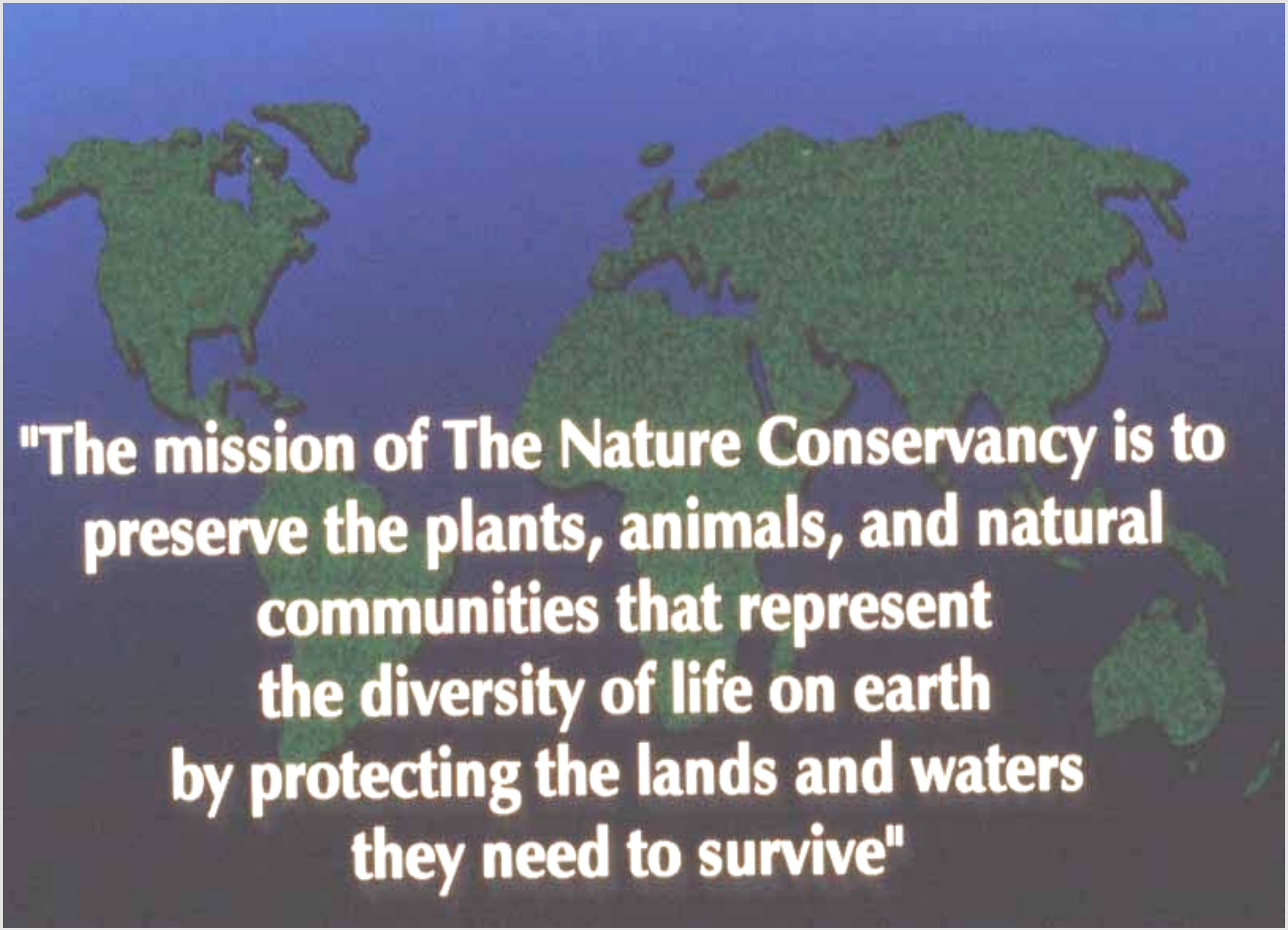
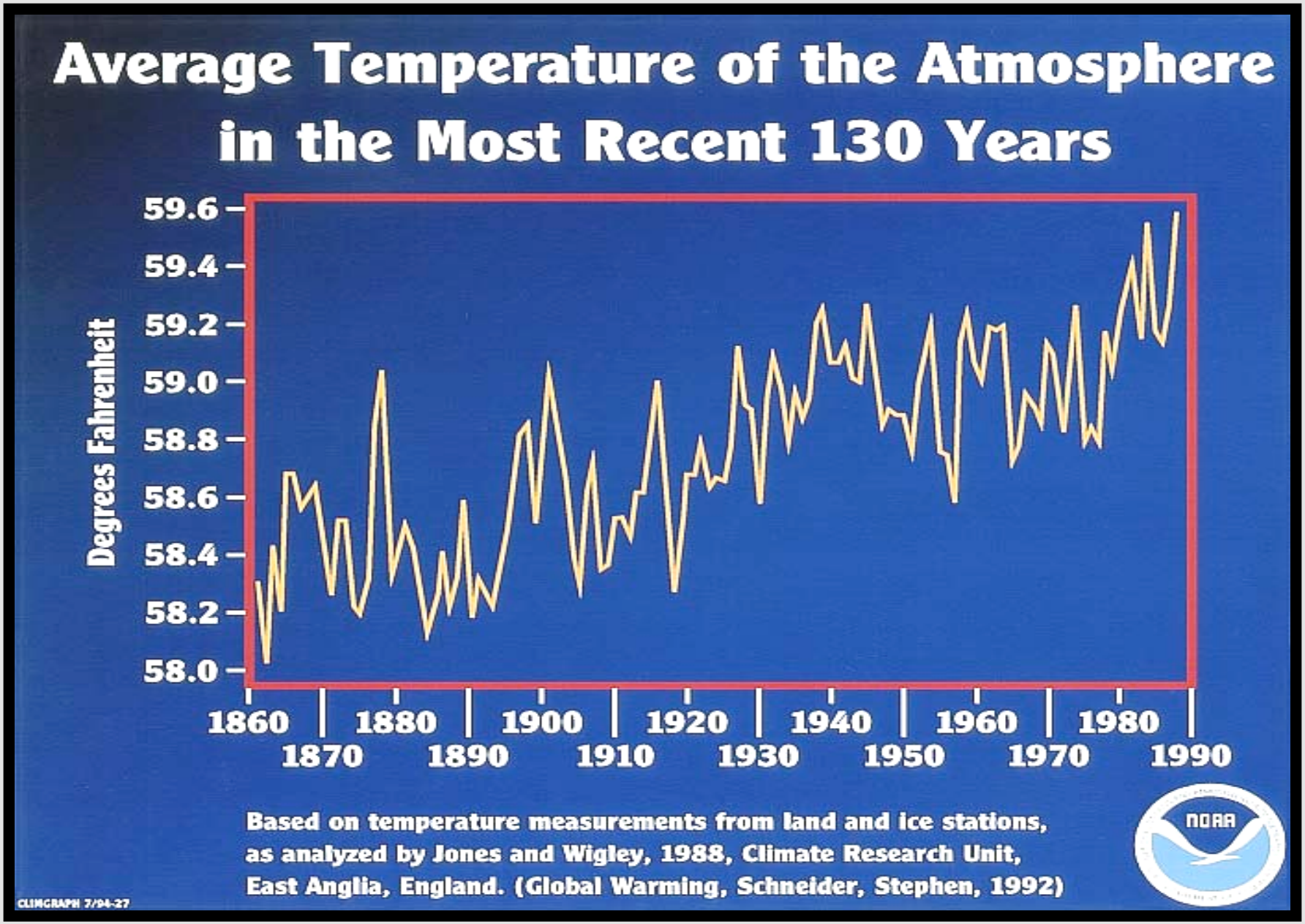
TNC's Adaptation Efforts in Conservation Landscapes: Sentinel Ecosystems

Sam Pearsall
Jeff DeBlieu

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH


"The mission of The Nature Conservancy is to
preserve the plants, animals, and natural
communities that represent
the diversity of life on earth
by protecting the lands and waters
they need to survive"


Average Temperature of the Atmosphere
in the Most Recent 130 Years
Degrees Fahrenheit
59.6
59.4
59.2
59.0
58.8
58.6
58.4
58.2
58.0
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Based on temperature measurements from land and ice stations,
as analyzed by Jones and Wigley, 1988, Climate Research Unit,
East Anglia, England. (Global Warming, Schneider, Stephen, 1992)
NOAA
CLIMGRAPH 7/94-27

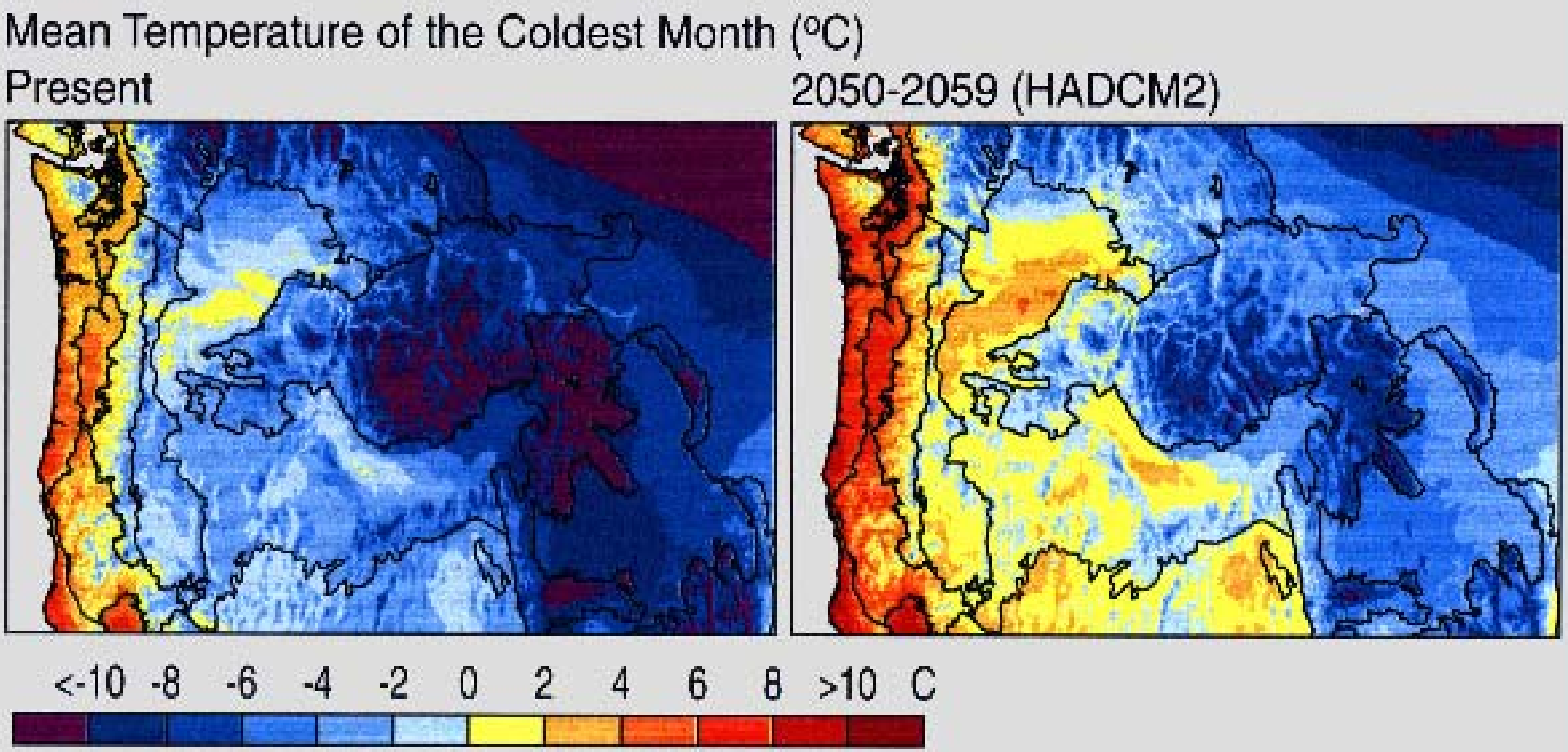


Figure 6. Mean temperature of the coldest month from the observed (1951-1980) climate data (left panel) and from the future (2050-2059) climate scenario (right panel). [Sarah Shafer, MS]

US Northwest 2x Scenario

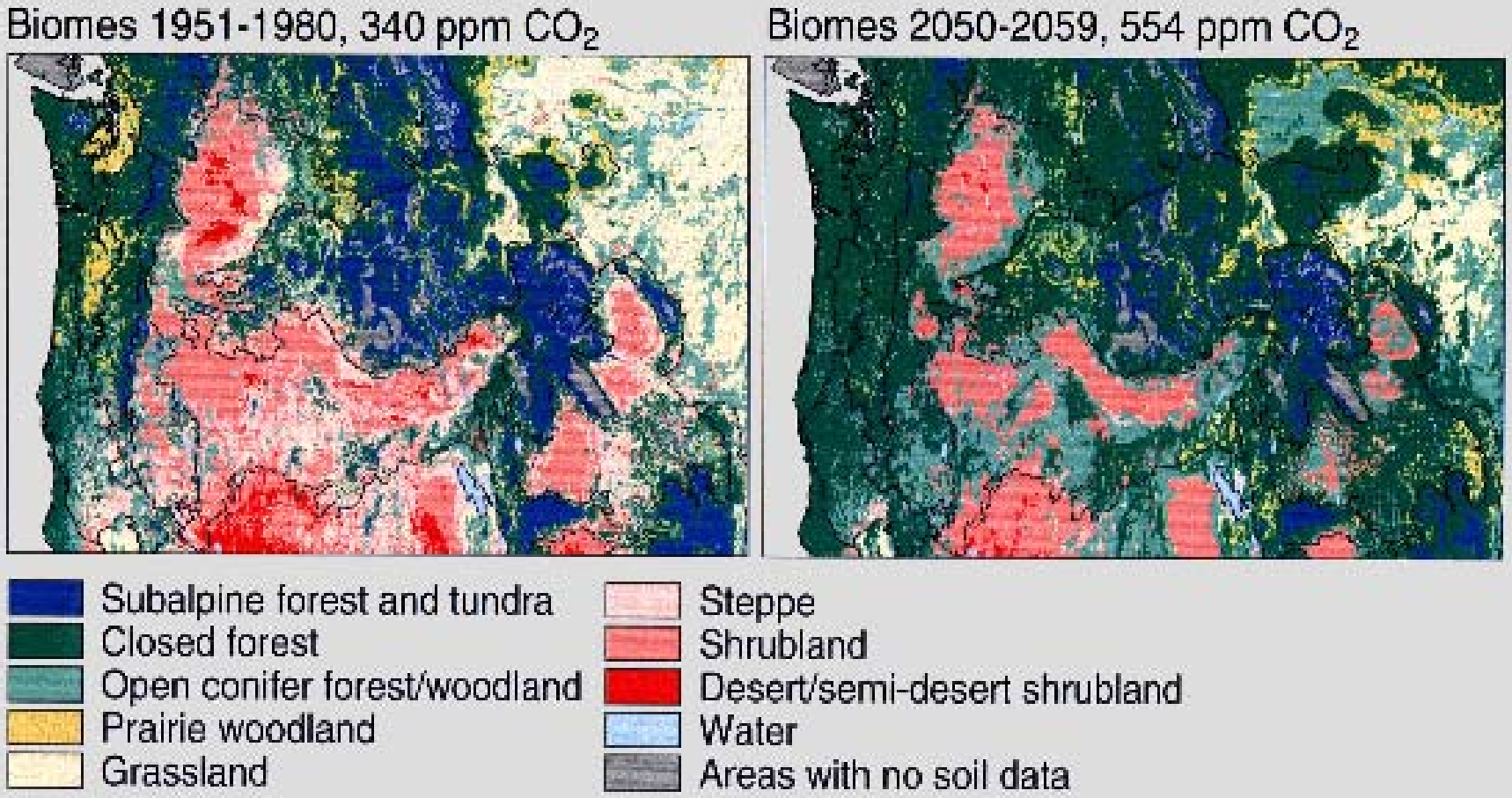
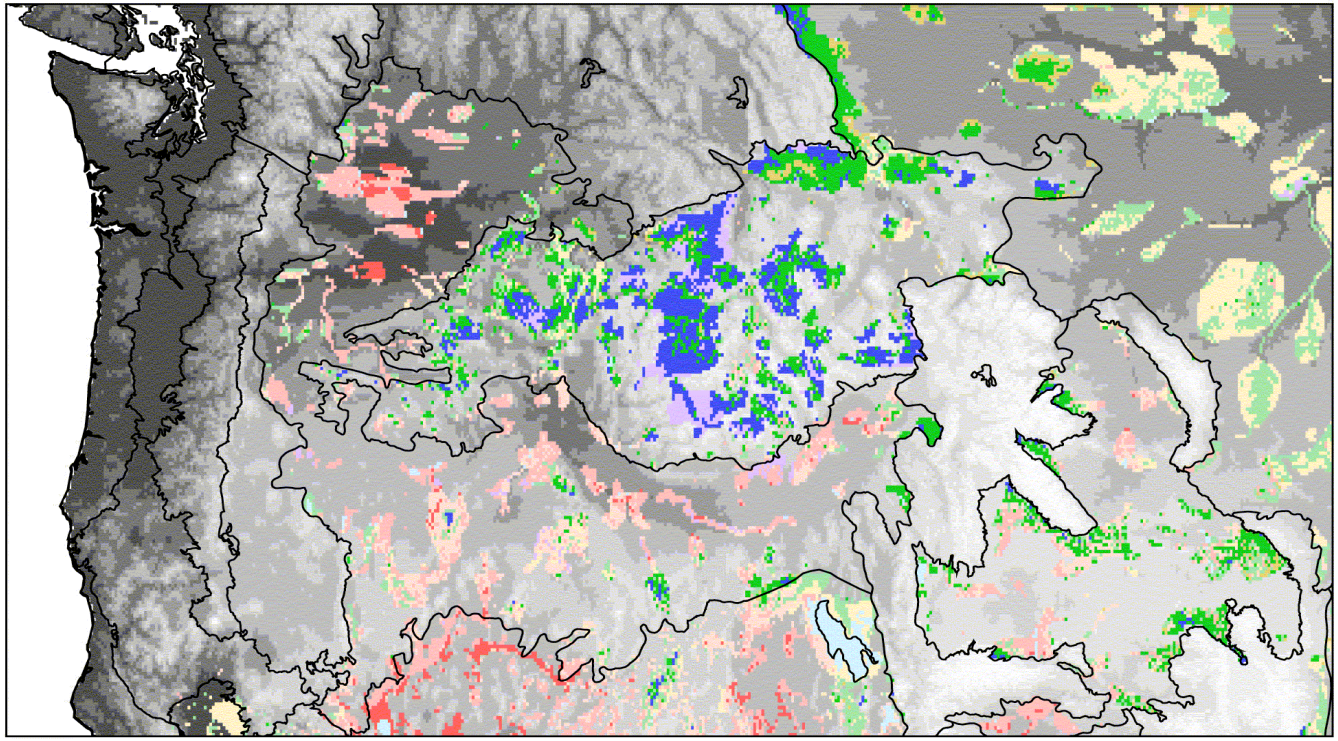


