Wildlife Response to Climate Change and the Management Challenge to Help Species Adapt

Jean Brennan PhD

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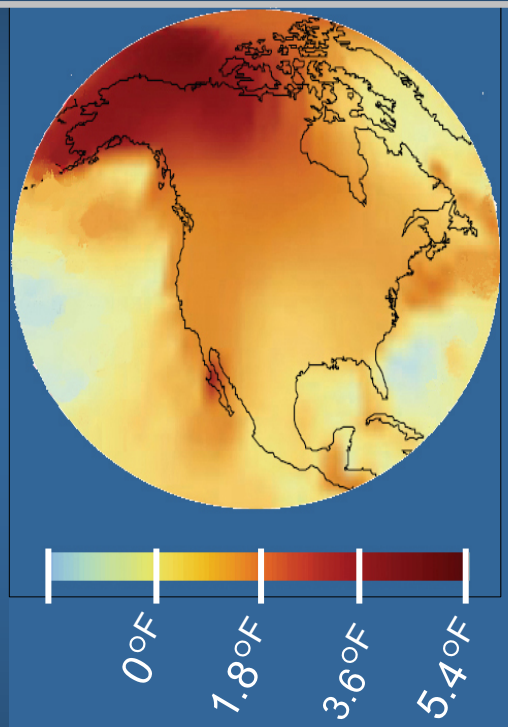
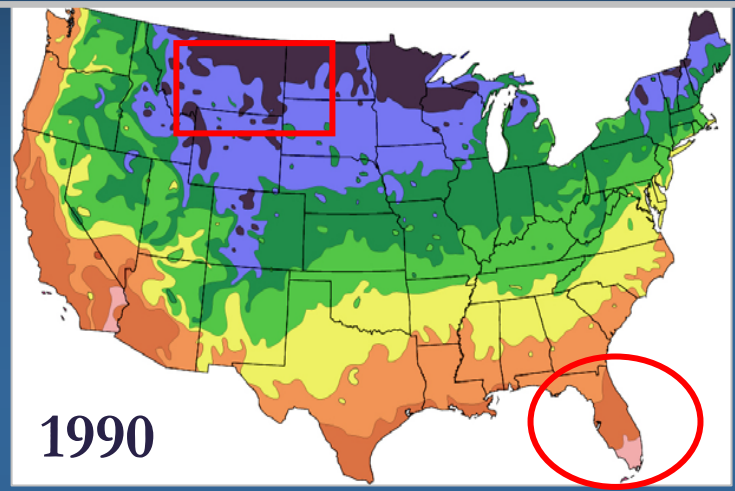
Change in the Climate System -- Shift in climatic zones

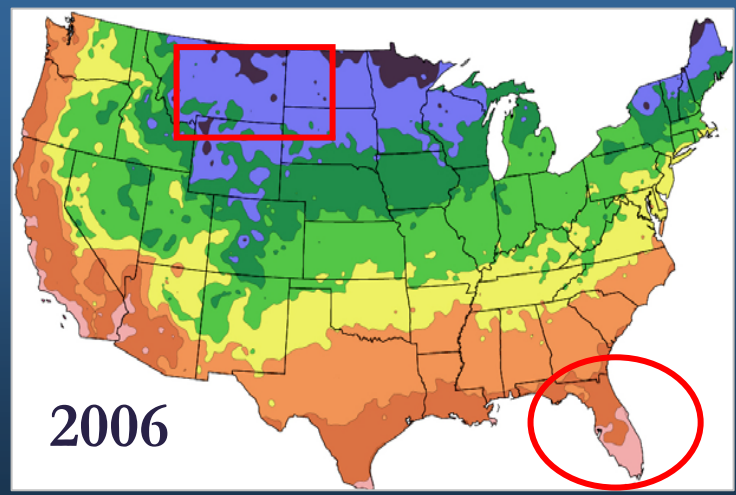


Change Annual Mean Temperature
(1995-2005)



Plant Hardiness Maps

Zone	Avg. Annual Low
2	-40°F through -50°F
3	-30°F through -40°F
4	-20°F through -30°F
5	-10°F through -20°F
6	0°F through -10°F
7	10°F through 0°F
8	20°F through 10°F
9	30°F through 20°F
10	40°F through 30°F



*since 1960s – FL 2°F ↑ av. winter T – subtropic line moved 25 mi. N

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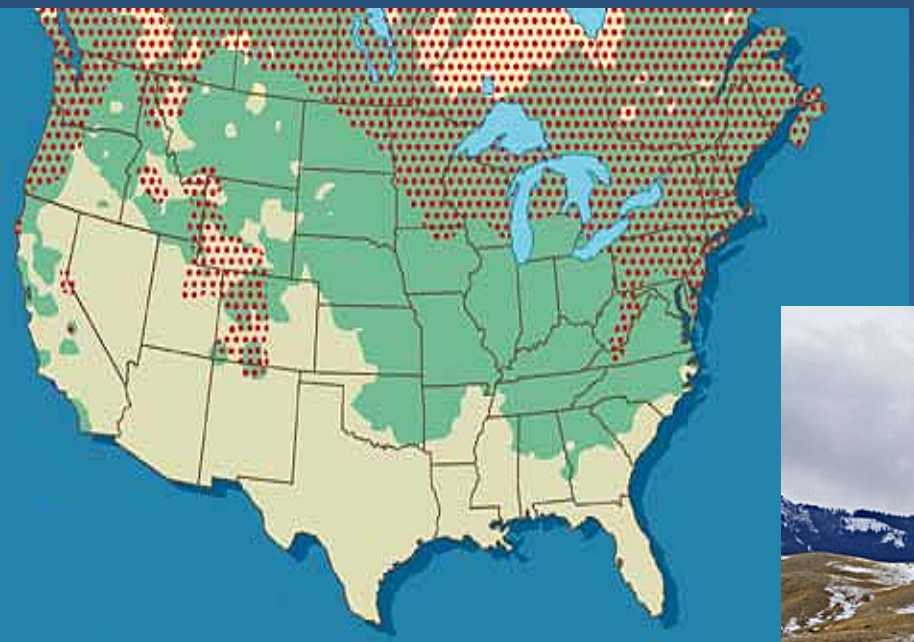
Species will track climate, adapt to new conditions, or go extinct

Response: => track

Shift species range (by latitude)



Current distribution

Predicted under 2x CO_2

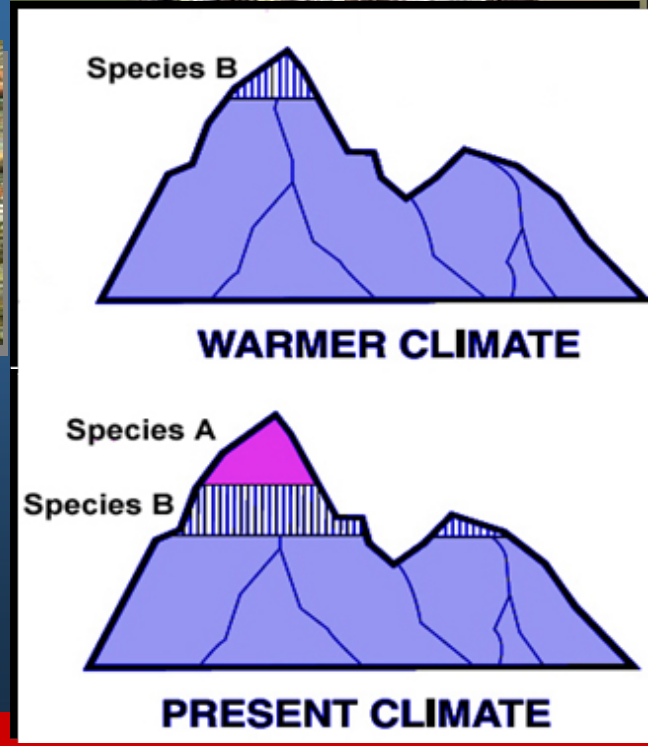
Response: => track

Stranded - exceed physiological tolerance

(by elevation)

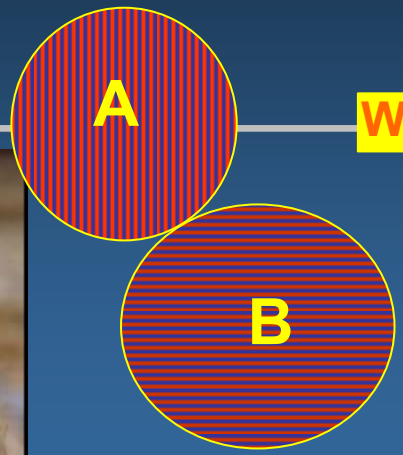
"Rapid movement of climatic zones is going to be another stress on wildlife

