Coping With A Changing Climate

Challenges & Resources for Land Trusts

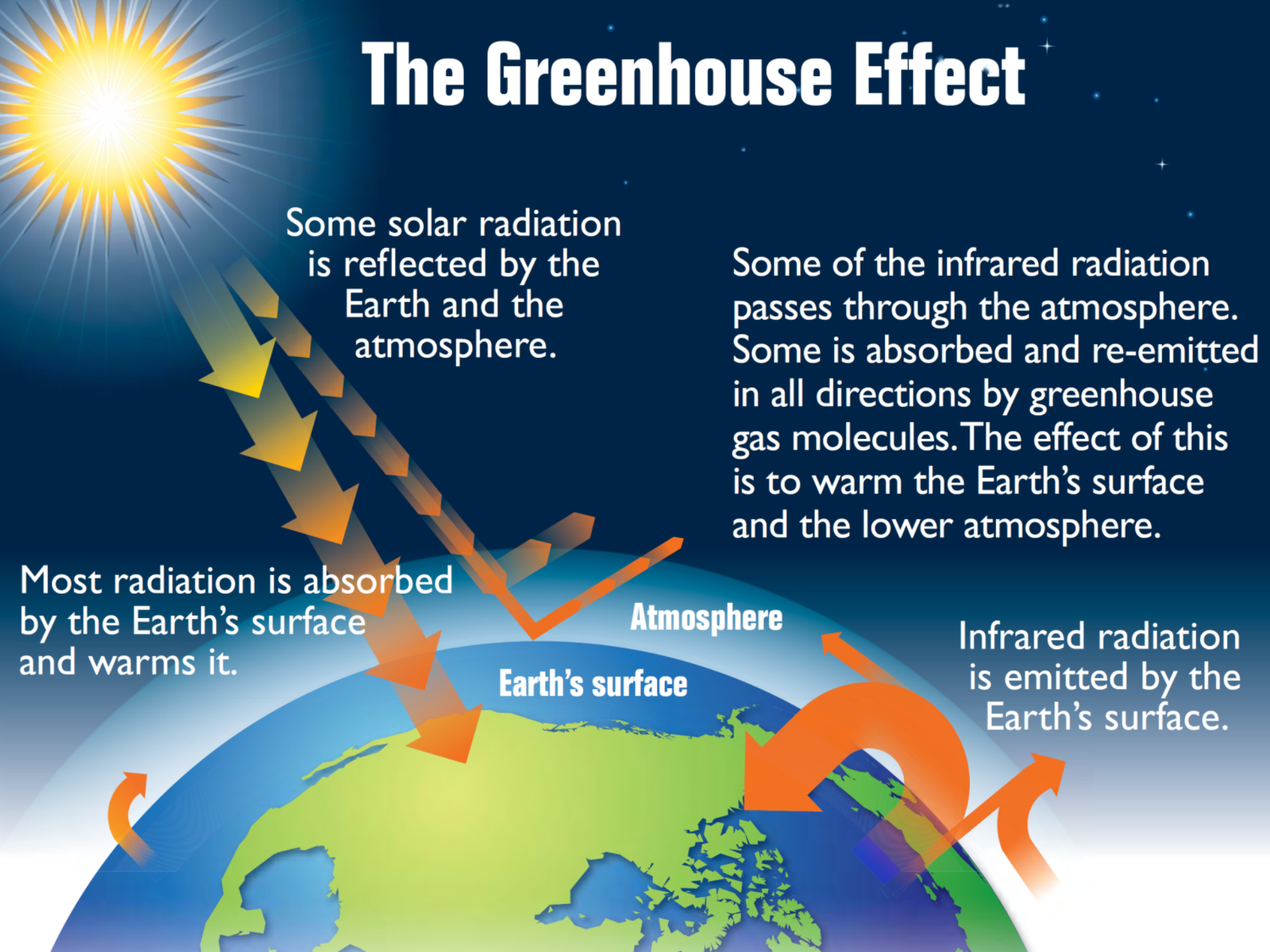
The Nature Conservancy

Protecting nature. Preserving life.™