Figure 3. Biomes simulated using the observed (1951-1980) climate data with 340 ppm CO_2 (left panel) and the future (2050-2059) climate scenario with 554 ppm CO_2 (right panel). [Sarah Shafer, MS]

Portfolio Sites
Simulated Biomes, 1951-1980, 340 ppm CO_2

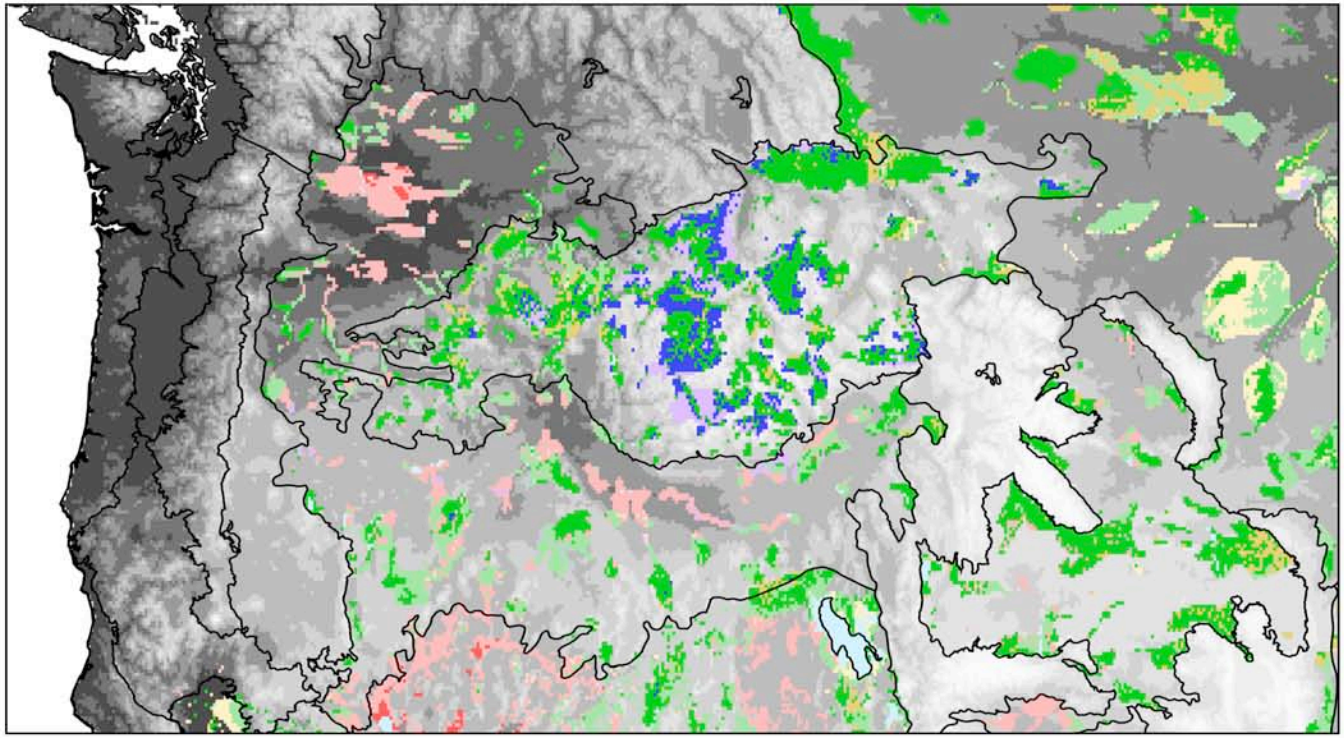


Environmental Change Research Group, Dept. of Geography, Univ. of Oregon.
Biomes simulated using a modified version of BIOME4, ver. 2. Kaplan and Prentice, 1999 model release.

- Subalpine forest and tundra
- Closed forest
- Open conifer forest/woodland
- Prairie woodland
- Grassland
- Steppe
- Shrubland
- Desert/semi-desert shrubland
- Water
- Areas with no soil data

Portfolio site biomes simulated using observed (1951-1980) climate data with 340 ppm CO_2.

Portfolio Sites
Simulated Biomes, 2050-2059, 554 ppm CO_2

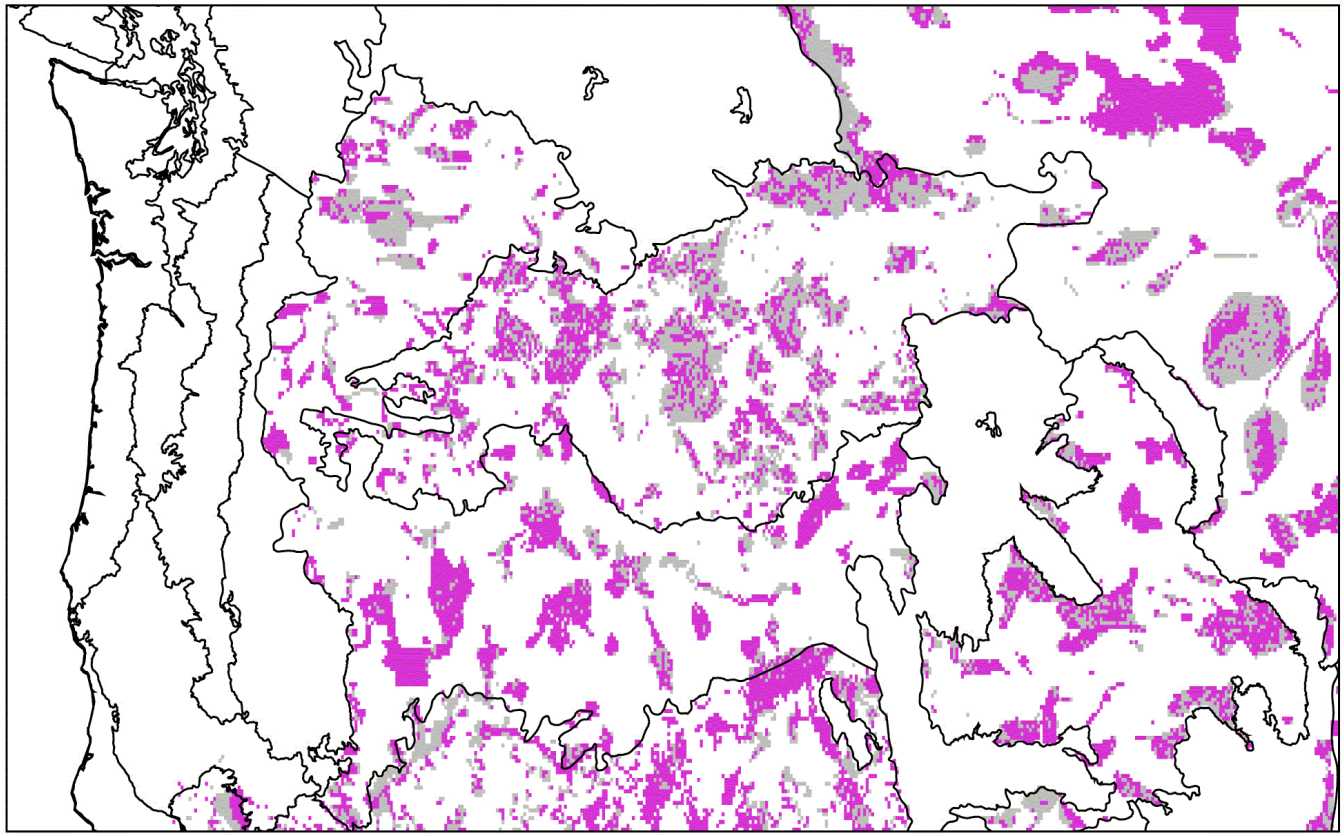


Environmental Change Research Group, Dept. of Geography, Univ. of Oregon.
Biomes simulated using a modified version of BIOME4, ver. 2. Kaplan and Prentice, 1999 model release.

- Subalpine forest and tundra
- Closed forest
- Open conifer forest/woodland
- Prairie woodland
- Grassland
- Steppe
- Shrubland
- Desert/semi-desert shrubland
- Water
- Areas with no soil data

Portfolio site biomes simulated using the HADCM2 future (2050-2059) climate scenario data with 554 ppm CO_2.

Simulated Future Biome Changes for Portfolio Sites



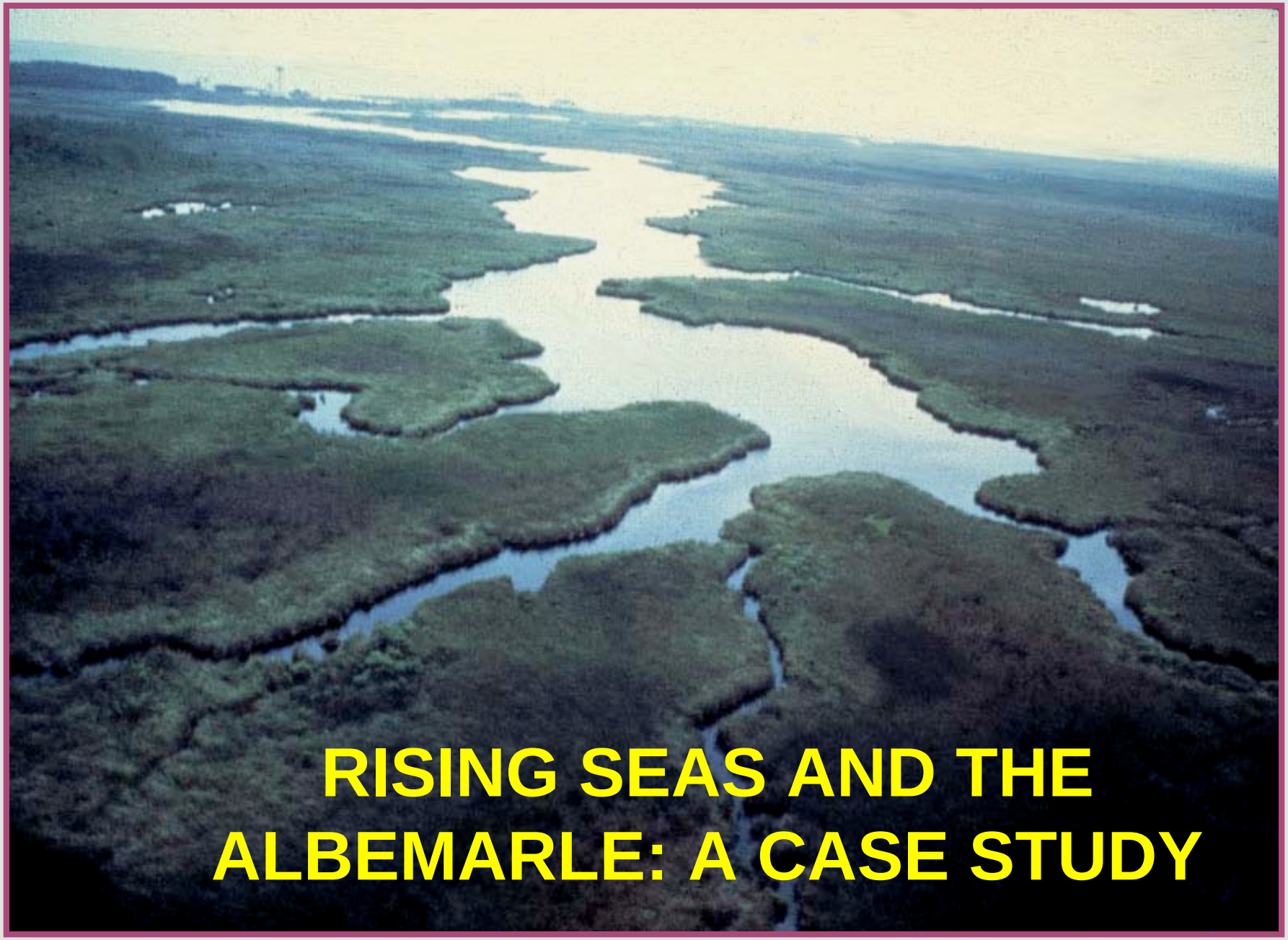
Environmental Change Research Group, Dept. of Geography, Univ. of Oregon.
Biomes simulated using a modified version of BIOME4, ver. 2. Kaplan and Prentice, 1999 model release.