…

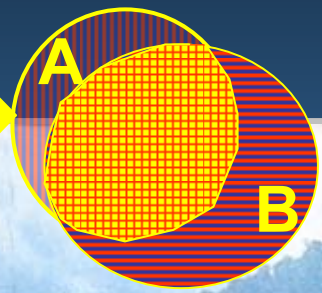


Response: => track

Change community structure



Warming



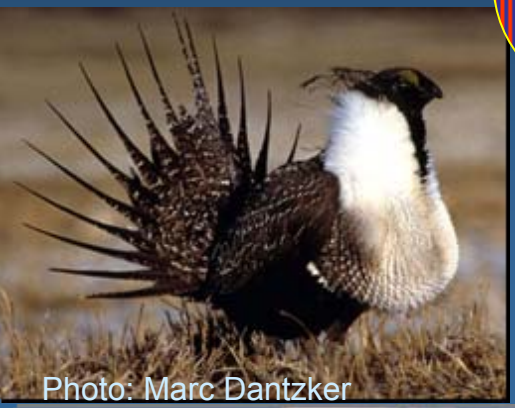
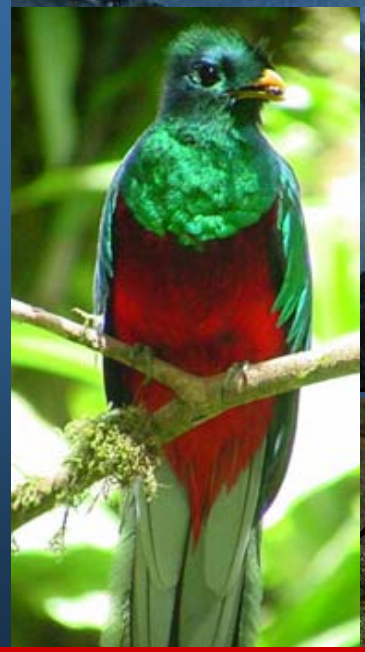
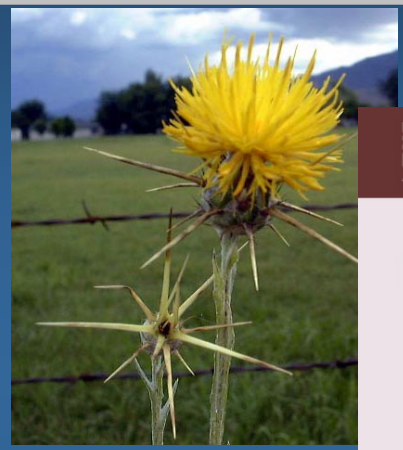


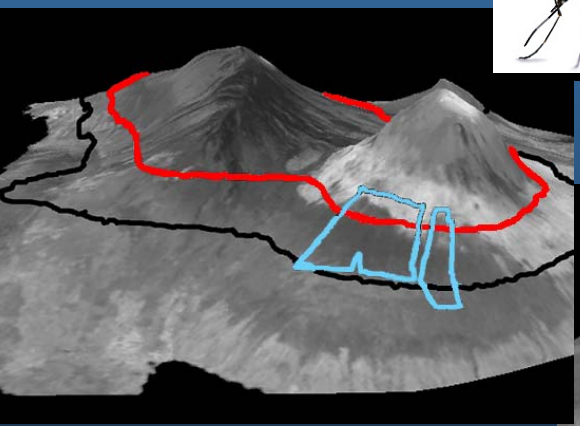
Photo: Marc Dantzker

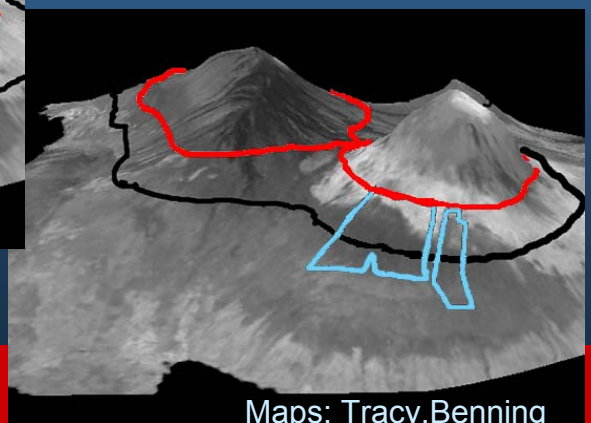


Response: => track

Invasive species advantage and "competitive host"







Maps: Tracy Benning

USGS
science for a changing world

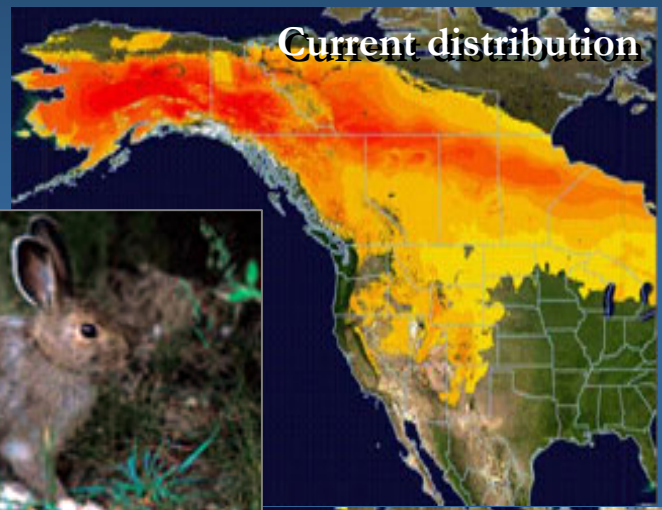
Invasive Species and Climate Change

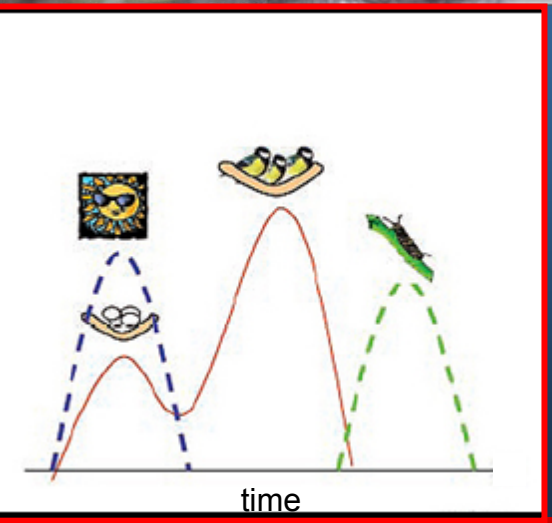
Open-File Report 2006–1153

U.S. Department of the Interior
U.S. Geological Survey

Response: => track?

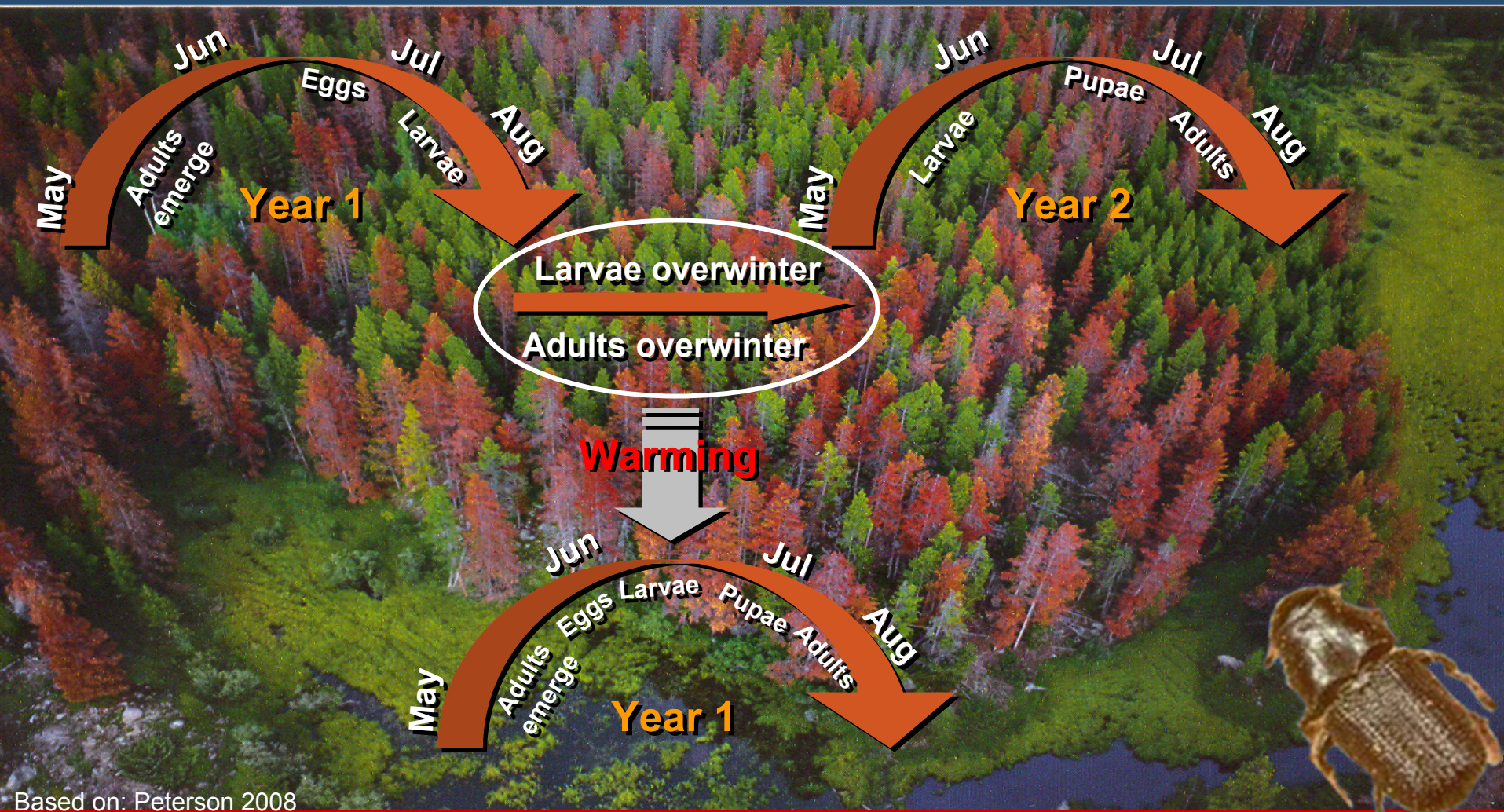
Change in phenology (+biotic interactions)





Response: => "winners + losers"

Increase disease, pests, pathogens



Based on: Peterson 2008

Wildlife Response to Climate Change and the Management Challenge to Help Species Adapt

✓

Species will track climate, adapt to new conditions, or go extinct

Adapt?

