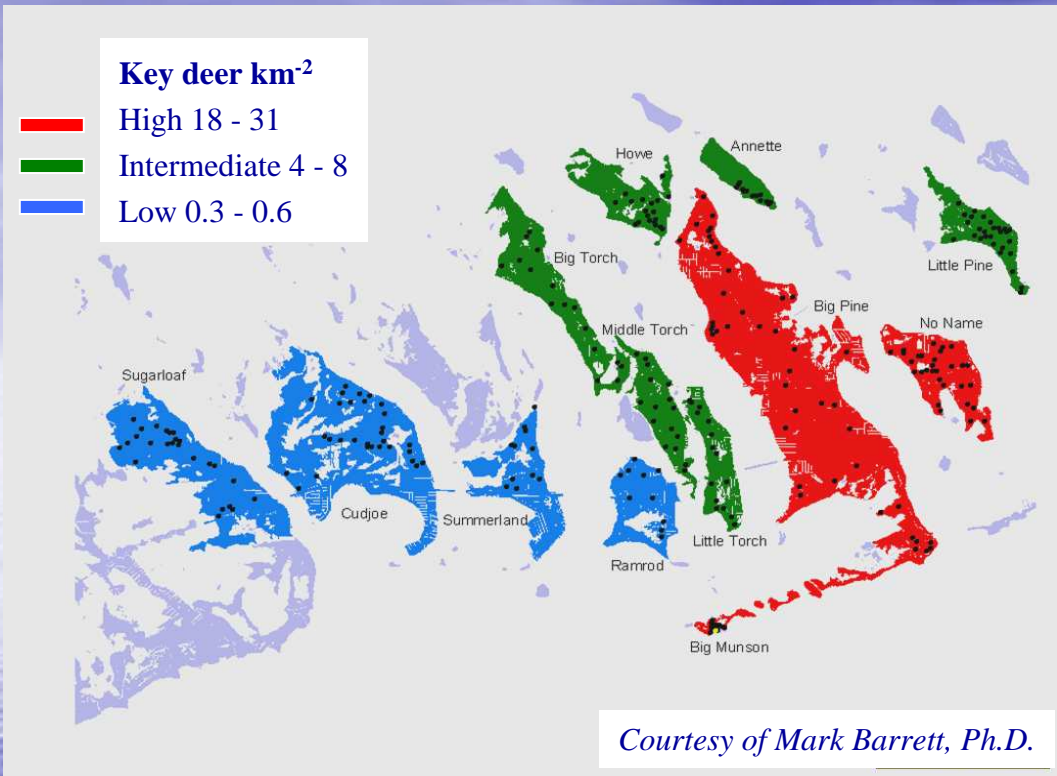
- Return habitat to historic conditions
- Return community to historic assemblage
- Opportunistic land acquisition
- Restore degraded habitats to natural gradient

Paradigm shift:

- Restore ecosystem processes
- Enhance habitat's capacity to recover from disturbance (resiliency)
- Strategic land acquisition to provide habitat and species migration corridors
- Focus habitat management efforts on higher elevation habitats that may persist longest
- Restore degraded habitats but maintain elevated gradient

Key Deer: An Endangered Species Success Story?





Developing an adaptive management framework for the implementation of prescribed fire in the face of climate change

Partners: Florida International University, USGS Florida Integrated Science Center, The Nature Conservancy, Institute for Regional Conservation, University of Tennessee, USFS National Fire Lab



- Fire behavior and fuels modeling
- Distribution of rare & endemic plants
- Plant community response to interactions between disturbance regimes, sea-level rise, and hydrology
- Fire history as determined by sediment coring and tree ring analysis
- Optimize ecologically appropriate outcomes (enhance biological diversity) vs. socially acceptable outcomes (reduce hazardous fuel loads)
- Enhance habitat resiliency and adaptability to climate-driven disturbances
- Strategic land acquisition to expand habitat connectivity and enhance management capability

Structured decision making process for prioritizing conservation strategies for the Lower Keys marsh rabbit in the face of climate change

Partners: USGS Patuxent Wildlife Research Center, University of New Hampshire, University of Central Florida, USFS Center for Forest Disturbance Science



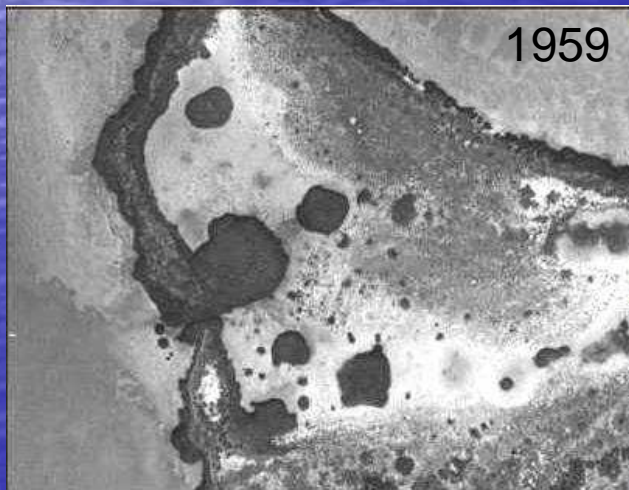
- Occupancy modeling to design effective monitoring protocol
- Feral cat removal
- Translocations
- Prescribed fire management to control overstory encroachment
- Strategic land acquisition to enhance habitat connectivity
- Sea level rise modeling to assess fate of rabbit habitat
- Captive breeding?

*Assessing loss of salt pond and tidal lagoon habitat for Species of Special Concern: Key silverside (*Menidia conchorum*)*

Partner: Dr. Charles D. Getter (ImpactofSeaLevelRise.org)



- Increased connection to tidal waters
- Increase in size and extent of tidal creeks
- Increase in size and extent of red mangrove forests
- Shift from salt pond to tidal lagoons
- Changes in salinity, flora, and fish community assemblage



Assess future fate of tidal flats and loss of foraging habitat for wading birds from sea level rise

Partners: Avian Conservation & Research Inc., Florida Atlantic University, USGS Coastal & Marine Geology Program, NOAA Center for Coastal Monitoring & Assessment, FFWCC, etc.



- Acquire shallow water bathymetric maps for backcountry
- Refine benthic habitat maps
- Monitor habitat use and foraging behavior of wading birds e.g. little blue herons, reddish egrets, great white herons, etc.
- Model sea level rise scenarios to assess changes in distribution and extent of tidal flats

Managing a Low-Island Ecosystem in the Face of Sea Level Rise

Public critics change their alarm call...“The sky is falling!” to “The sea level is rising!”

“The effects of sea level change is that the animals will die...what is NOT known about that?”

“There is no need to spend tax dollars and time to see why herons are disappearing when we know sea level is rising and changing the environment.”

“In addition to killing pines, prescription burns have removed soil, decreased biodiversity, and made these ecosystems more vulnerable to hurricanes and sea level rise.”

Comments received on Comprehensive Conservation Plan for the Lower Florida Keys National Wildlife Refuges



Questions?

For more information:

Anne Morkill

anne_morkill@fws.gov

(305) 872-2239