Change
No change

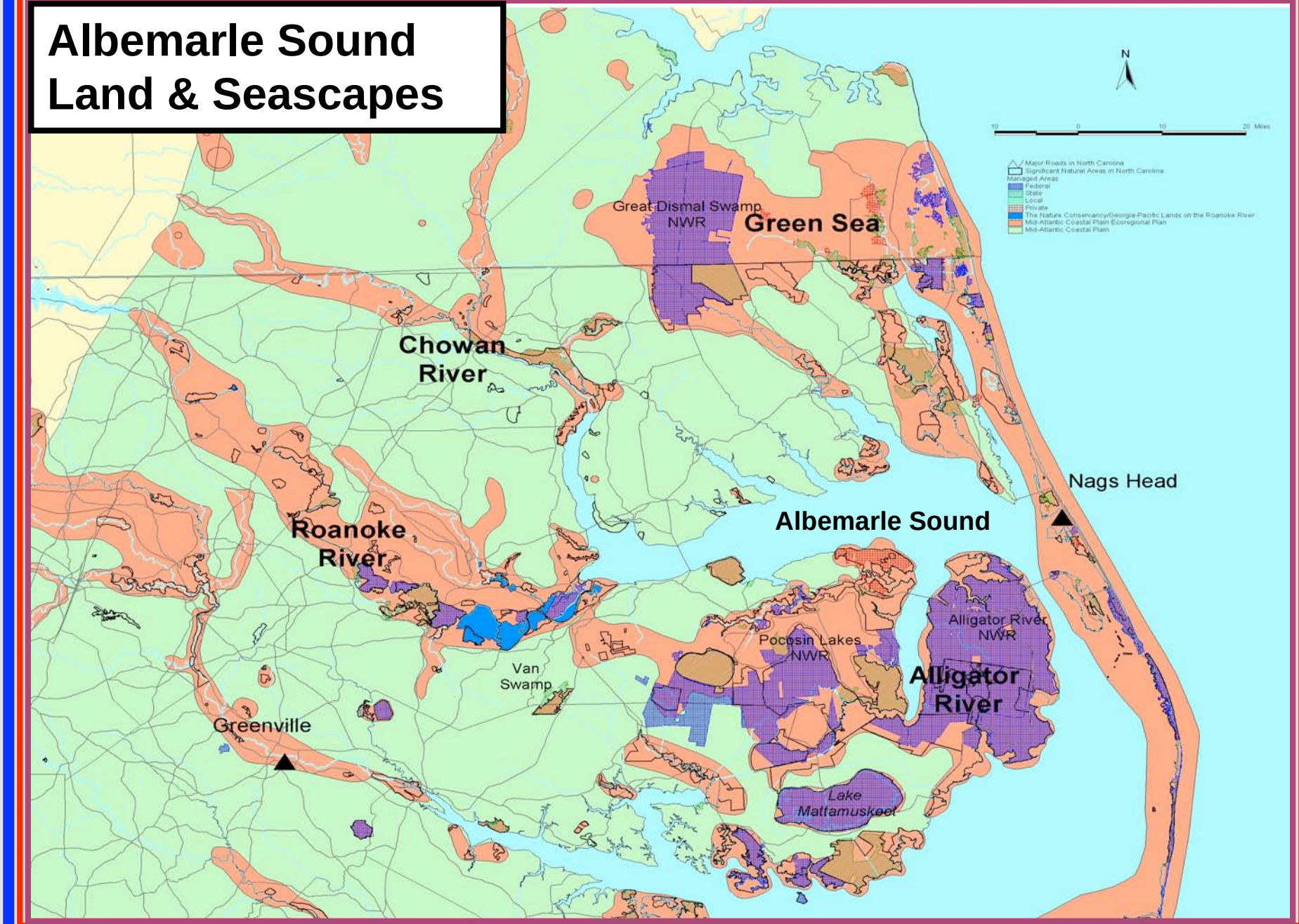
Grid cells within portfolio sites that are simulated to contain a different biome type under the future (2050-2059) climate scenario than they are simulated to contain under the observed (1951-1980) climate.

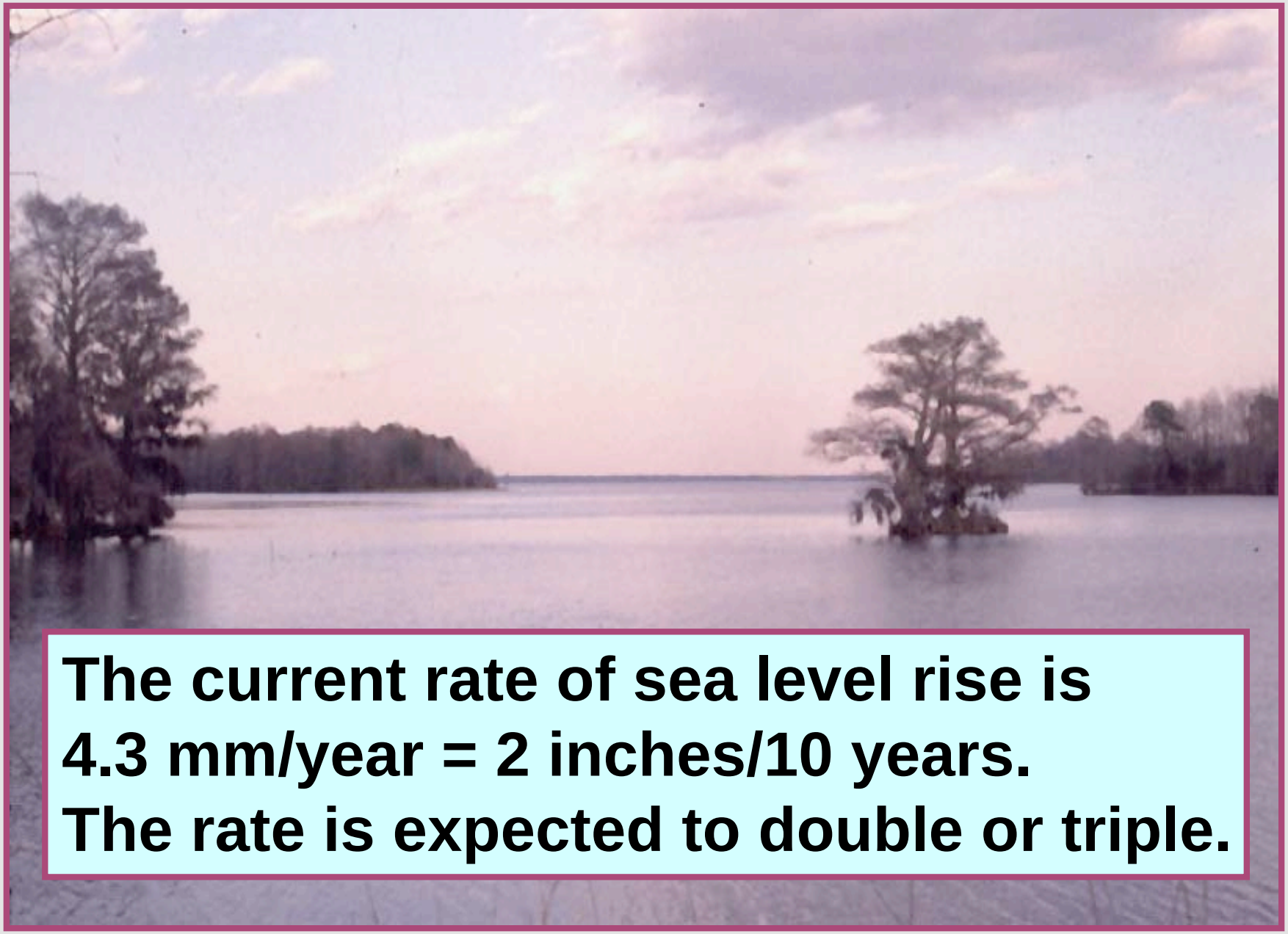
Are we stuck with being sitting ducks?

A Sentinel Ecosystem is one where the threat is clear and we test response hypotheses. We will use the results to guide our actions in similar situations globally.

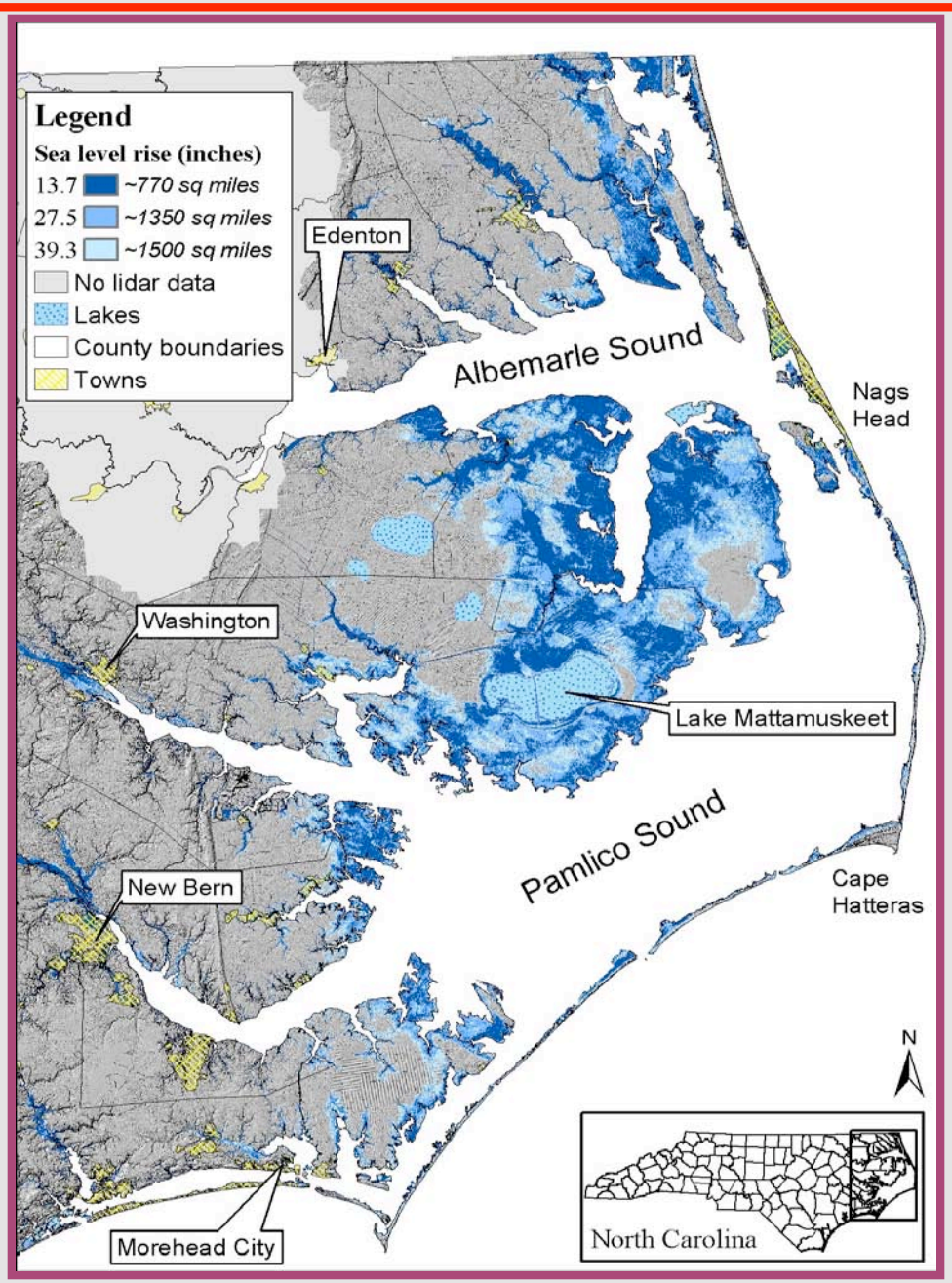

RISING SEAS AND THE
ALBEMARLE: A CASE STUDY

Albemarle Sound Land & Seascapes





The current rate of sea level rise is 4.3 mm/year = 2 inches/10 years. The rate is expected to double or triple.

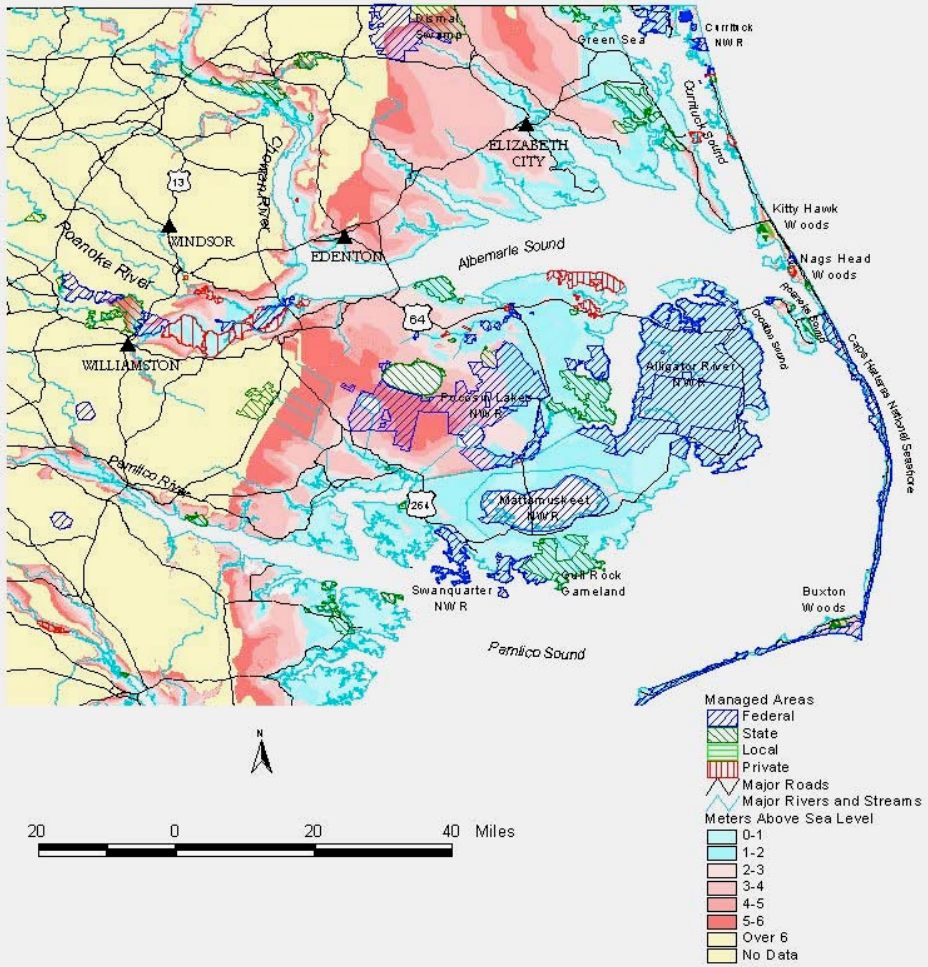


Inundation at 1/3, 2/3 and 1 meter levels.

The question is not whether the sea will rise a meter, but only how long will it take.

It will rise 1/2 meter in the next 100 years if the present rate does not increase!

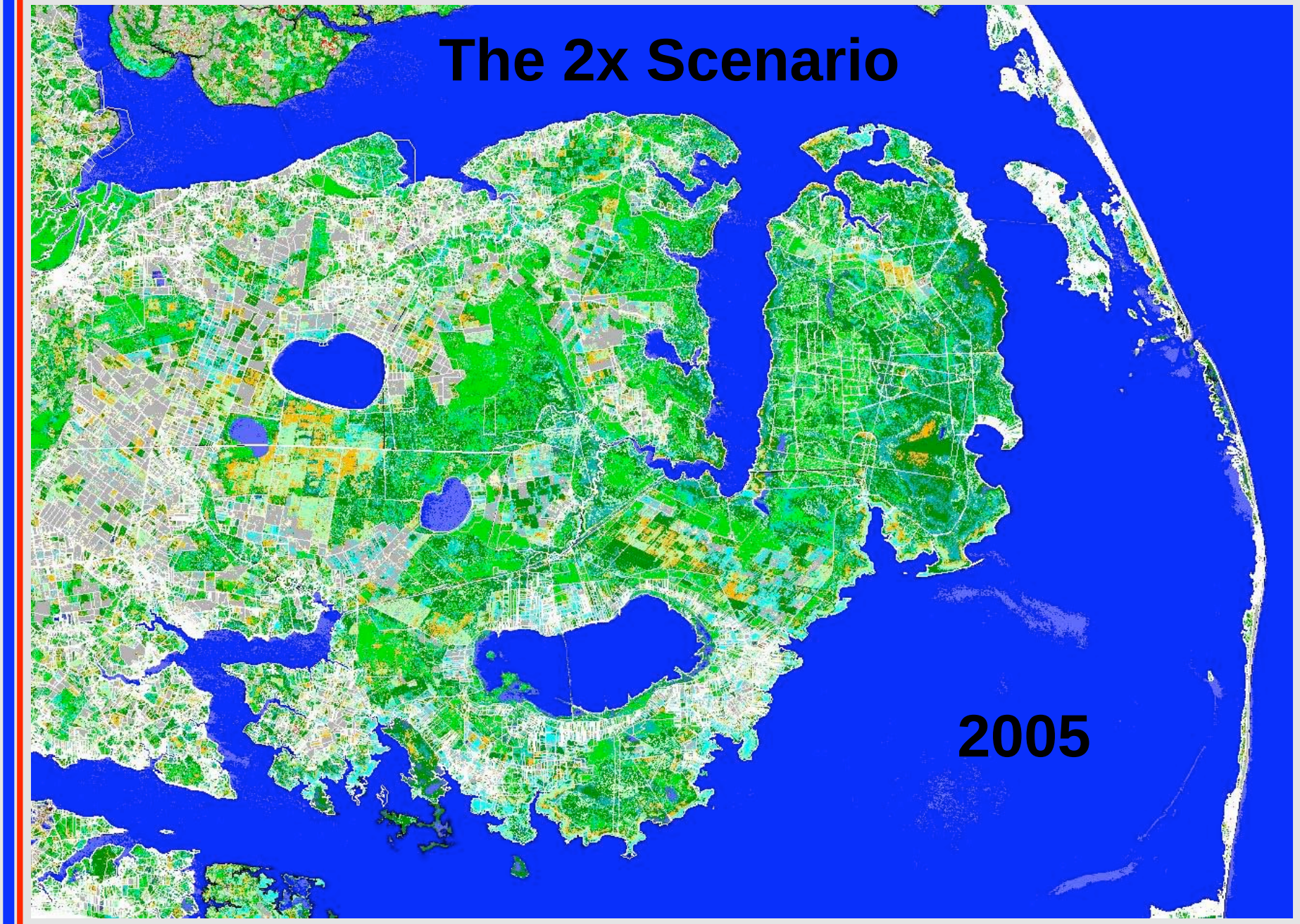
In the Albemarle Area:

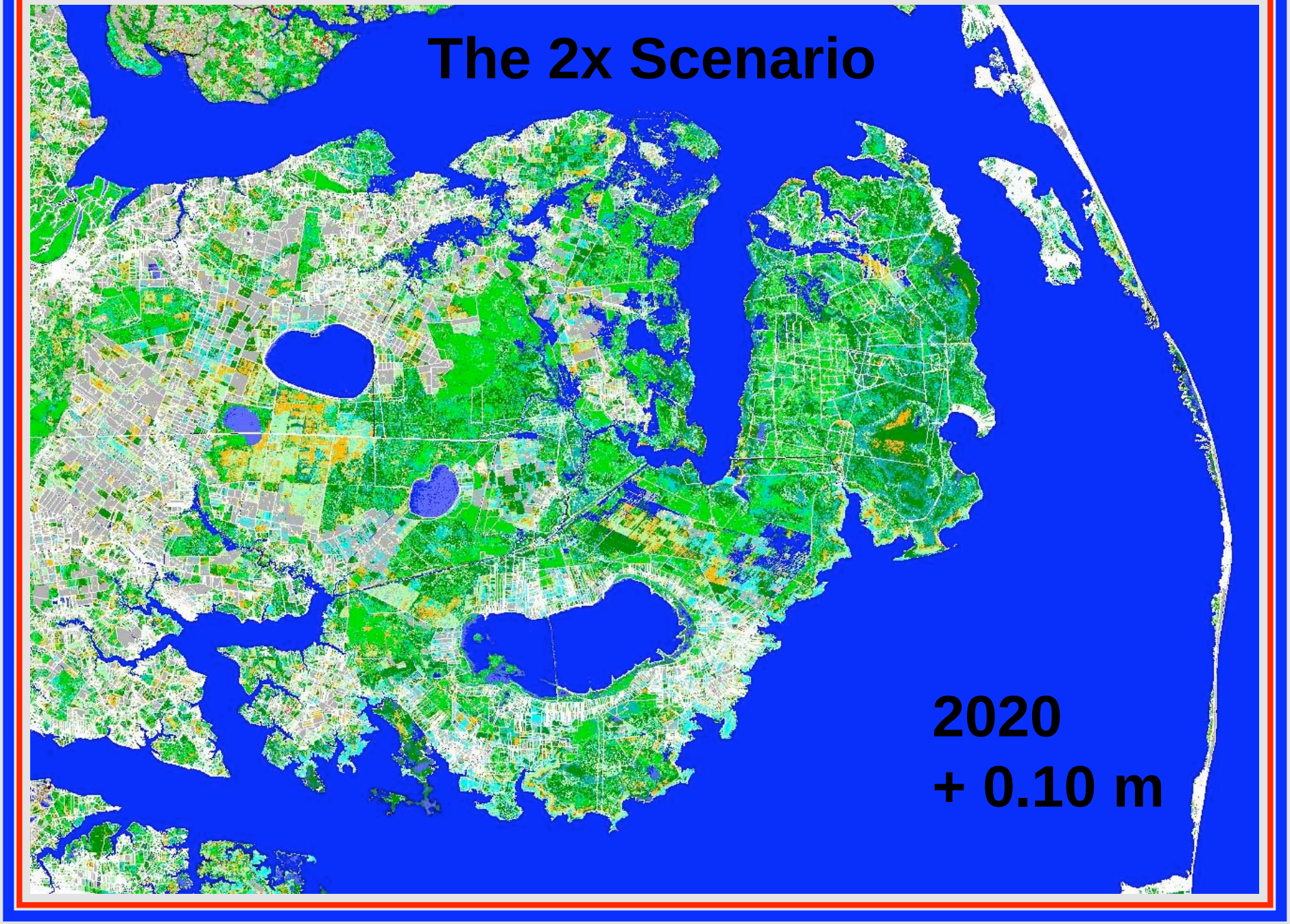


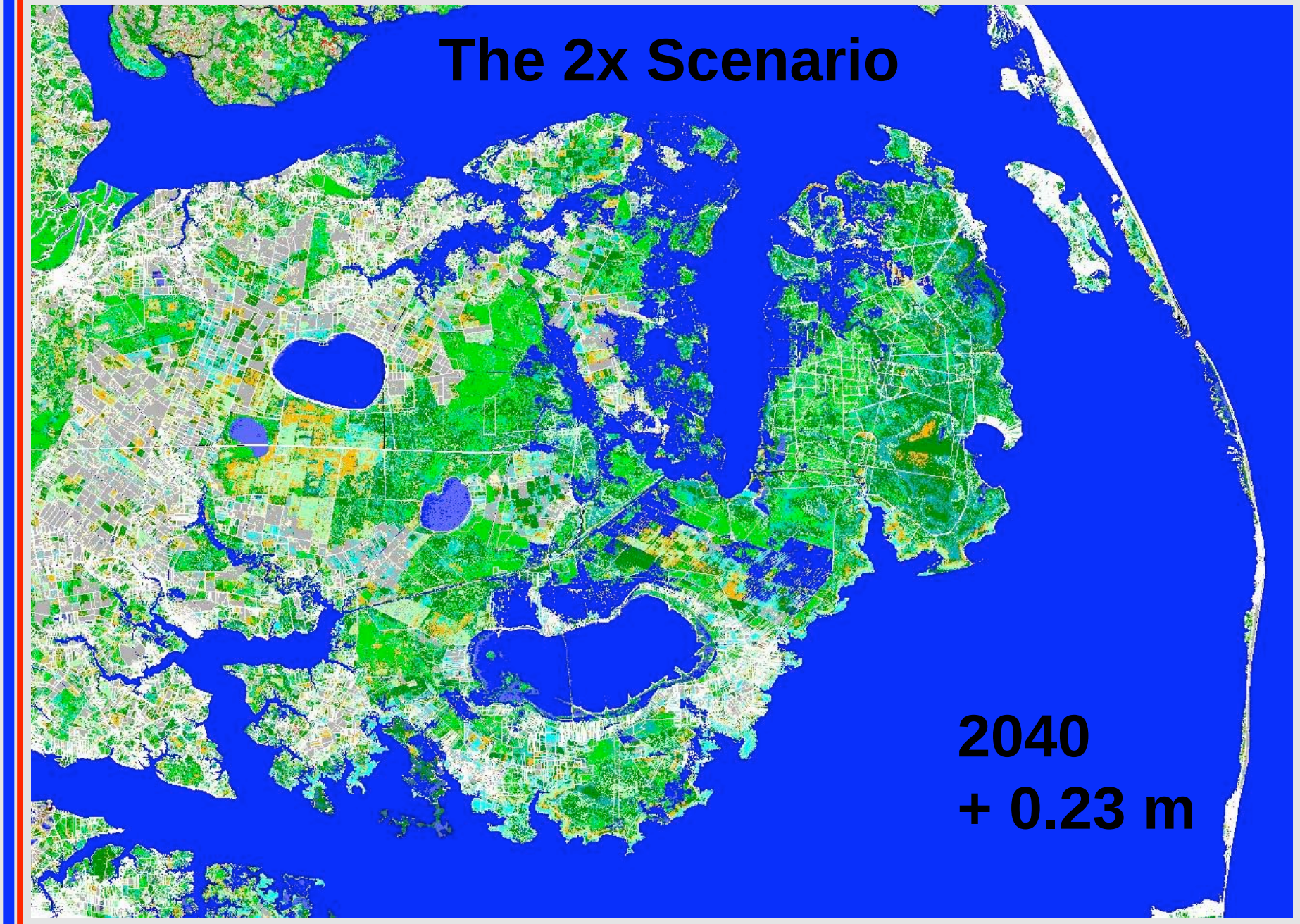
Roughly a million acres of conservation interest lands are in jeopardy.

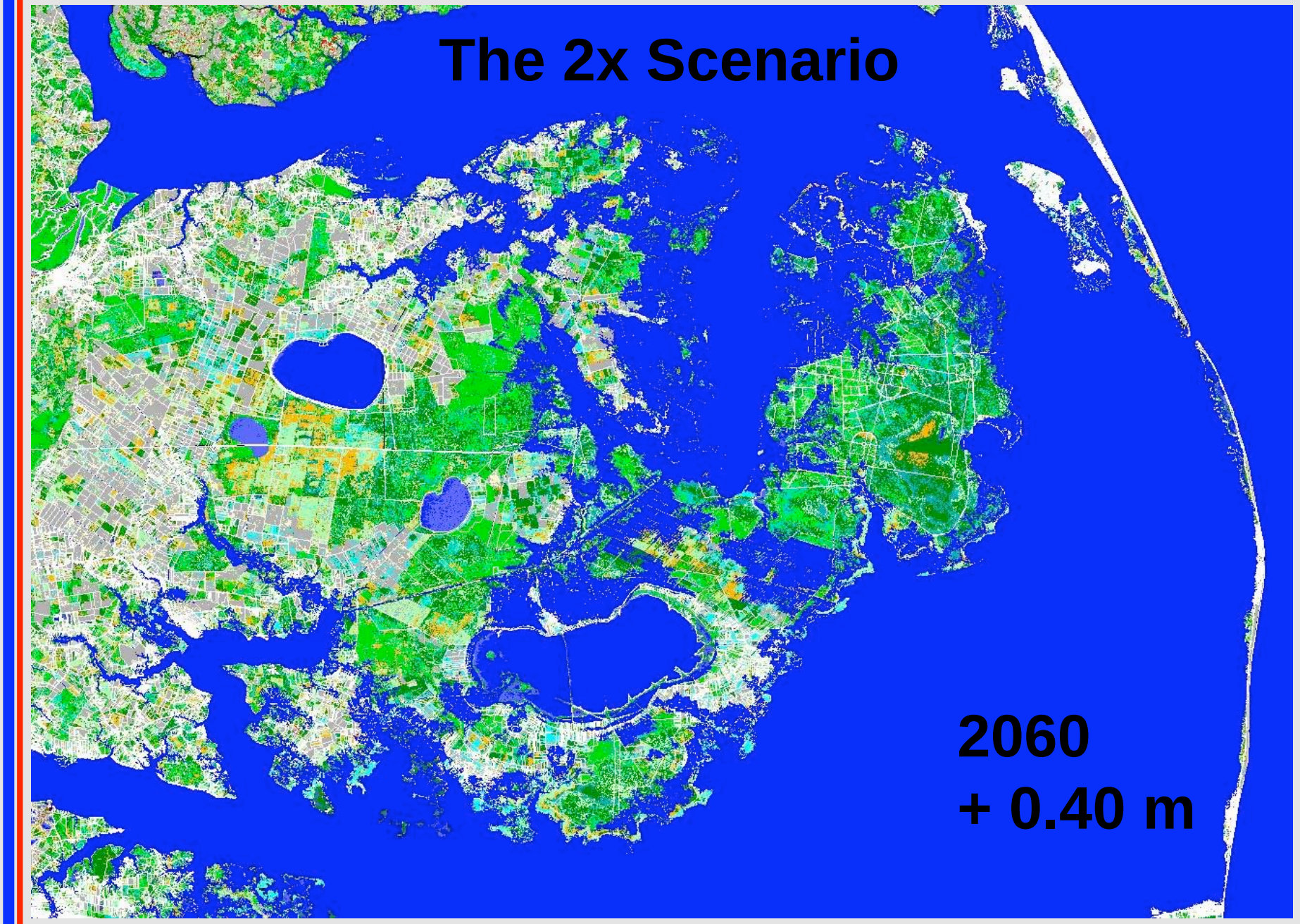
Roughly 700,000 acres of protected lands (shaded) are in jeopardy.

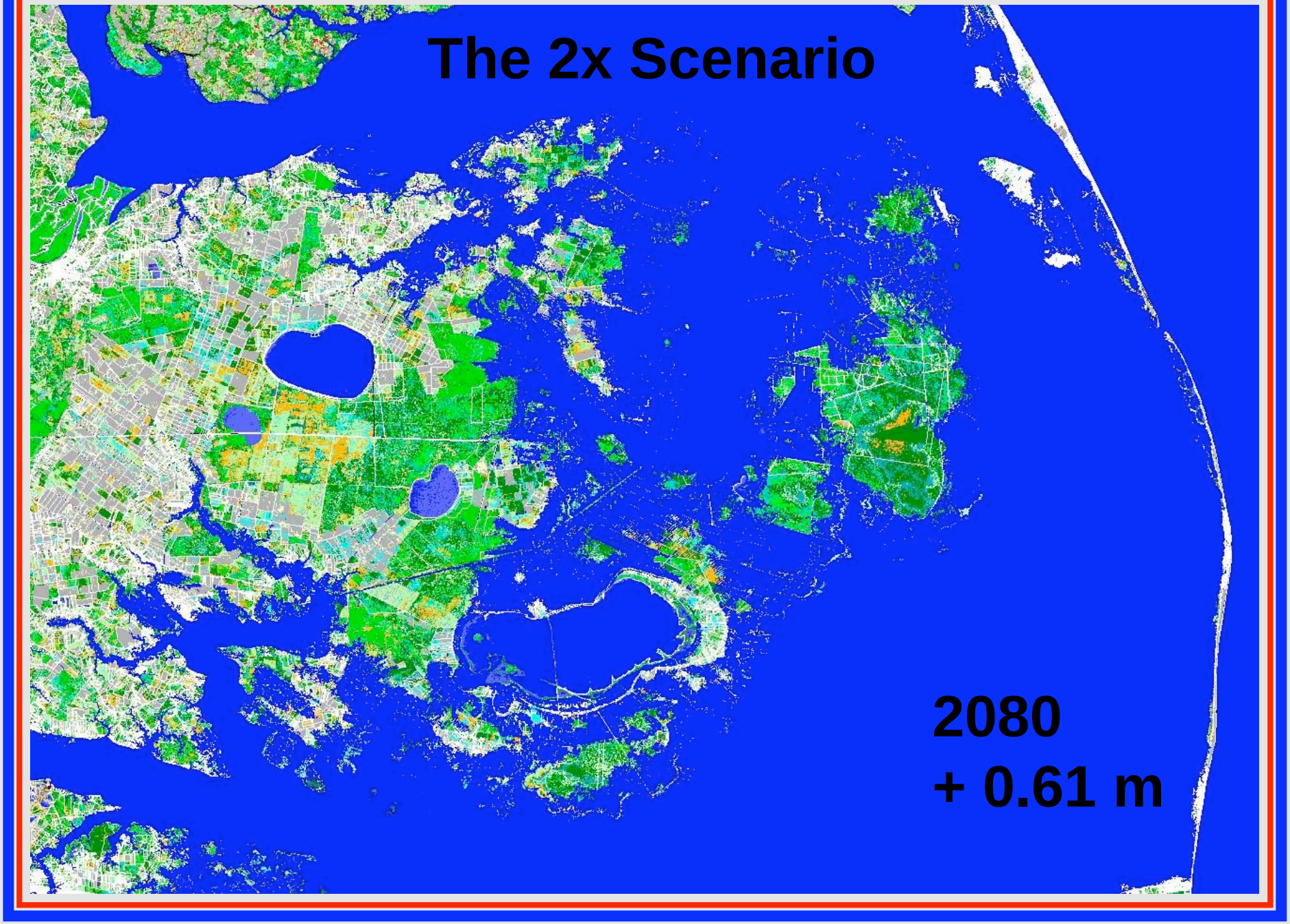
About 360,000 acres of land that TNC helped protect are in jeopardy.