Available travel corridors or environmental obstacle course?

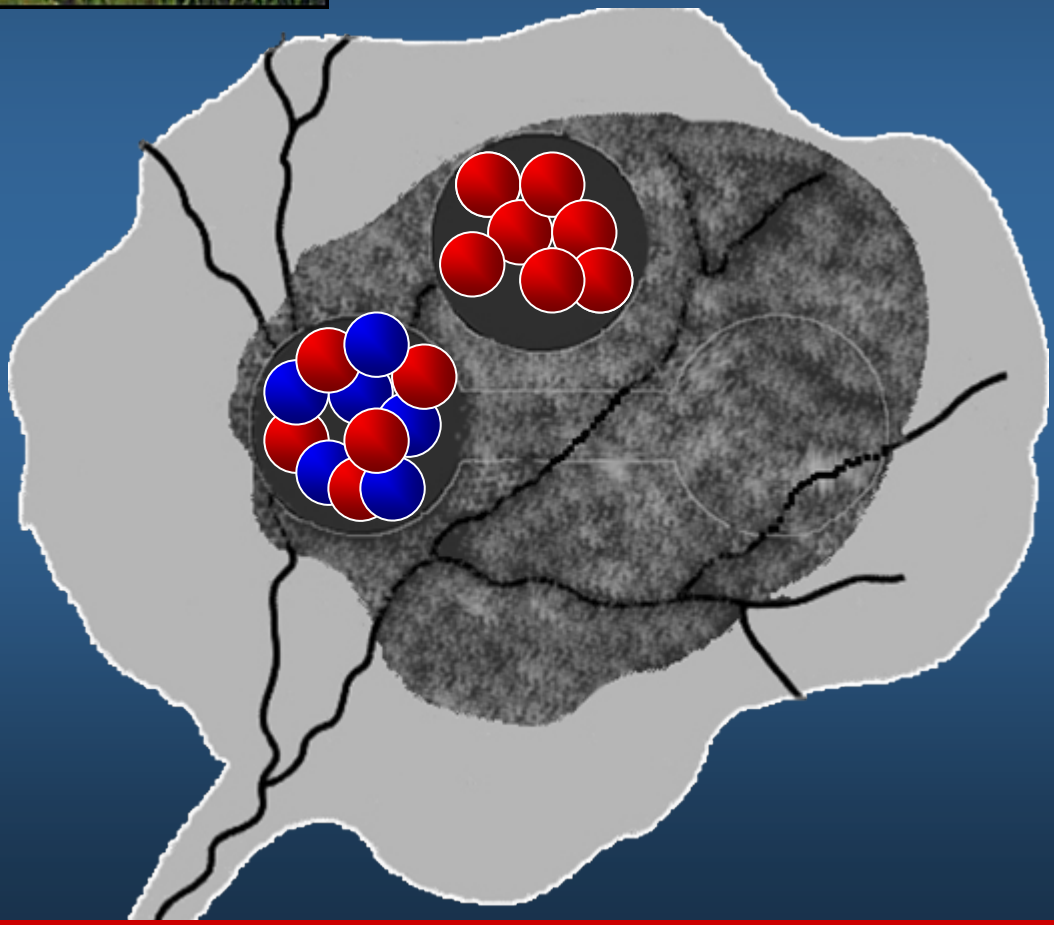
Photo: Kevin Schafer/Corbis-Bettmann

Photo: BioResource Consultants

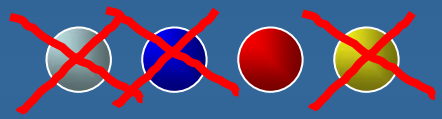
*identify potential travel corridors – plan for CC + human engineered landscape

Adapt? or decline in biodiversity?

Population/Genetic Bottleneck



- different genotypes



- loss genetic diversity due to bottleneck effect
- or founder effect

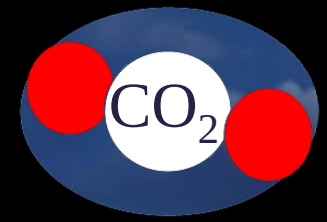
*biodiversity @ the community/ecosystem, species/population, genetic level

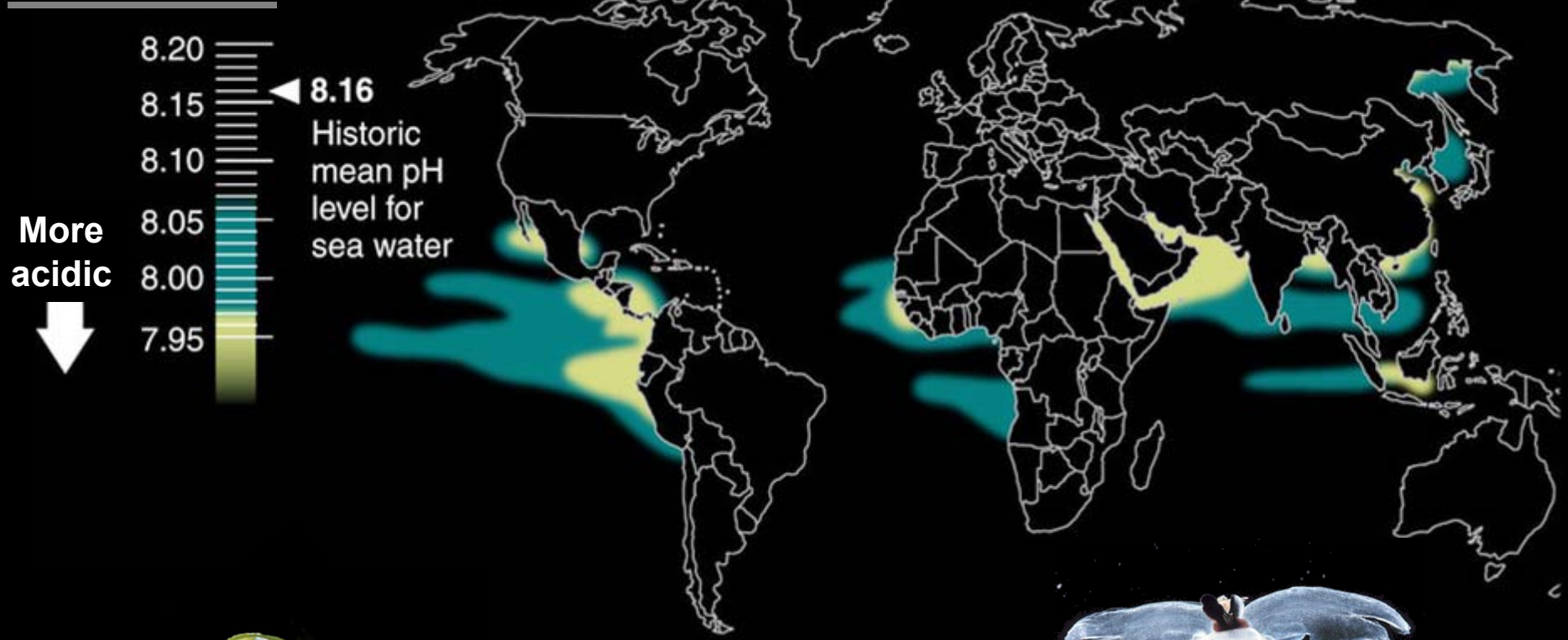
Wildlife Response to Climate Change and the Management Challenge to Help Species Adapt

Species will track climate, adapt to new conditions, or go extinct

Impact => go extinct?

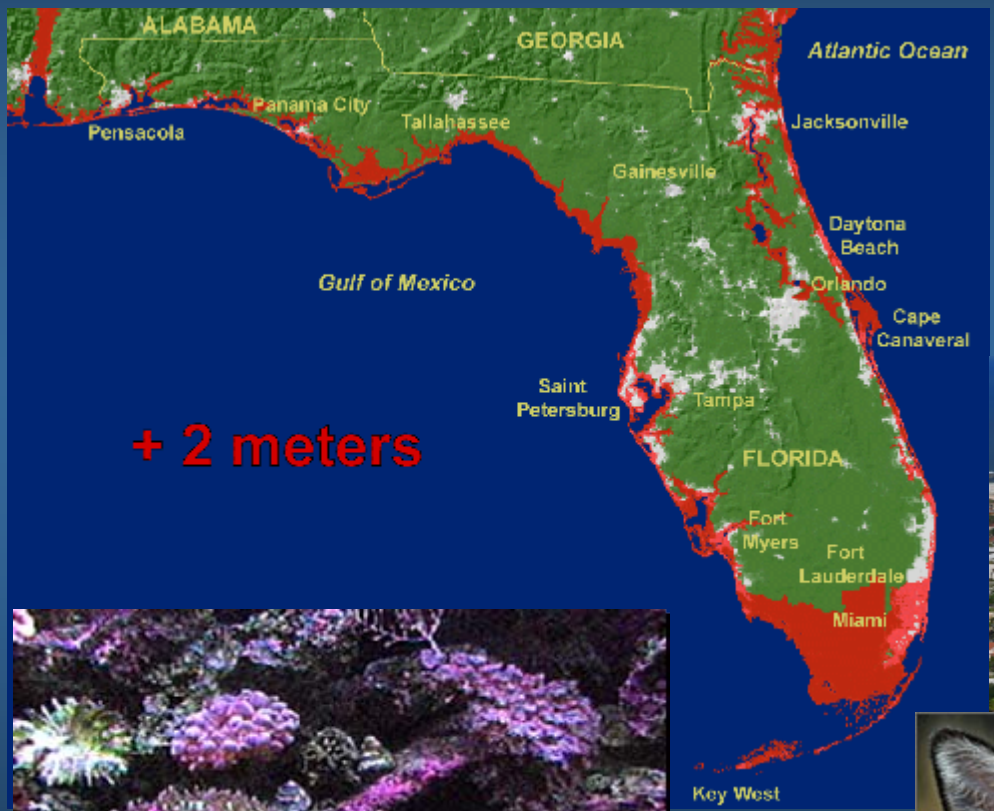
Ocean acidification





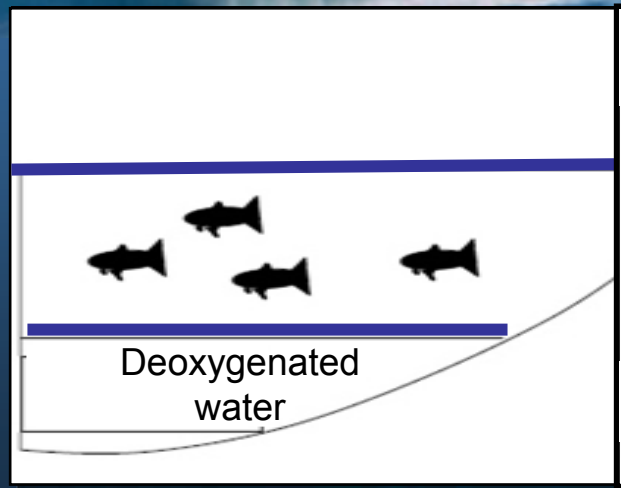
Impact => go extinct?

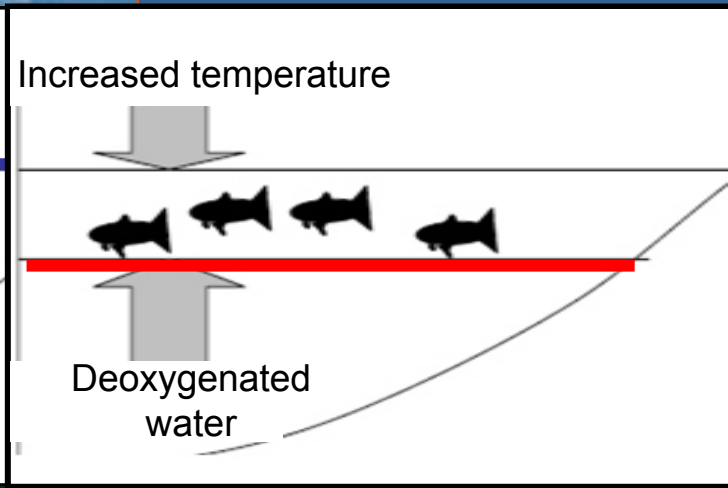
Rise in sea level



Impact: => go extinct?

Loss of critical habitat

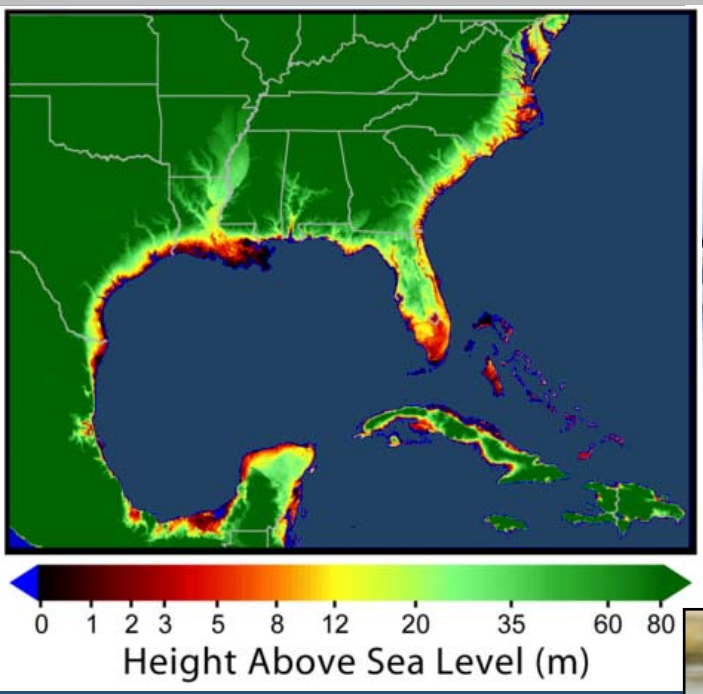




Impact => go extinct?

Increase intensity of Atlantic storms (wave intensity, winds, storm surge)

(satellite data – global trends => best estm. indicate stronger storms w/ ↑ SST)



Globally, ⇈ 1°C SST –

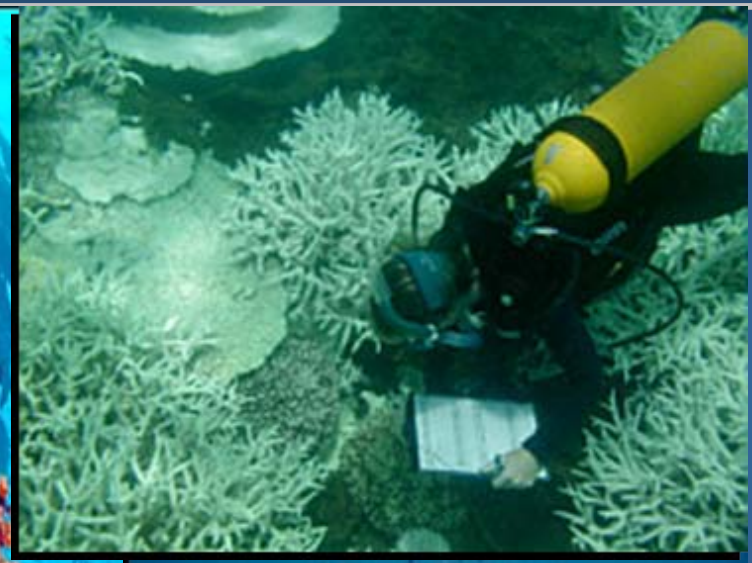
↑ incidence strong storms freq. (31%) per yr.

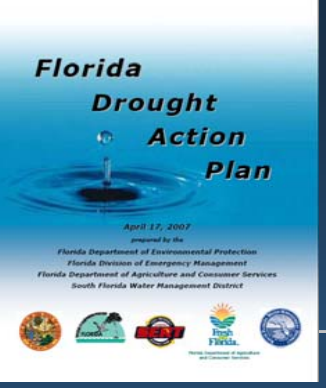
Source: J. Elsner et al., 2008

Impact => go extinct?

System collapse - "tipping point"

(tolerance: thermal, pollutants)



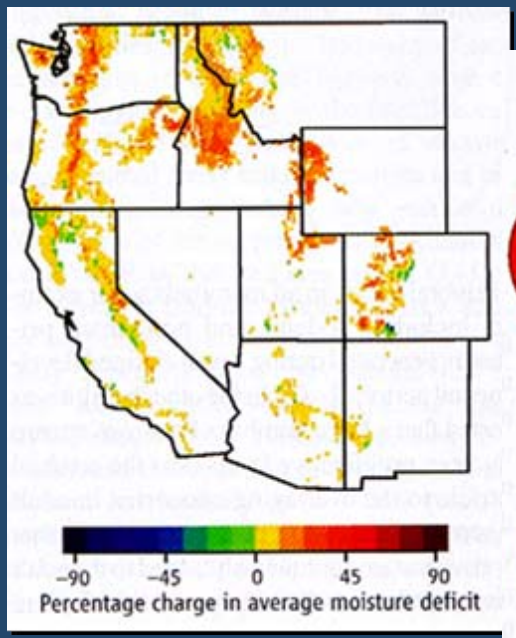


Impact => go extinct? (magnitude)

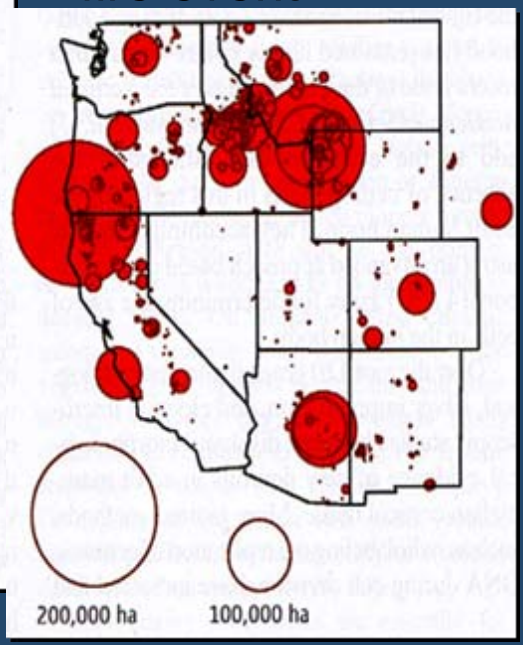
Increase fire frequency & intensity

(not directly attributed - correlated w/ ↑ T. & Δ precip. patterns)