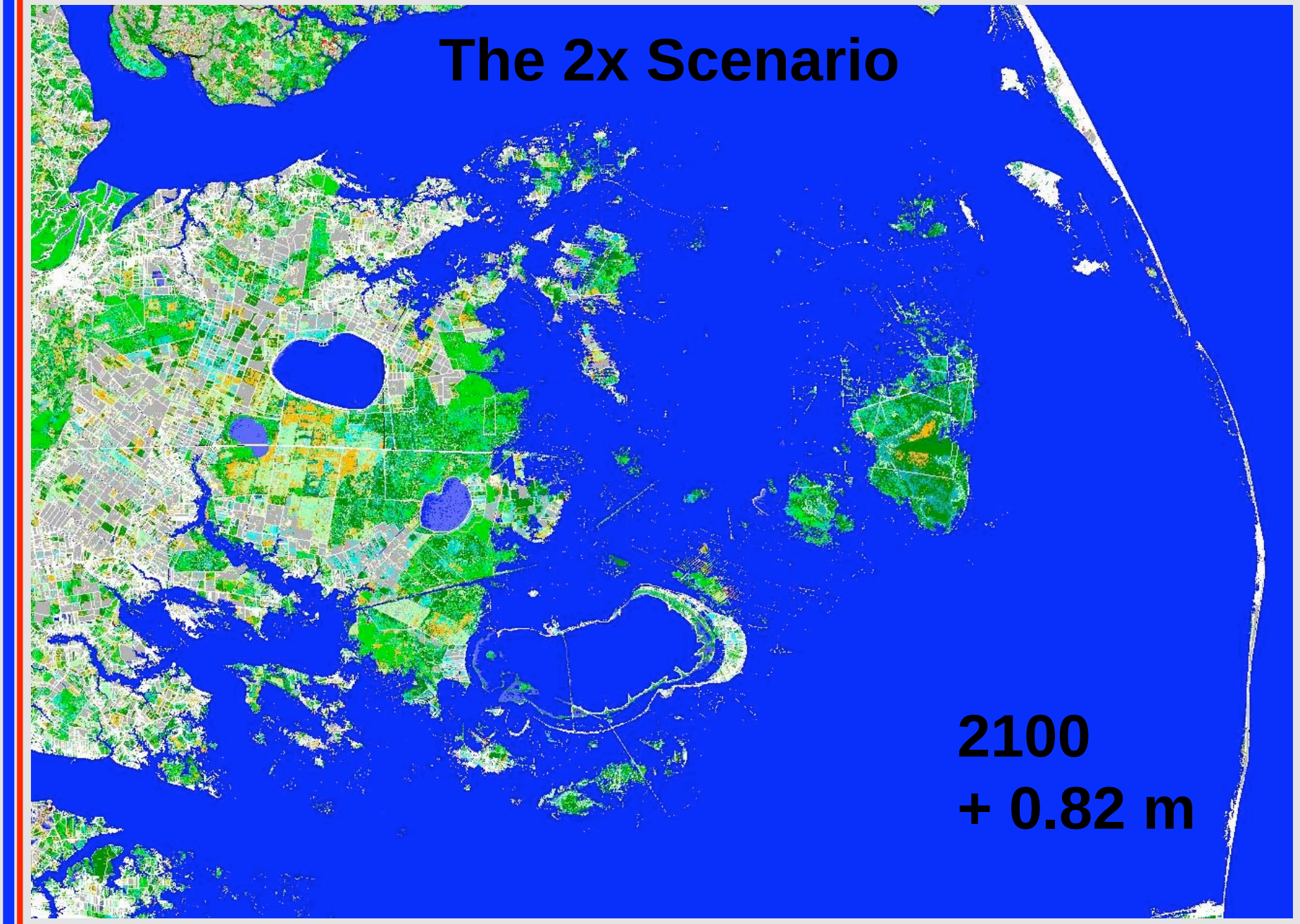

The 2x Scenario
2005

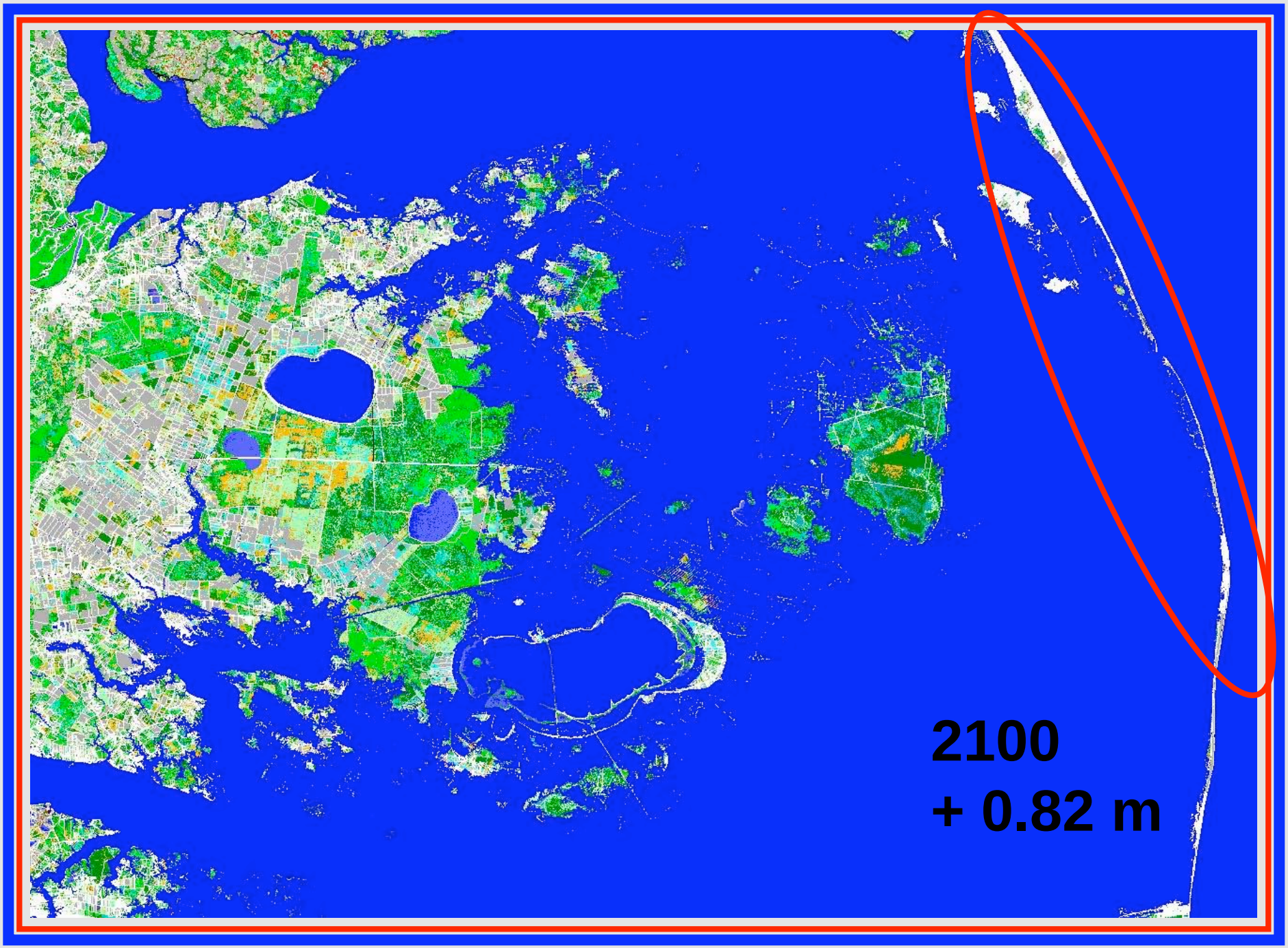

The 2x Scenario
2020
+ 0.10 m

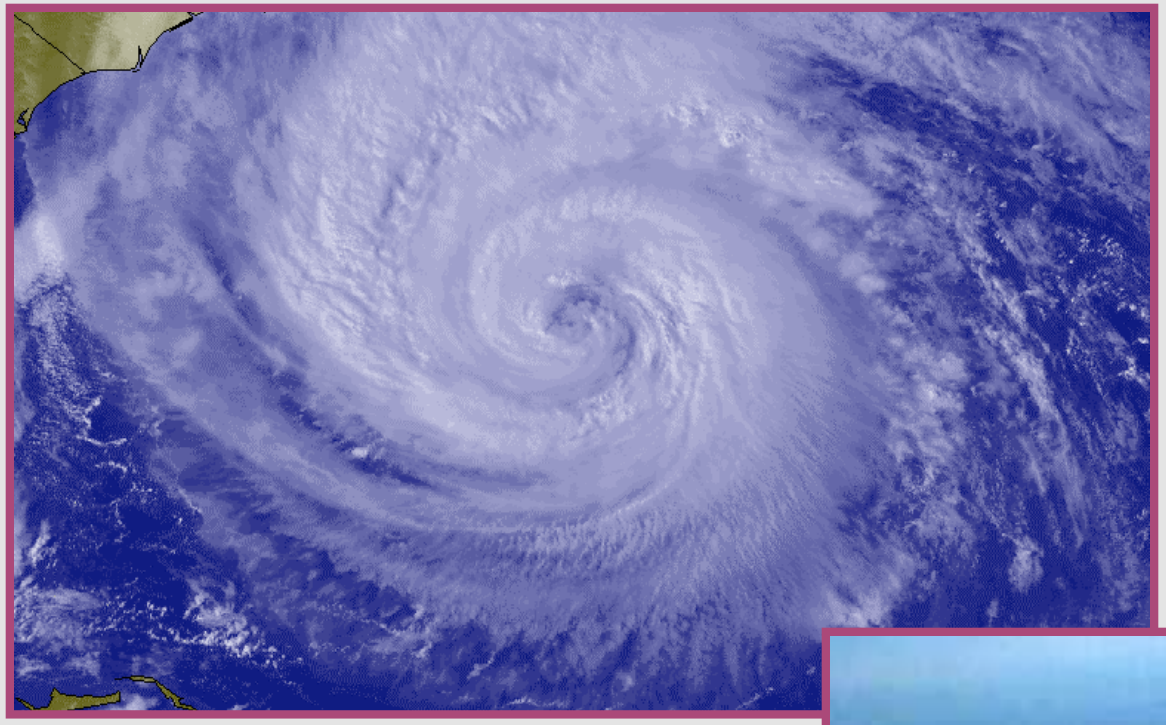

The 2x Scenario
2040
+ 0.23 m

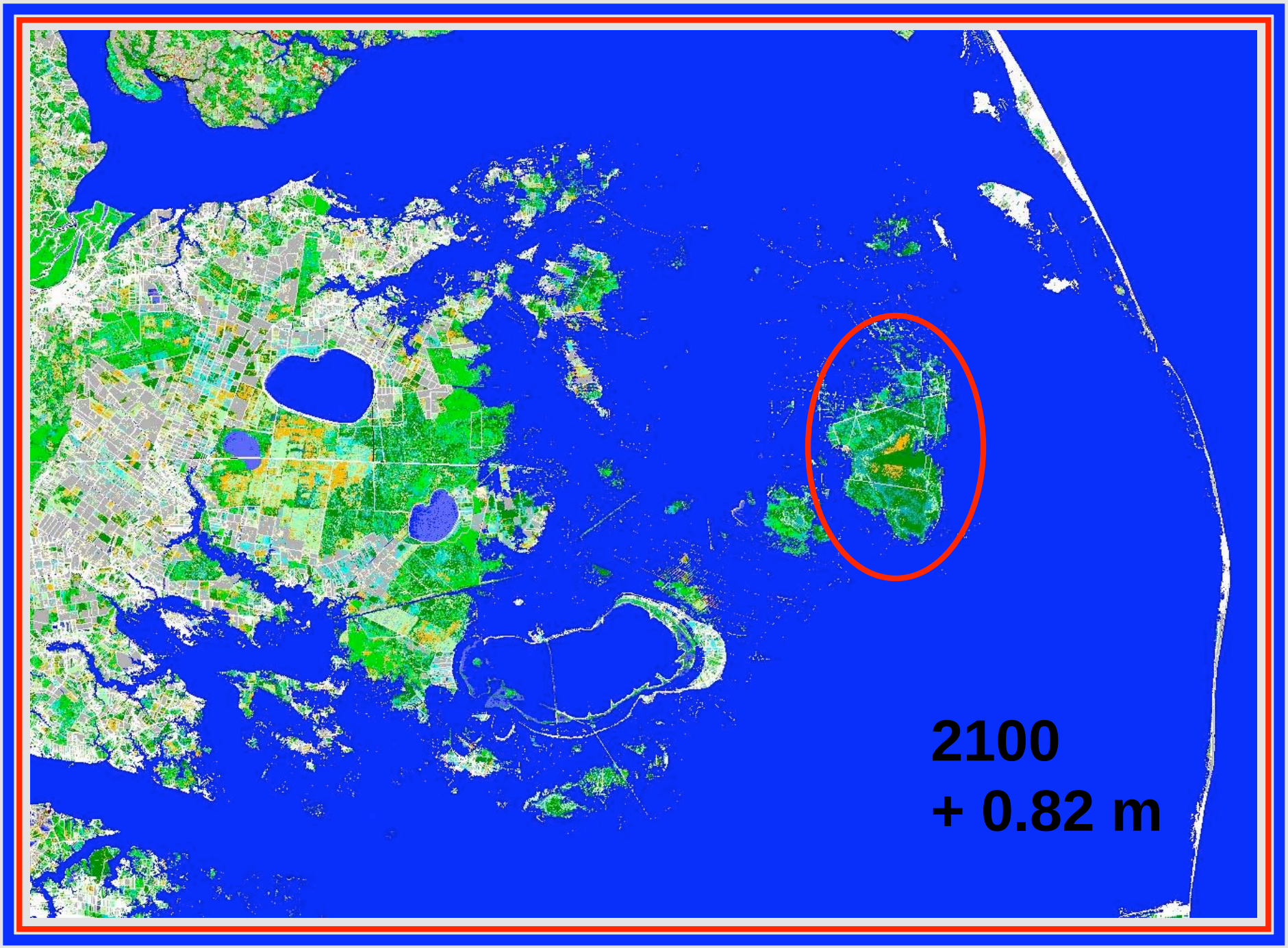

The 2x Scenario
2060
+ 0.40 m

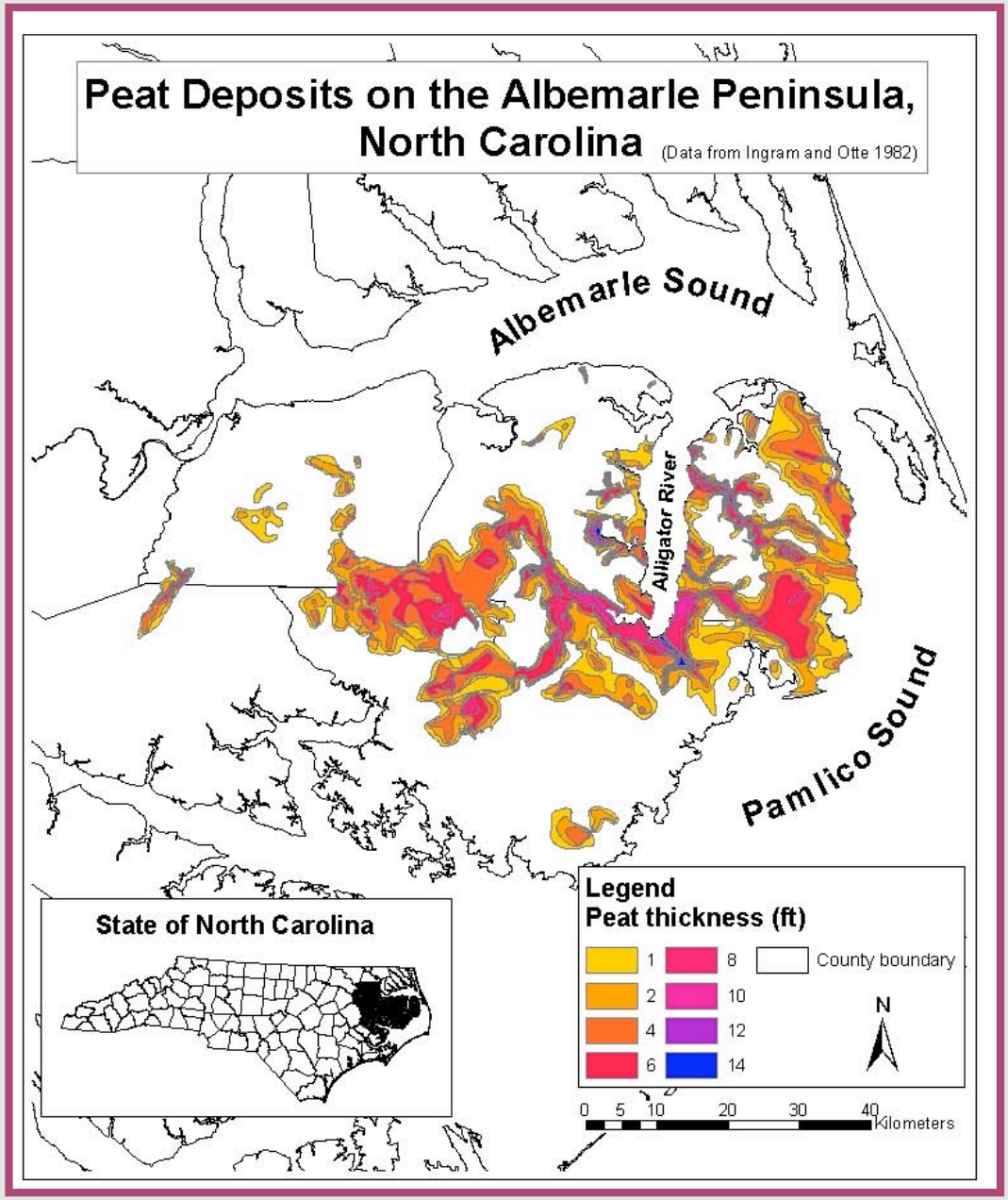

The 2x Scenario
2080
+ 0.61 m


The 2x Scenario
2100
+ 0.82 m

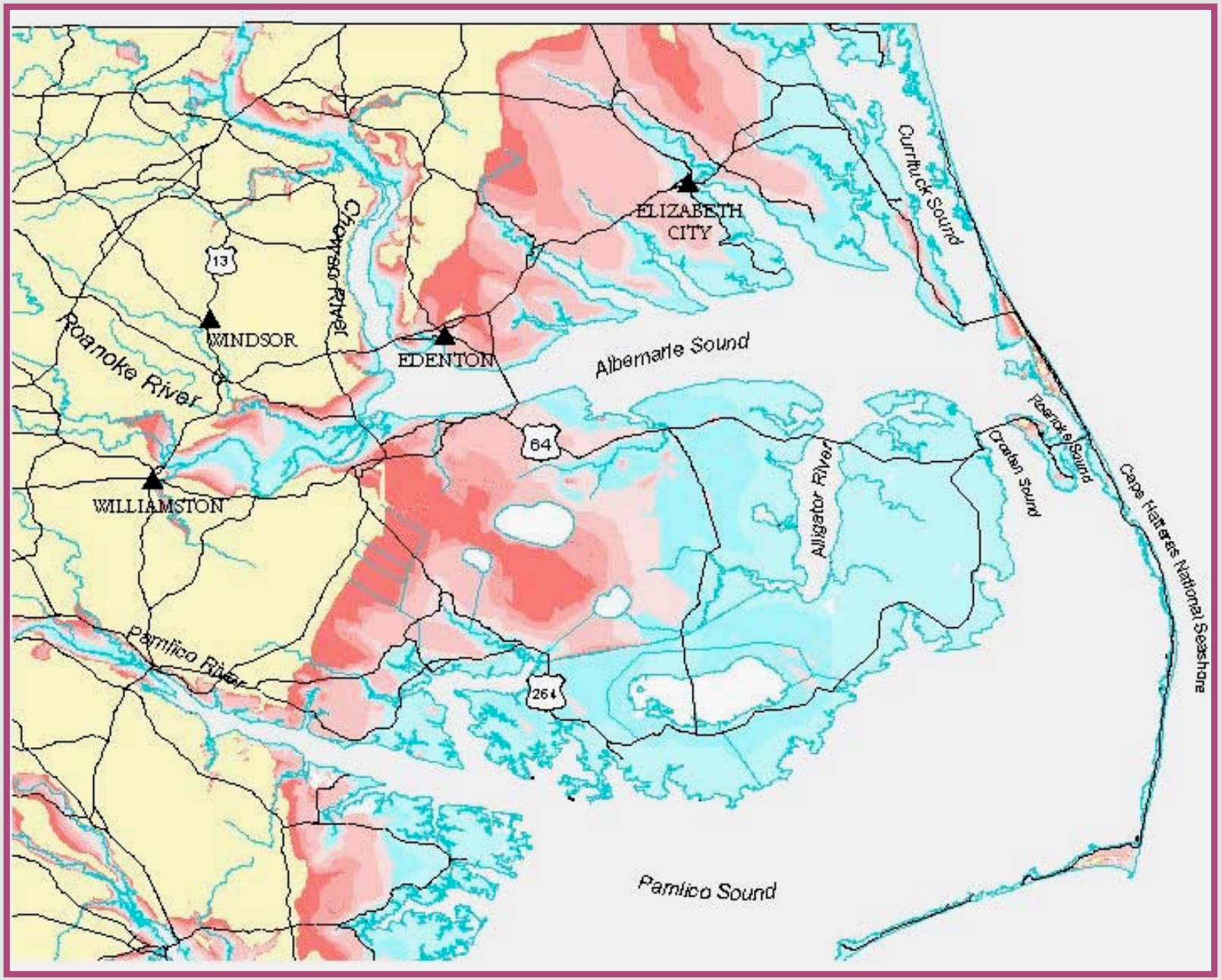

2100
+ 0.82 m




2100
+ 0.82 m



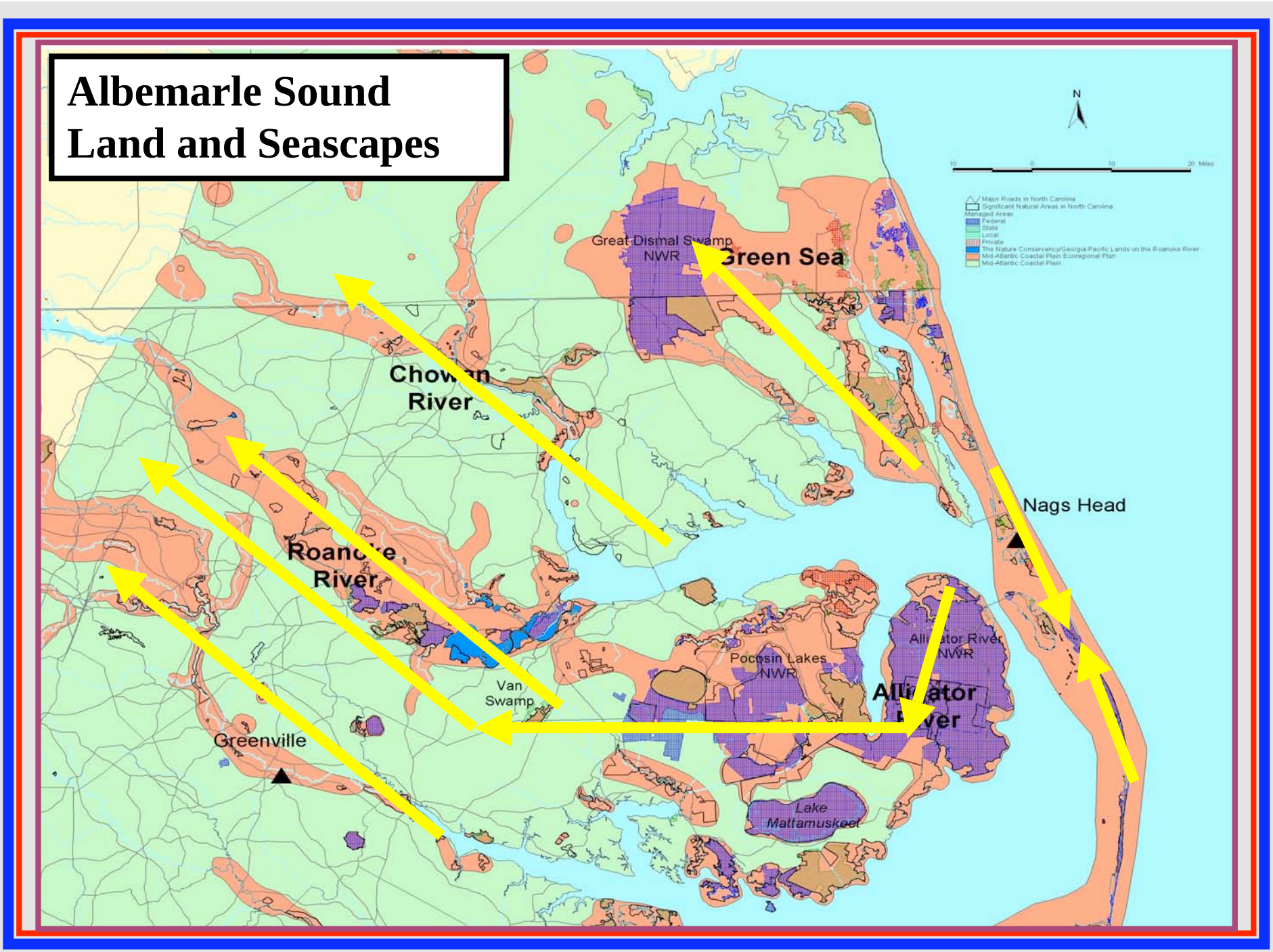
Many of the soils east of the Suffolk Scarp through the sound-side marshes and estuaries of the Outer Banks are peat-based.


ELIZABETH CITY
Currituck Sound
13
WINDSOR
Chowan River
Roanoke River
EDENTON
Albemarle Sound
64
Roanoke Sound
Croatan Sound
Alligator River
Cape Hatteras National Seashore
WILLIAMSTON
Pamlico River
264
Pamlico Sound

Two hopes:

1. Corridors: Ecosystems will migrate.

2. Castles: Ecosystems will transform without simplification.


Albemarle Sound
Land and Seascapes
N
Great Dismal Swamp NWR
Green Sea
Chowan River
Roanoke River
Nags Head
Pocosin Lakes NWR
Van Swamp
Greenville
Lake Mattamuskeet


BROOKINS
WELL, DUH-H-H!...
CLIMATE SHIFTS BUT SOILS AND TOPO STAY PUT!

In a greenhouse gas scenario that is only modestly improved over the status quo, 63% of the natural habitat types in the US will simply disappear by 2100 (Saxon, Baker, Hargrove, Hoffman, Zganjar).

They will be replaced by new habitat types!

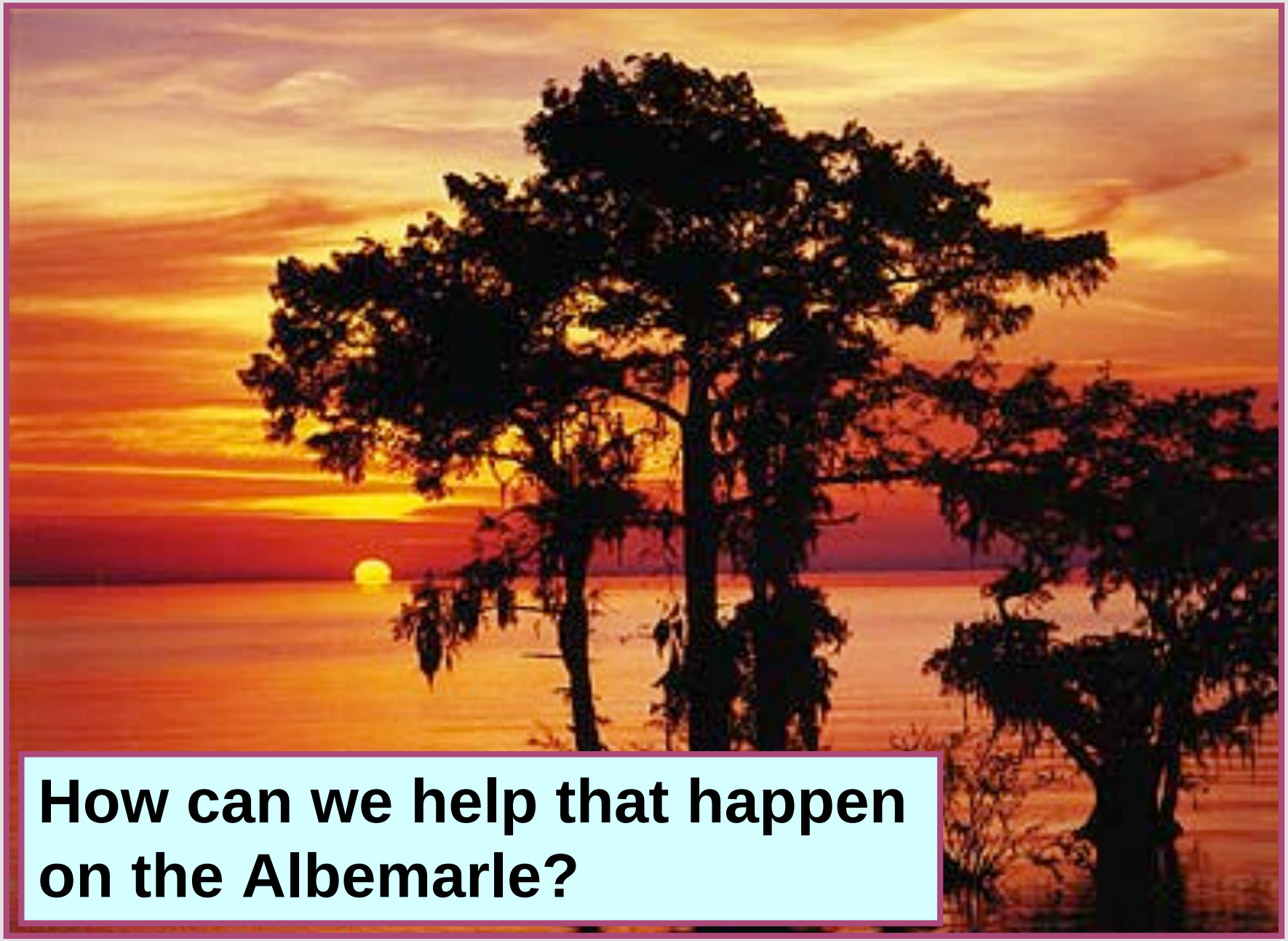
What does our mission require us to do under this circumstance?

Two hopes:

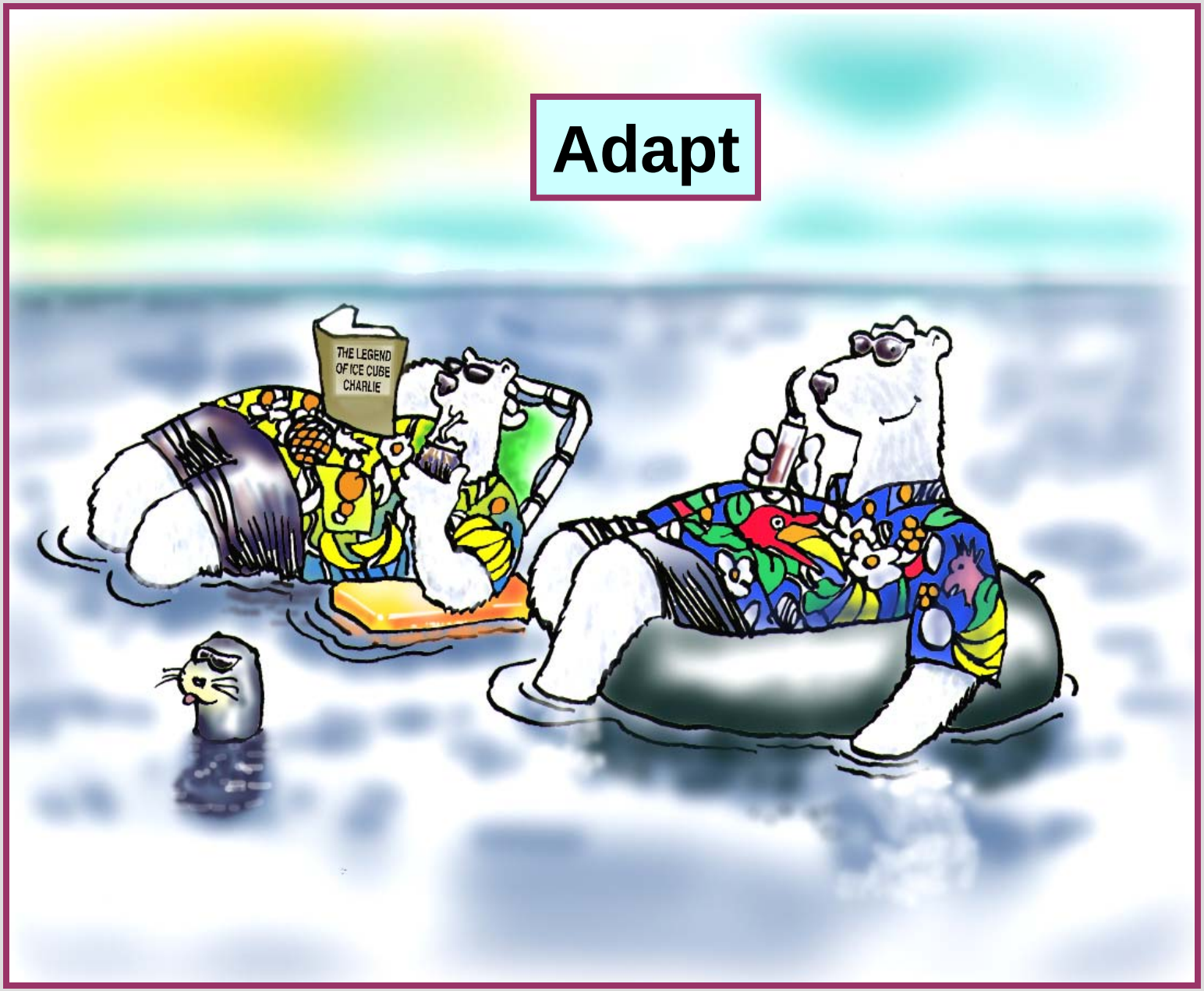
1. Corridors: Ecosystems will migrate.