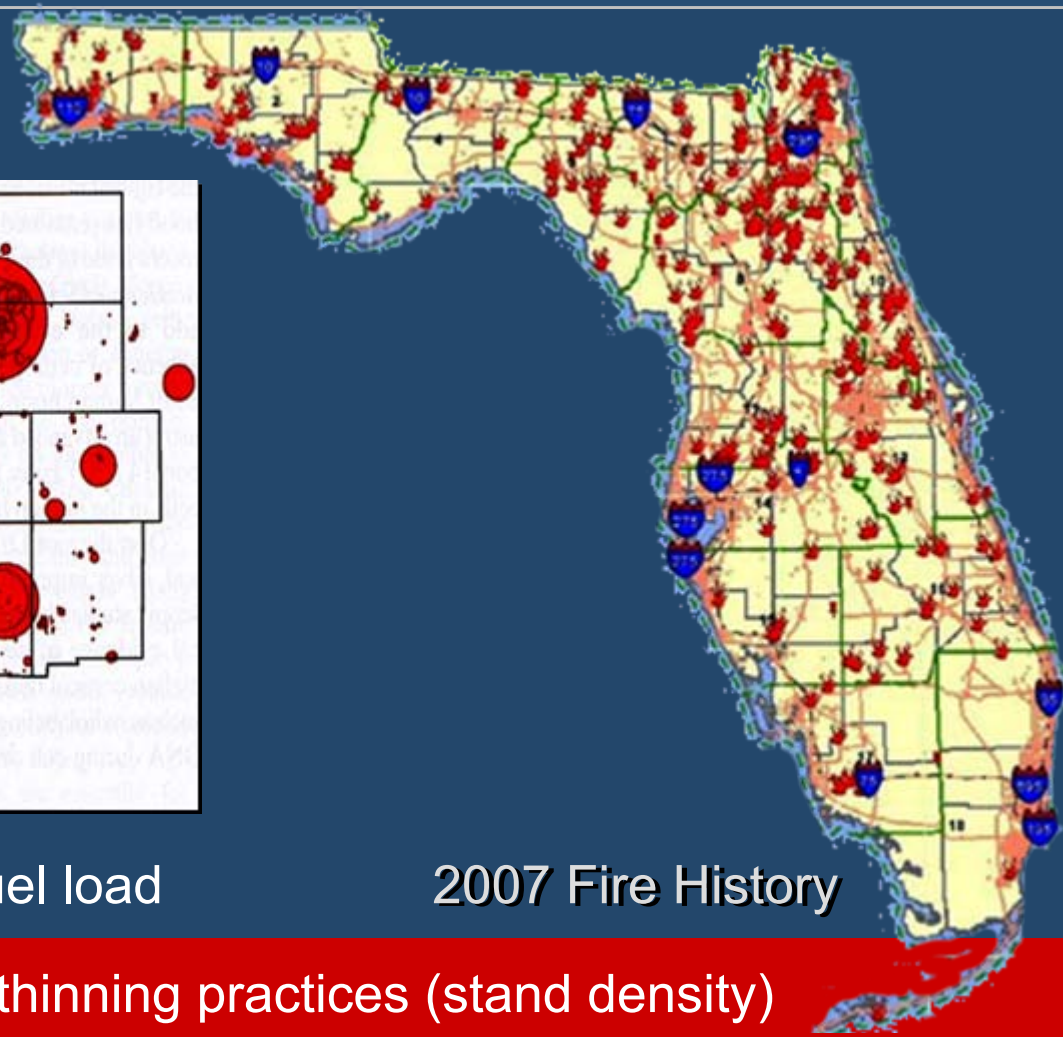
soil moisture



fire event



Source: Running et al. 2006



2007 Fire History

↑ Veg. growth under ↑ CO_2 => ↑ fuel load

*history fire suppression – thinning practices (stand density)

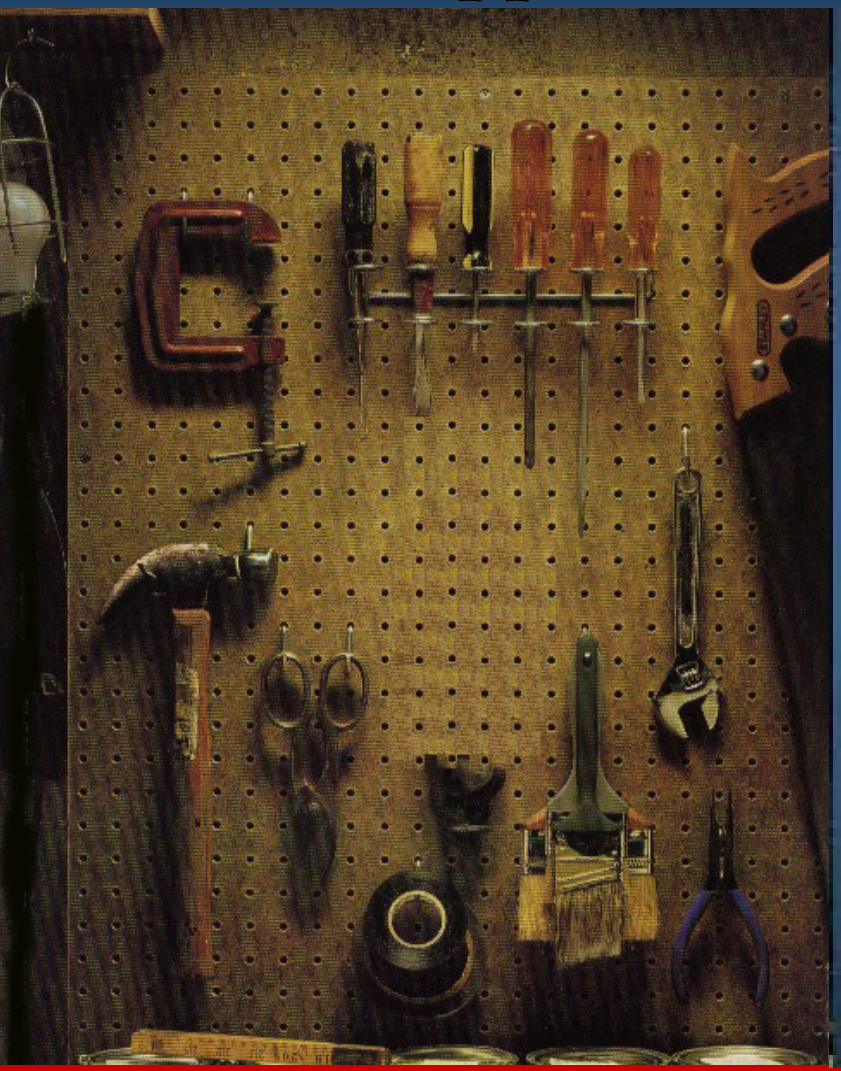
Wildlife Response to Climate Change and the Management Challenge to Help Species Adapt

"The ability of some plants and animals to migrate and adapt appears to be much slower than the predicted rate of climate change."

EPA 230-F-97-008i

Management Challenge

Proven approaches – most cost effective tool

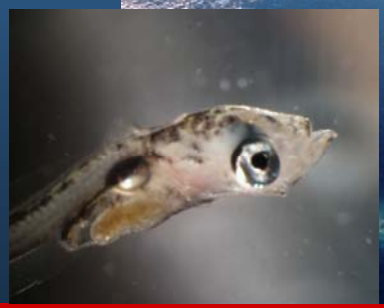


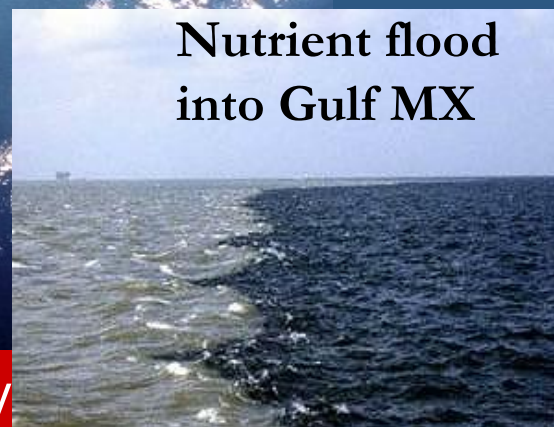
1. Protect natural spaces
2. Maintain resilience
3. Maintain travel corridors
4. Reduce other stressors
5. Practice *active* adaptive mgmt

Management:

1. Protect adequate and appropriate space

spatial



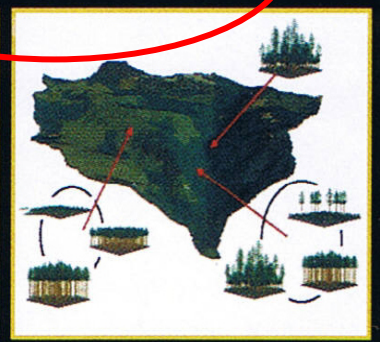


*verify representation & redundancy w/in CC sensitivity

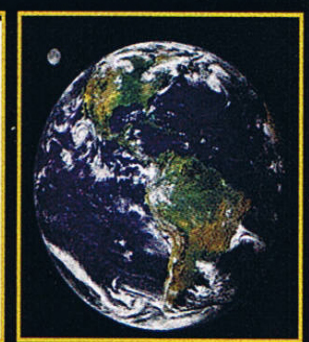
Management: Modeling

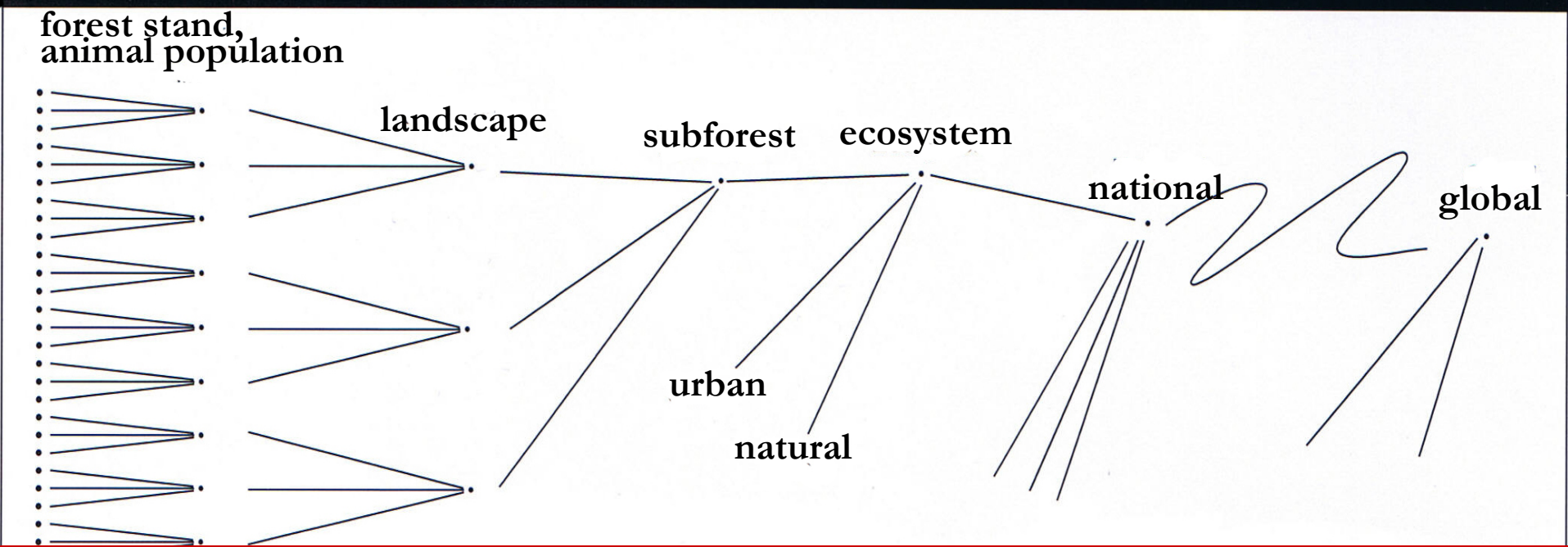
1. Protect adequate and appropriate space

temporal

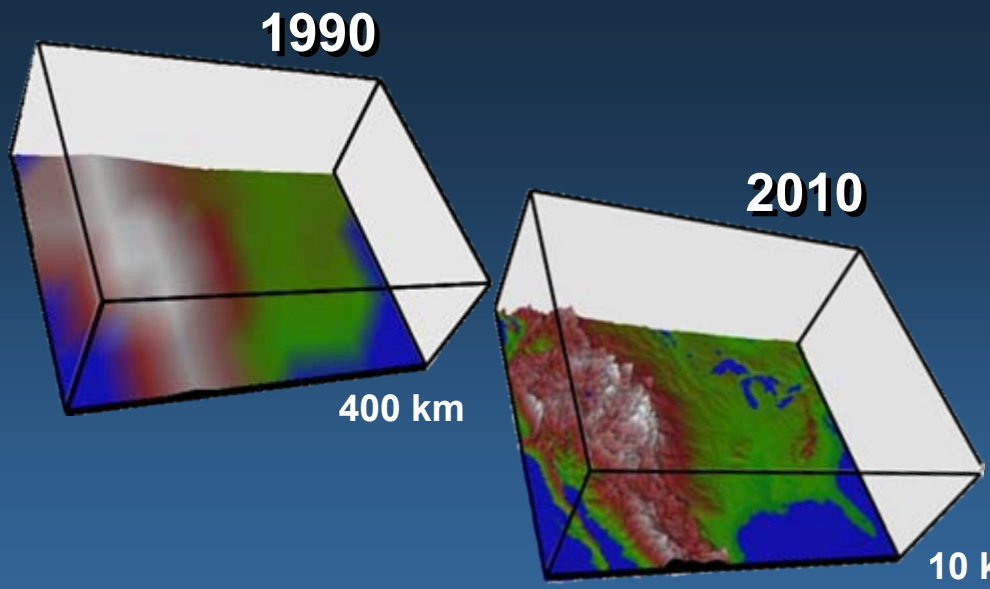


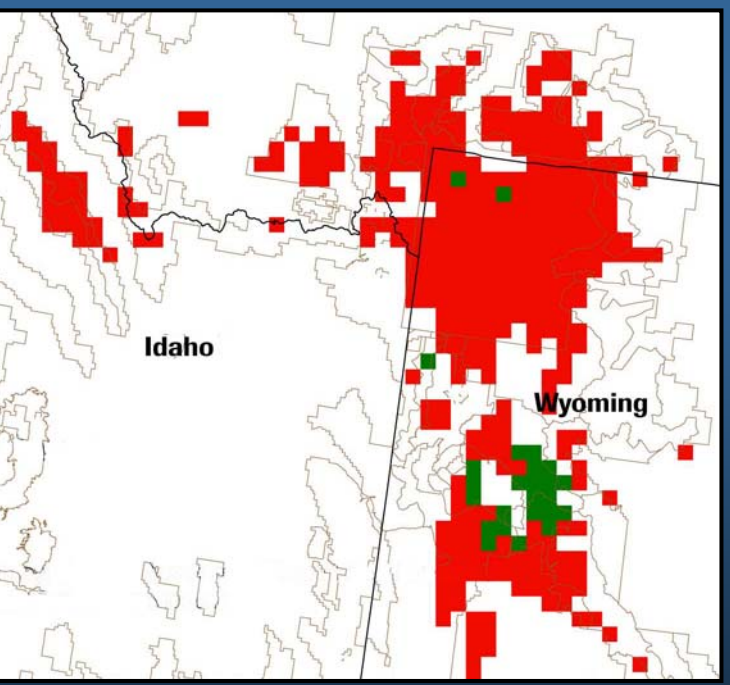
scale





*scientists and managers work more closely (*integrate modeling into mgmt*)



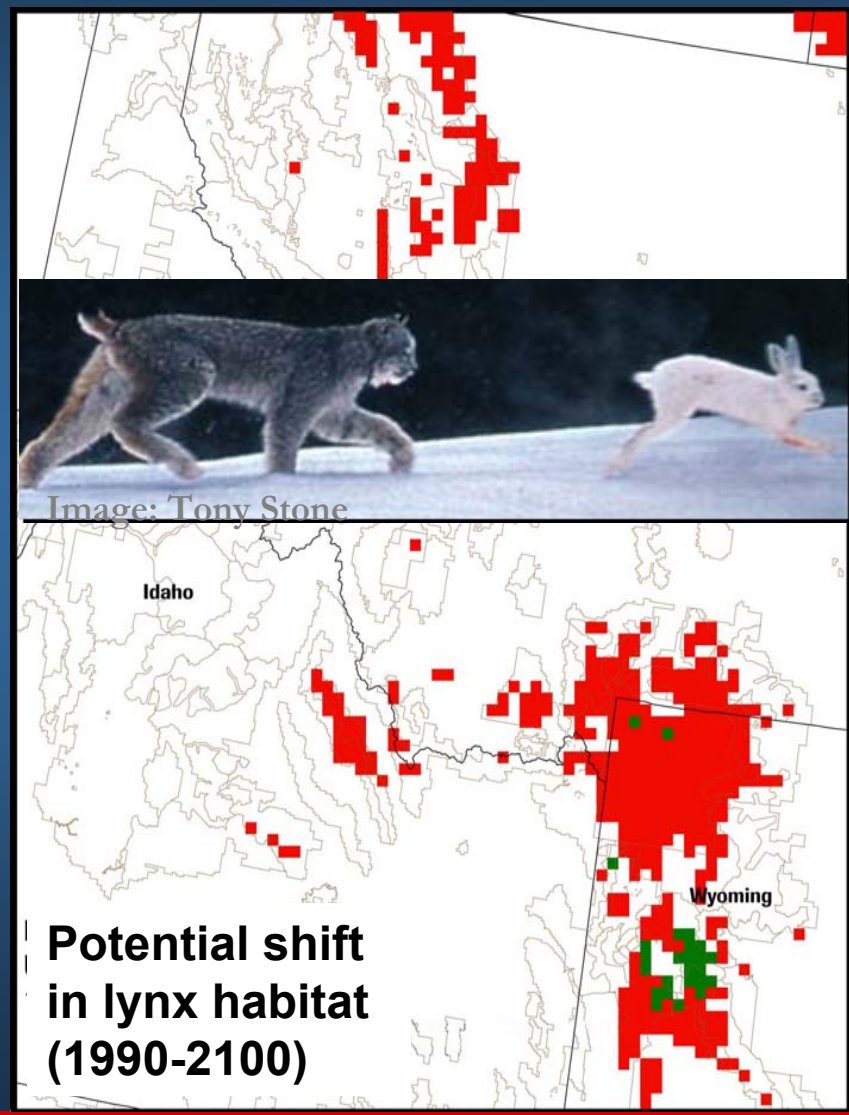


Source: P.Gonzalez et al., 2007

potential loss

potential refugia

Nat'l forest, park, refuge



*identify refugia *("hotspots" "cold spots")* => predicting future range

Management:

2. Enhance resilience - natural systems

*measures, benchmarks, indicators

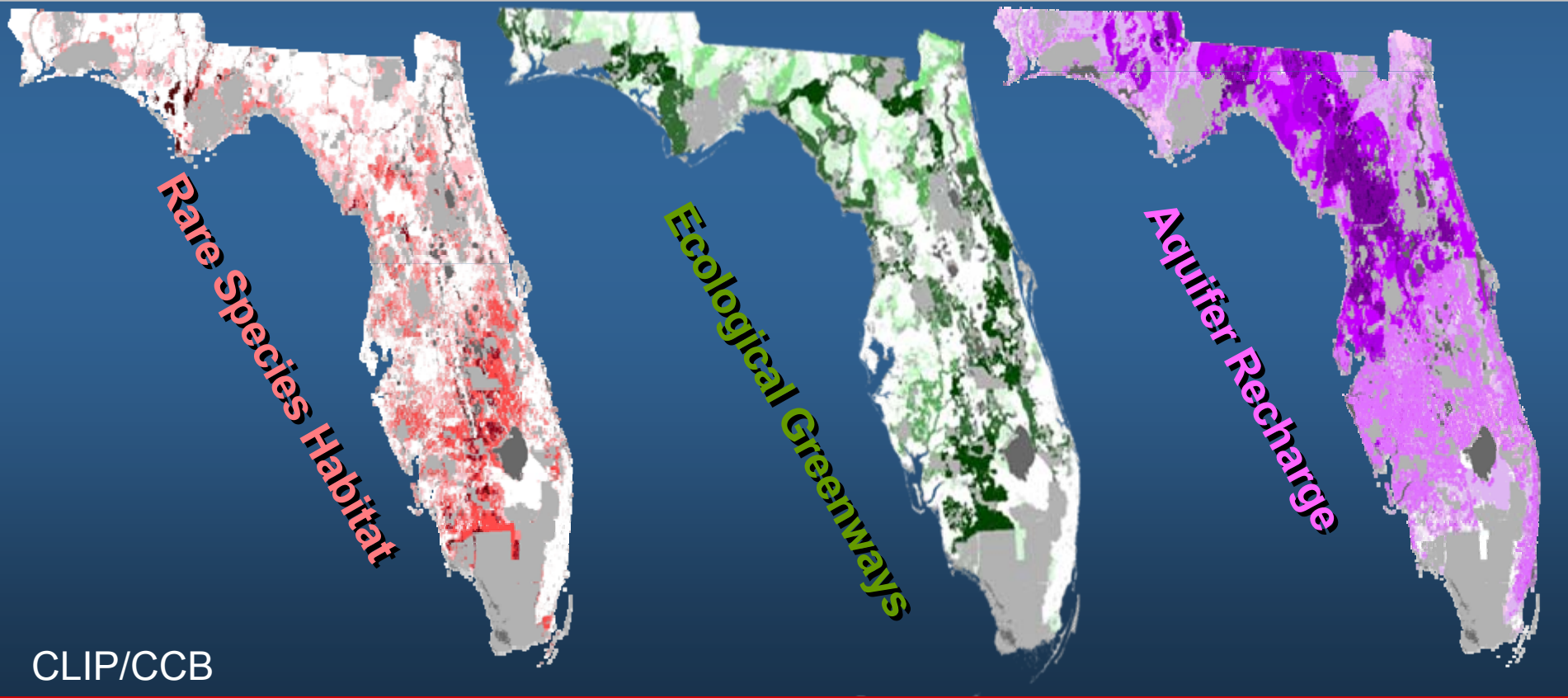
– Q. success?

- manage groundwater extraction, augment stream flow, restore natural flow and filtration *(wetlands)*
- translocation, captive propagation & reintroduction
- improve habitat quality, restoration degraded
- planning incorporate dynamics outside PAs

*act – we can do these NOW

Management:
3. Estab./Maintain Travel Corridors

Critical Lands & Waters Identification Project
& the Cooperative Conservation Blueprint



CLIP/CCB

Management:
4. Eliminate/reduce other stressors

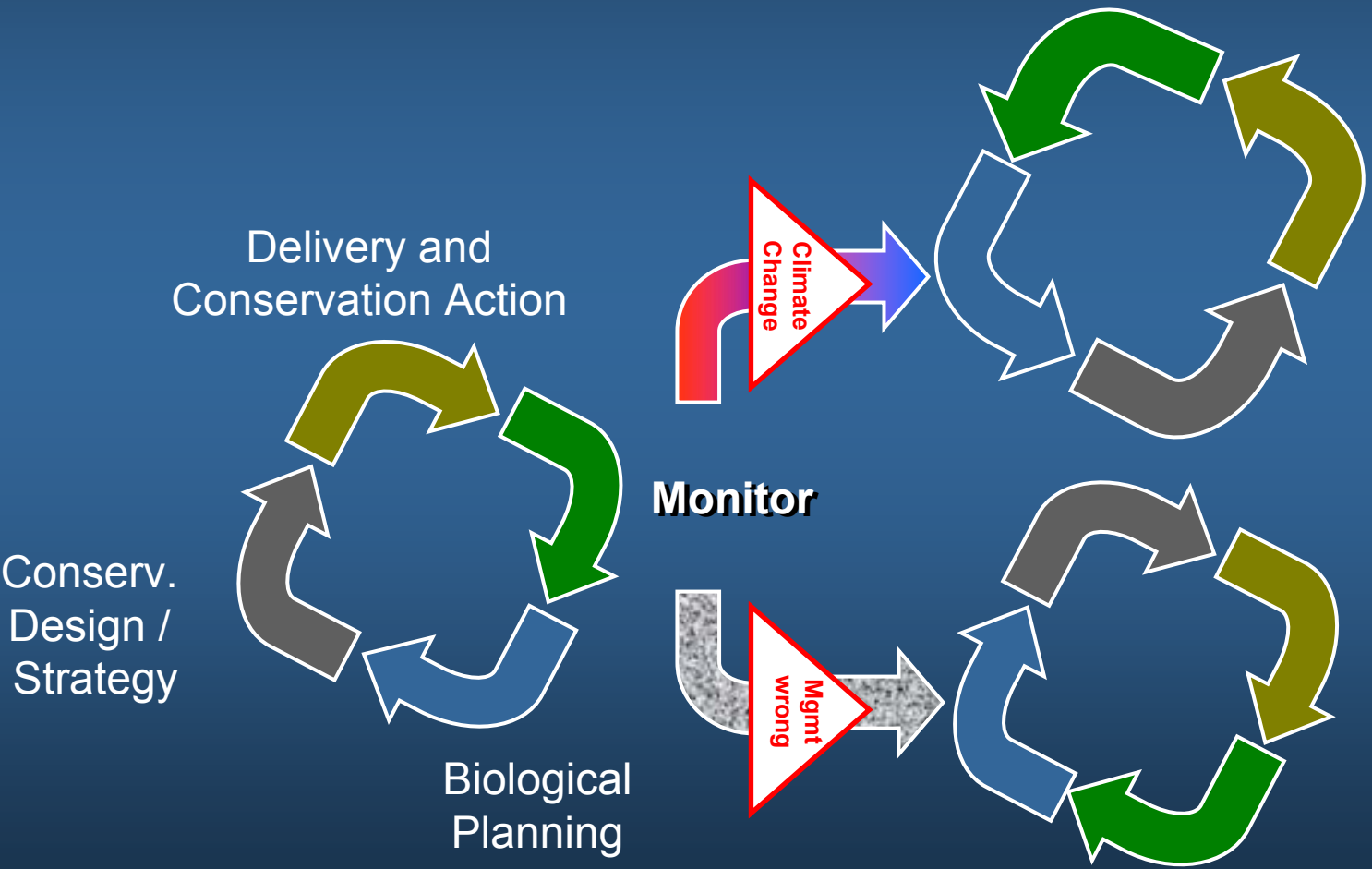
- eradication of injurious invasive species
- fire and pest management
- reduce pollution
- minimize fragmentation
- prevent genetic hybridization

Management:

** Integrated monitoring*

*monitor!!!!

Management:
5. Institute proactive adaptive management



If we wait until we work out the uncertainties

"climate change would have changed the playing field yet again."

Lara Hansen

"act and study" – treat as testable hypotheses

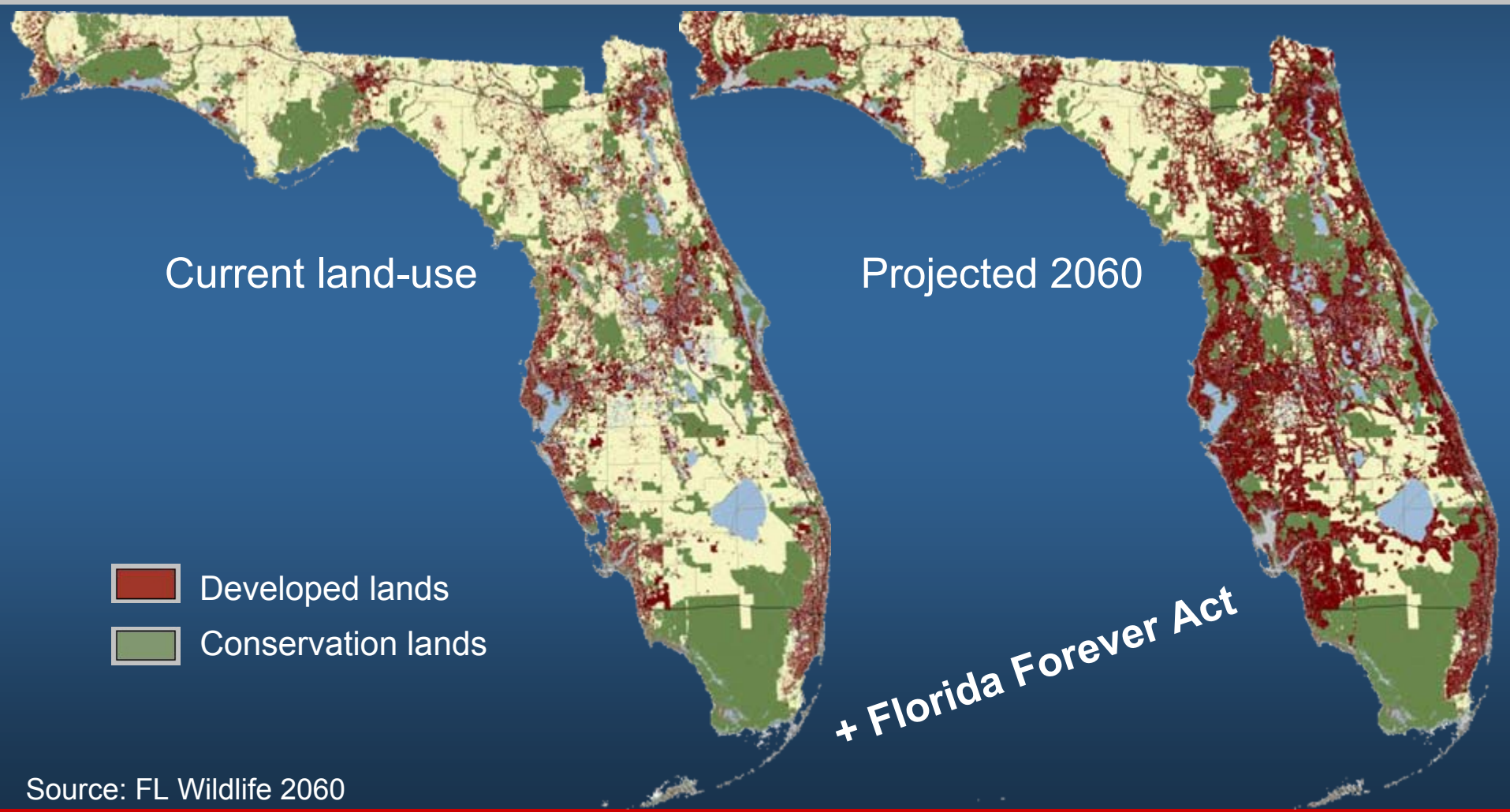
Institutional/Policy Challenge

Leadership & Commitment:

1. ID current and potential options: corridors and partnerships
2. Infuse flexibility into Mgmt approach - (non analog)
3. Layout research agenda
4. Formulate new/revise policies and incentives
5. Develop policy guidance - new/revised approaches

FL FWC "*is committed to a transformation that will take us from being a good wildlife conservation agency to being a great one.*"

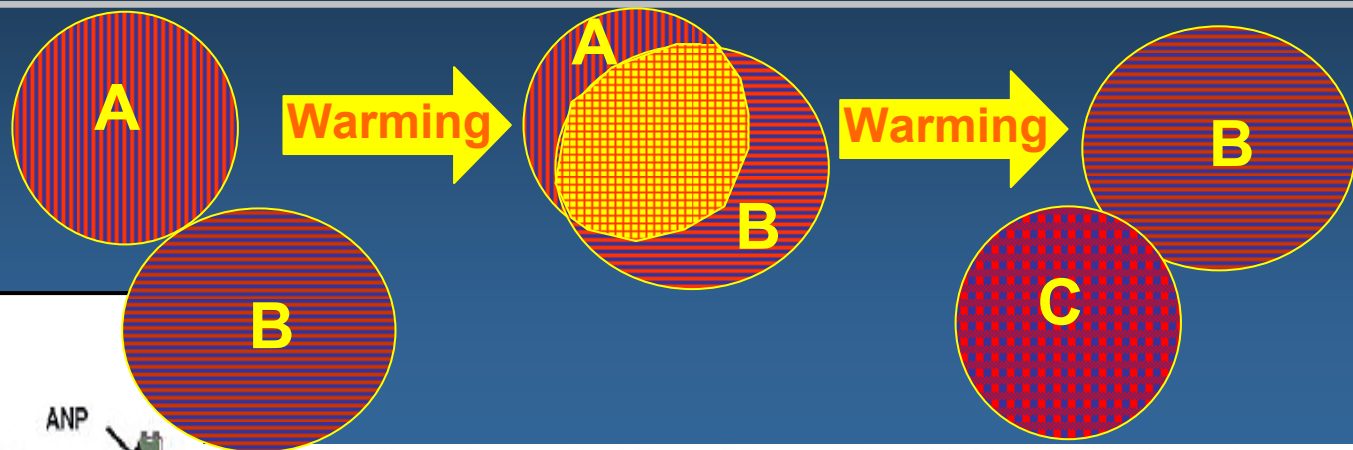
ID current and potential options: corridors and partnerships – private lands and development



Source: FL Wildlife 2060

*create networks – geographic and human

Infuse flexibility into Mgmt approach - managers able to respond to unanticipated changes (non analog)



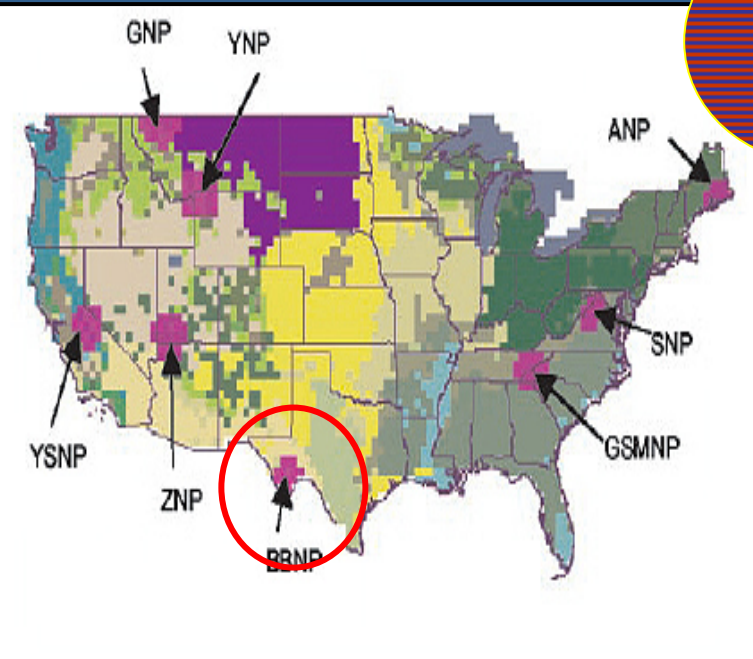


Table 1. Current species found in selected U.S. national parks and predicted species losses, gains, and net turnover under a doubling of atmospheric CO_2

Park	Current species richness*	Species lost	Species gained	Turnover†
Acadia	43	3	8	5
Big Bend	48	10	22	12
Glacier	52	2	45	43
GSM	48	8	29	21
Shenandoah	33	3	11	8
Yellowstone	53	0	49	49
Yosemite	64	6	25	19
Zion	53	1	41	40

†Turnover calculated as species gained minus species lost.

*adopt policies to facilitate managers' ability to respond to changing conditions

"even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades,

which makes adaptation essential, particularly in addressing near-term impacts" *(IPCC 2007)*

What's at stake?

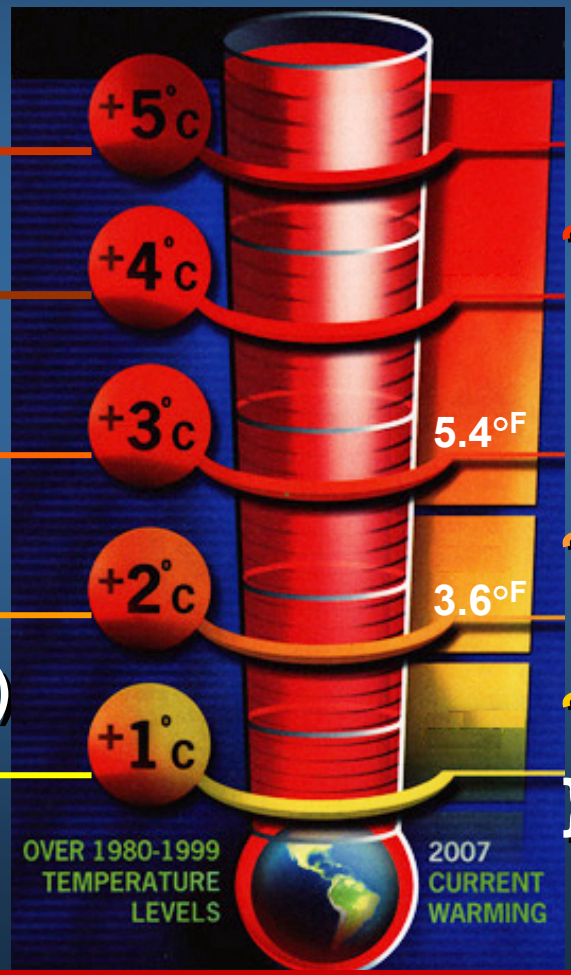
Extinction (>40% known species)

~30% of Global Wetlands lost

Major Changes in Natural Systems => Negative Effect on Biodiversity

↑ risk extinction (20-30% known species)

↓ water, ↑ drought, ↑ fire risk, ↑ flood/storm damage



Graphic adopted from: www.net.org

FL WILDLIFE: FRONTLINES SUMMIT – WORKING SESSIONS

"Whether we succeed or fail at this endeavor will be determined less by how much the FWC alone can do, and more by how effective we all become at building the meaningful partnerships that will be needed to take advantage of the often elusive but very tangible conservation opportunities at hand and on the horizon."

Kenneth Haddad, Exec. Dir, FL FWCC

Florida's Wildlife: On the Frontline of Climate Change

... Florida's FWC at the Forefront in Addressing it.