2. Castles: Ecosystems will transform without simplification.

Beginning now, we need to build conservation programs for future, as yet unknown, ecosystems!


How can we help that happen
on the Albemarle?

Adapt

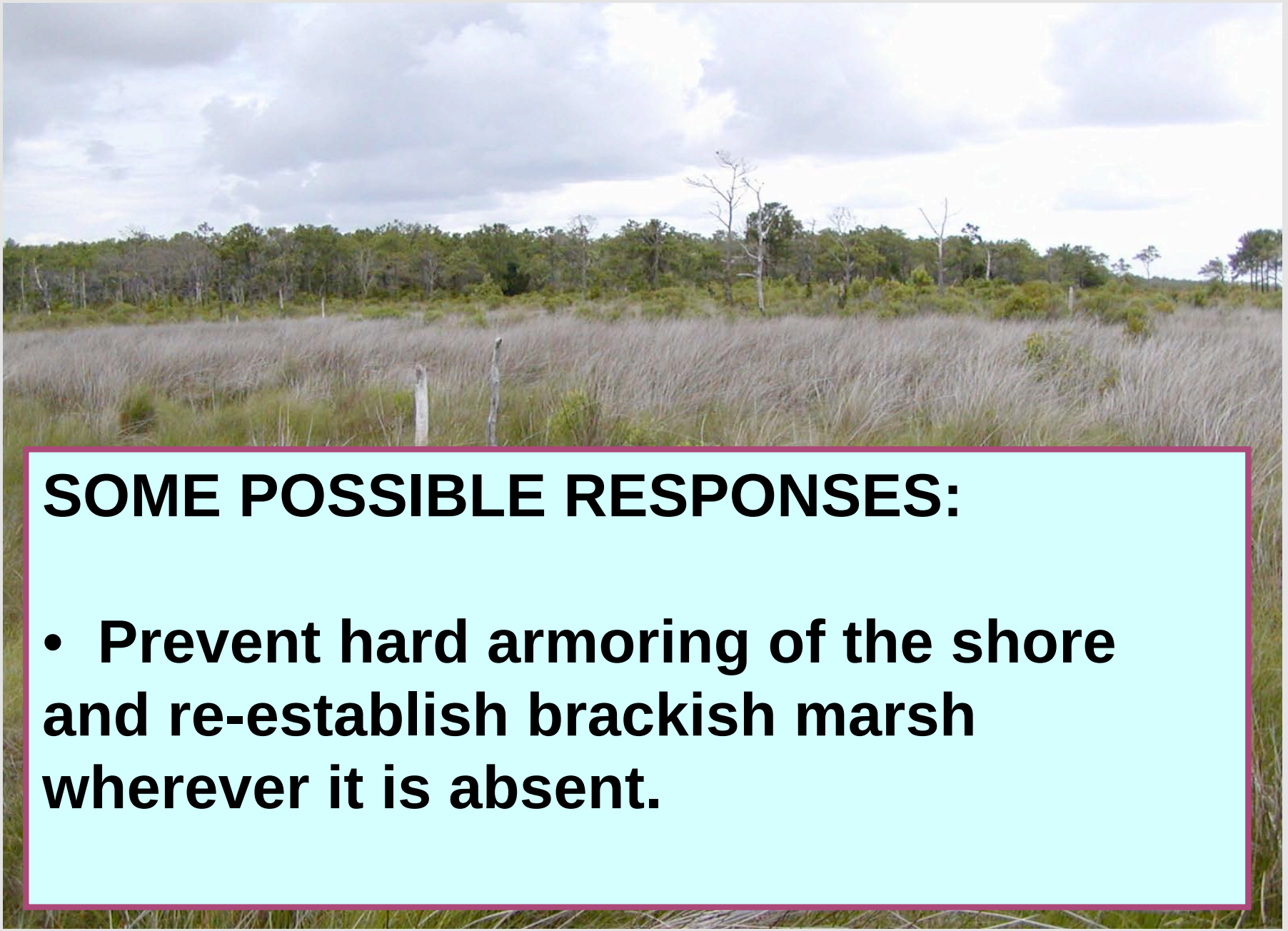


SOME POSSIBLE RESPONSES:

- **Re-regulate or plug ditches.**

SOME POSSIBLE RESPONSES:

- **Conserve all existing cypress and re-establish cypress (perhaps as plantations) wherever the land has been cleared.**



SOME POSSIBLE RESPONSES:

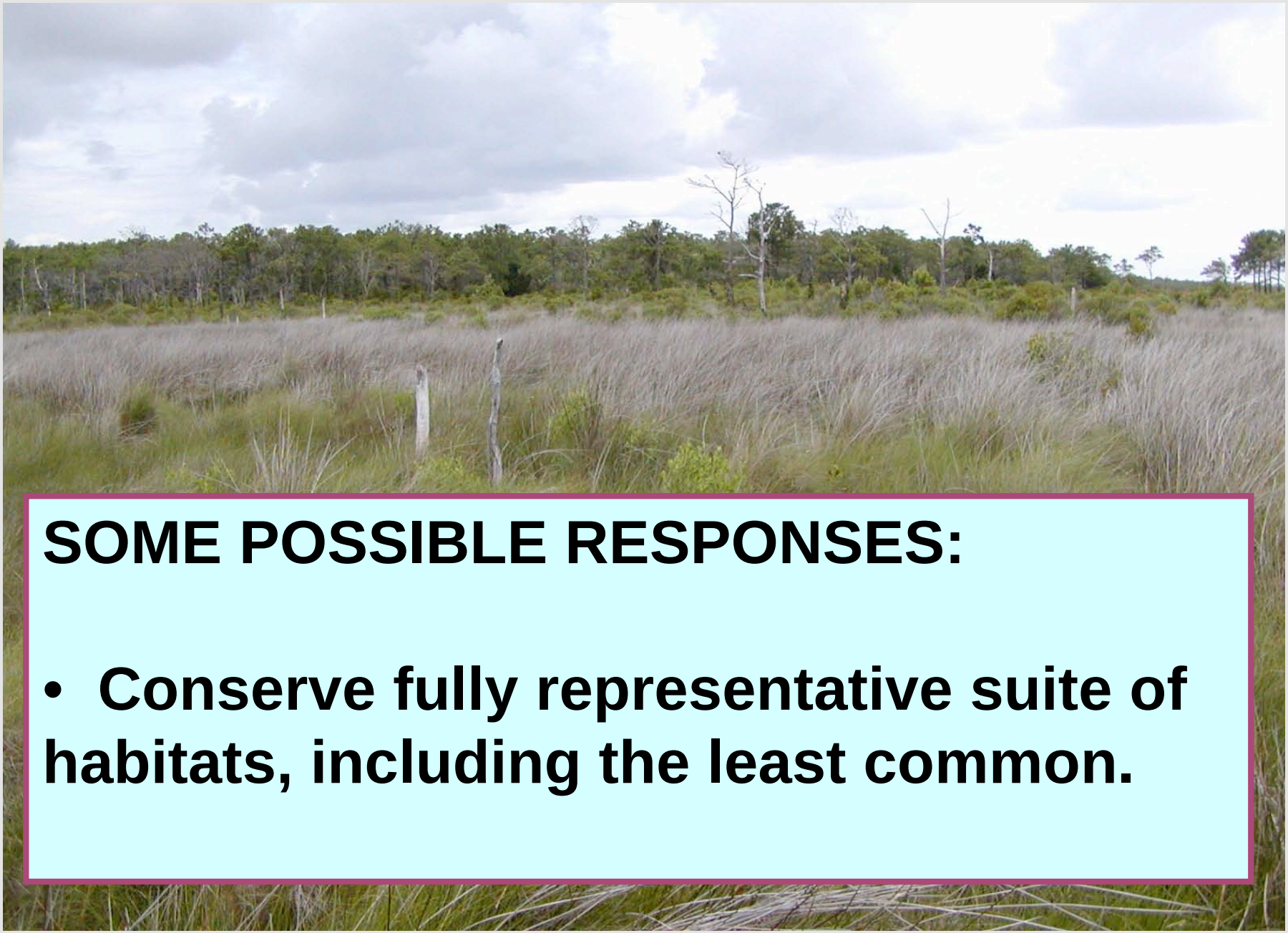
- **Prevent hard armoring of the shore and re-establish brackish marsh wherever it is absent.**

SOME POSSIBLE RESPONSES:

- **Re-establish sea grass beds and, as salinity rises, oyster reefs.**

SOME POSSIBLE RESPONSES:

- **Conserve corridors from the sounds as far inland as possible, following substrates.**



SOME POSSIBLE RESPONSES:

- **Conserve fully representative suite of habitats, including the least common.**

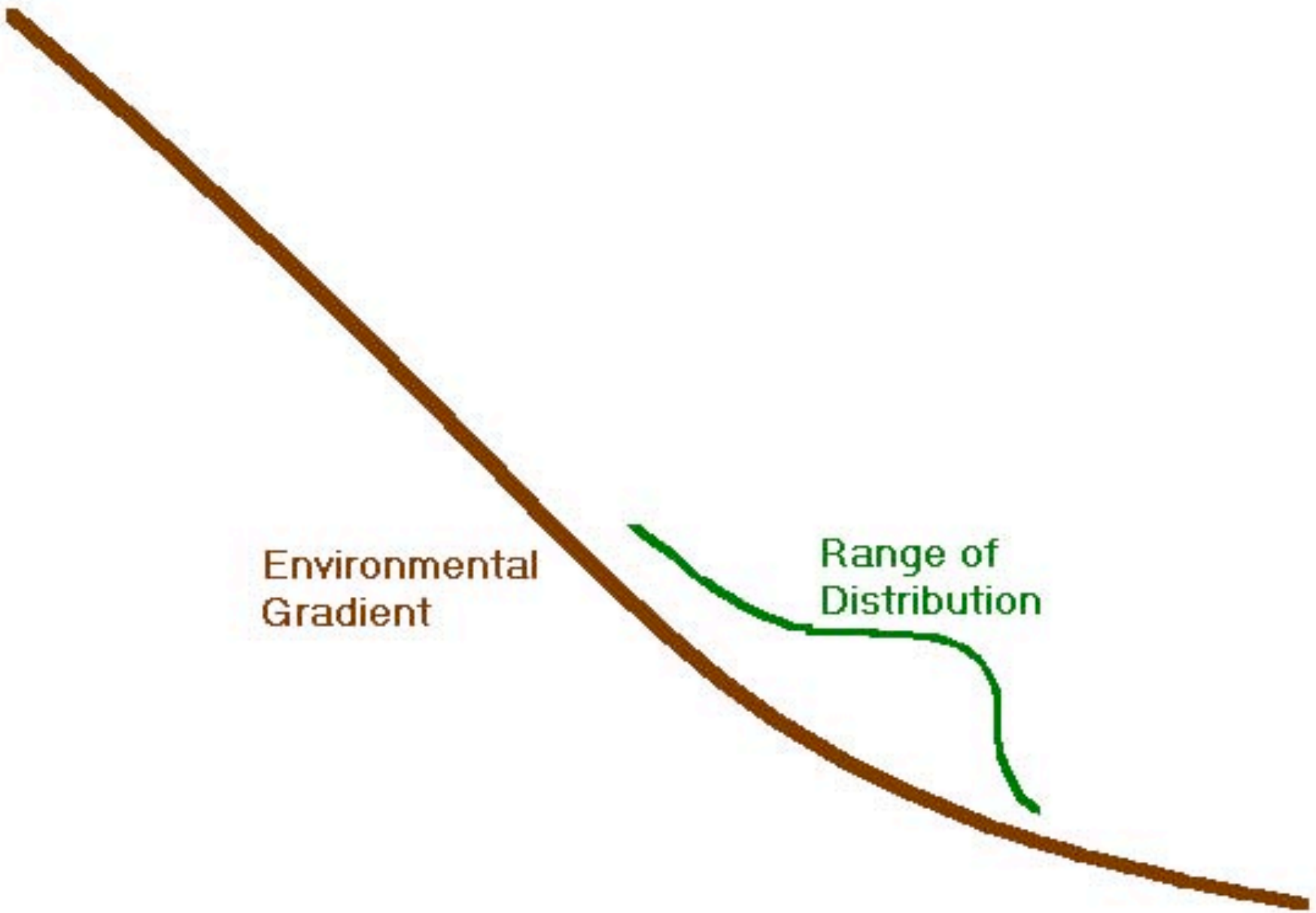
SOME POSSIBLE RESPONSES:

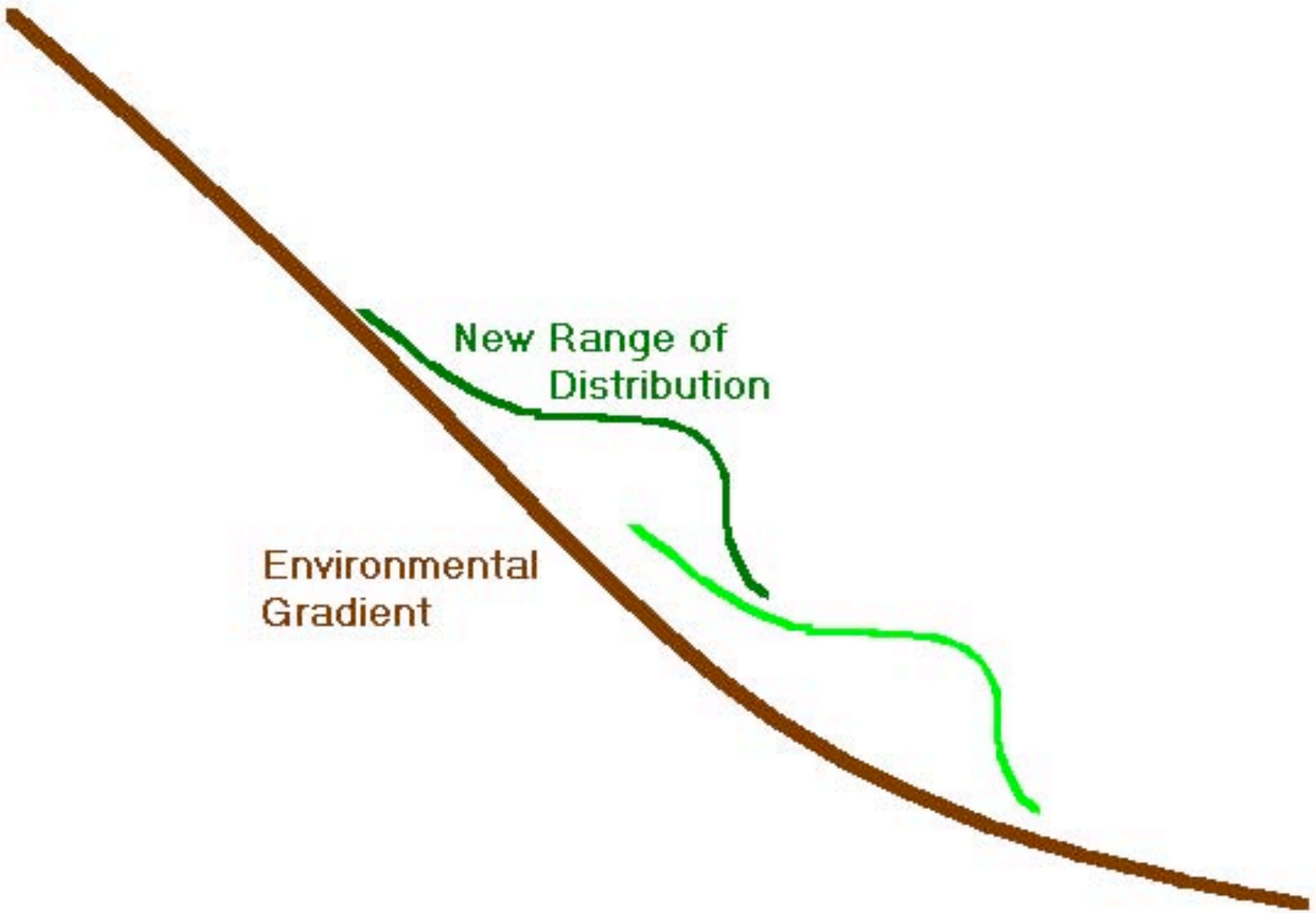
- **Constantly evaluate the potential for invasive species to be simplifying.**

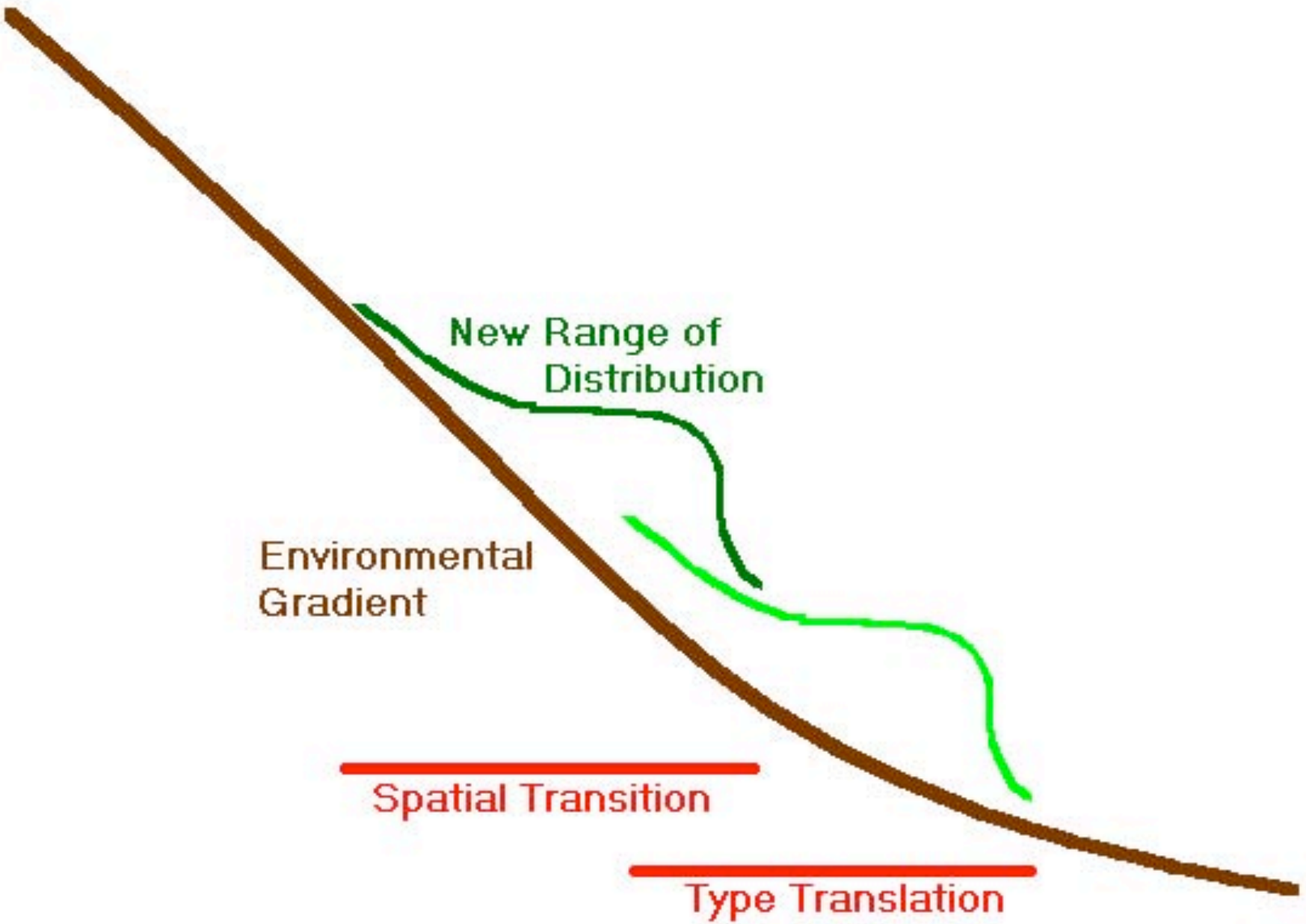
Control simplifying invasive species.

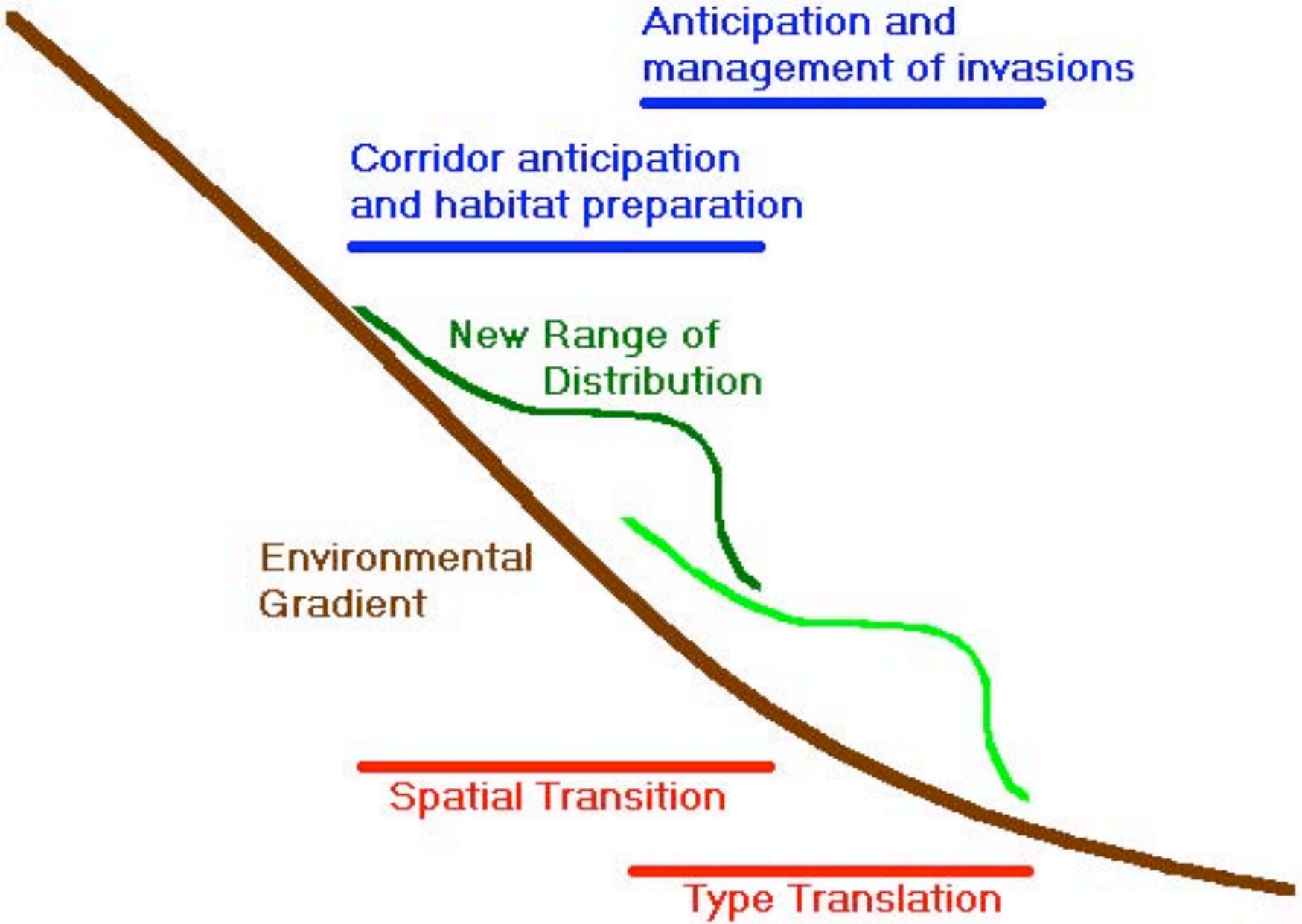
SOME POSSIBLE RESPONSES:

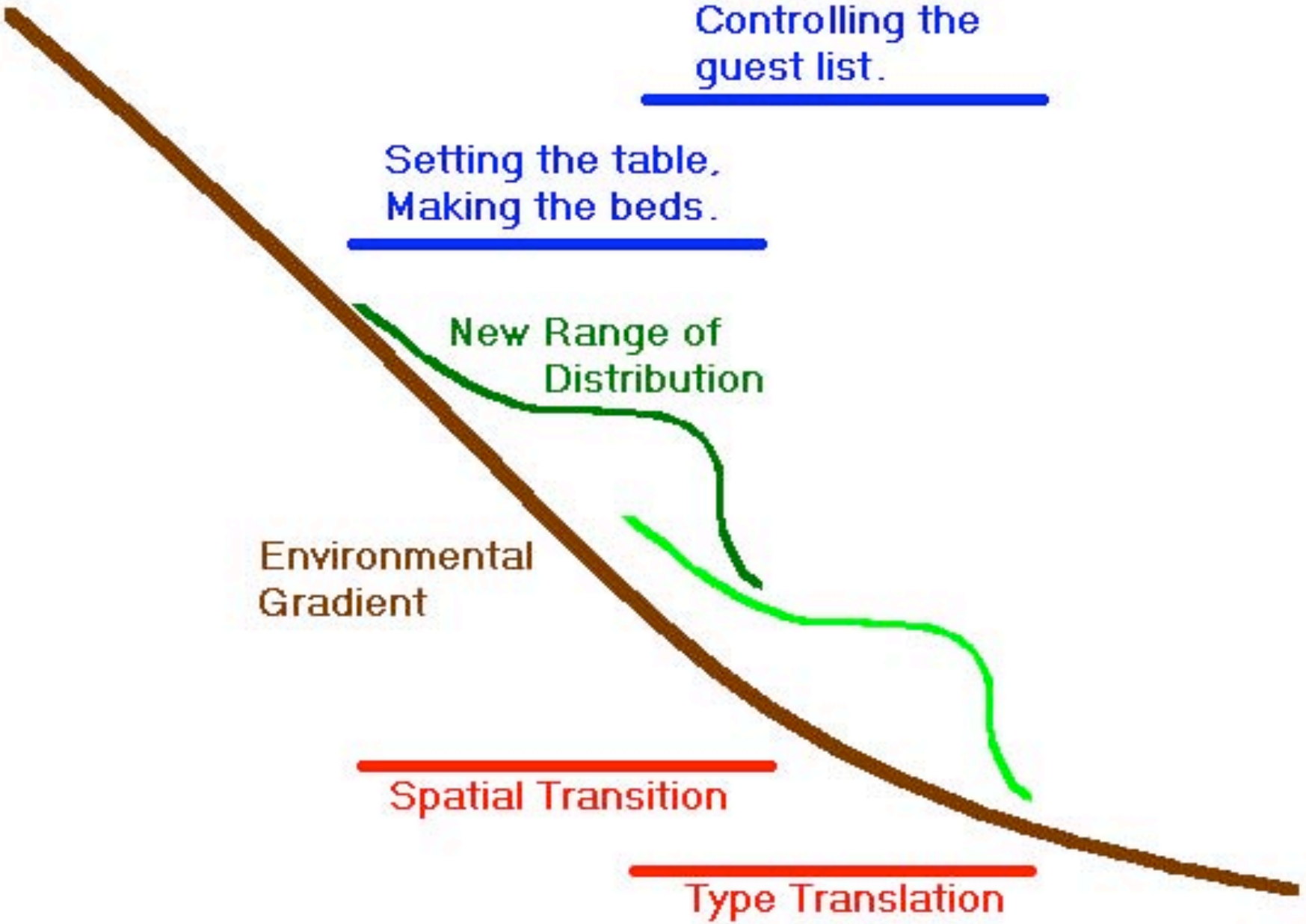
- **De-fragment the forested and marsh landscapes.**


Environmental
Gradient
Range of
Distribution

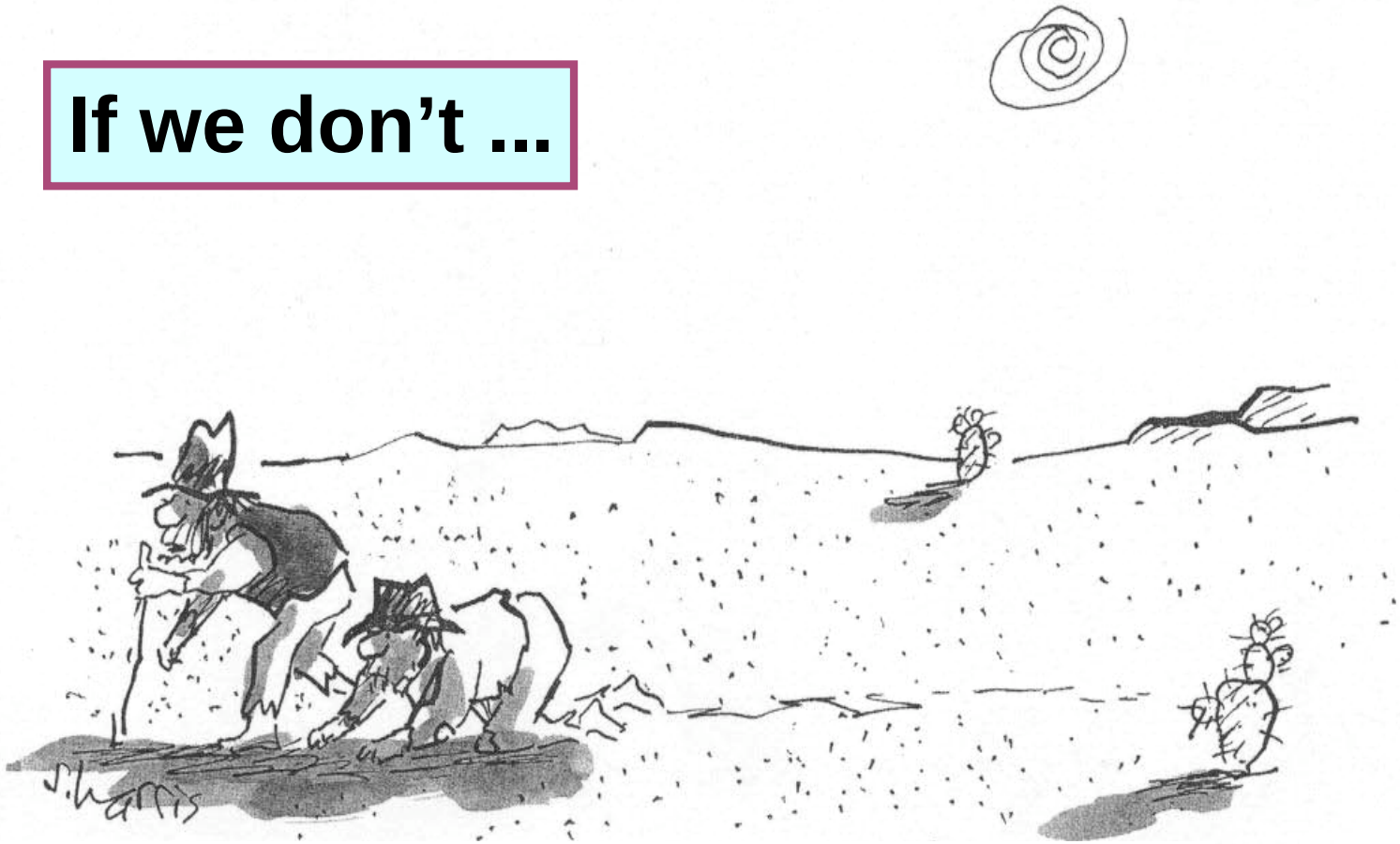

New Range of
Distribution
Environmental
Gradient


New Range of
Distribution
Environmental
Gradient
Spatial Transition
Type Translation


Anticipation and
management of invasions
Corridor anticipation
and habitat preparation
New Range of
Distribution
Environmental
Gradient
Spatial Transition
Type Translation


Controlling the
guest list.
Setting the table,
Making the beds.
New Range of
Distribution
Environmental
Gradient
Spatial Transition
Type Translation

If we don't ...



"Even worse than the heat is the complete lack of biodiversity."

STAY COOL !
DON’T QUIT !