PRAIRIE STATE CONSERVATION COALITION

Making Conservation Land Trusts Stronger

The Greenhouse Effect



the greenhouse effect


Svante August Arrhenius

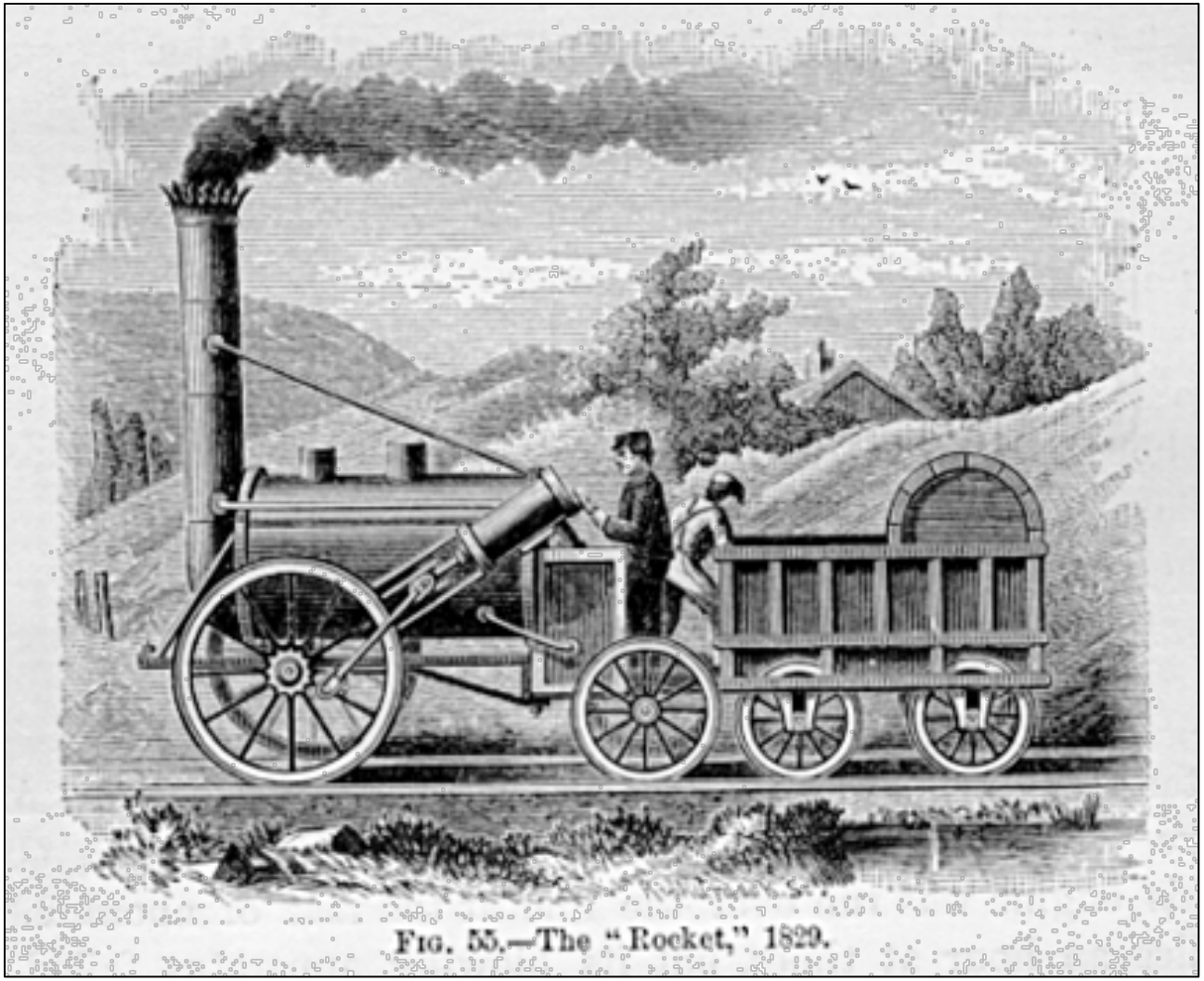
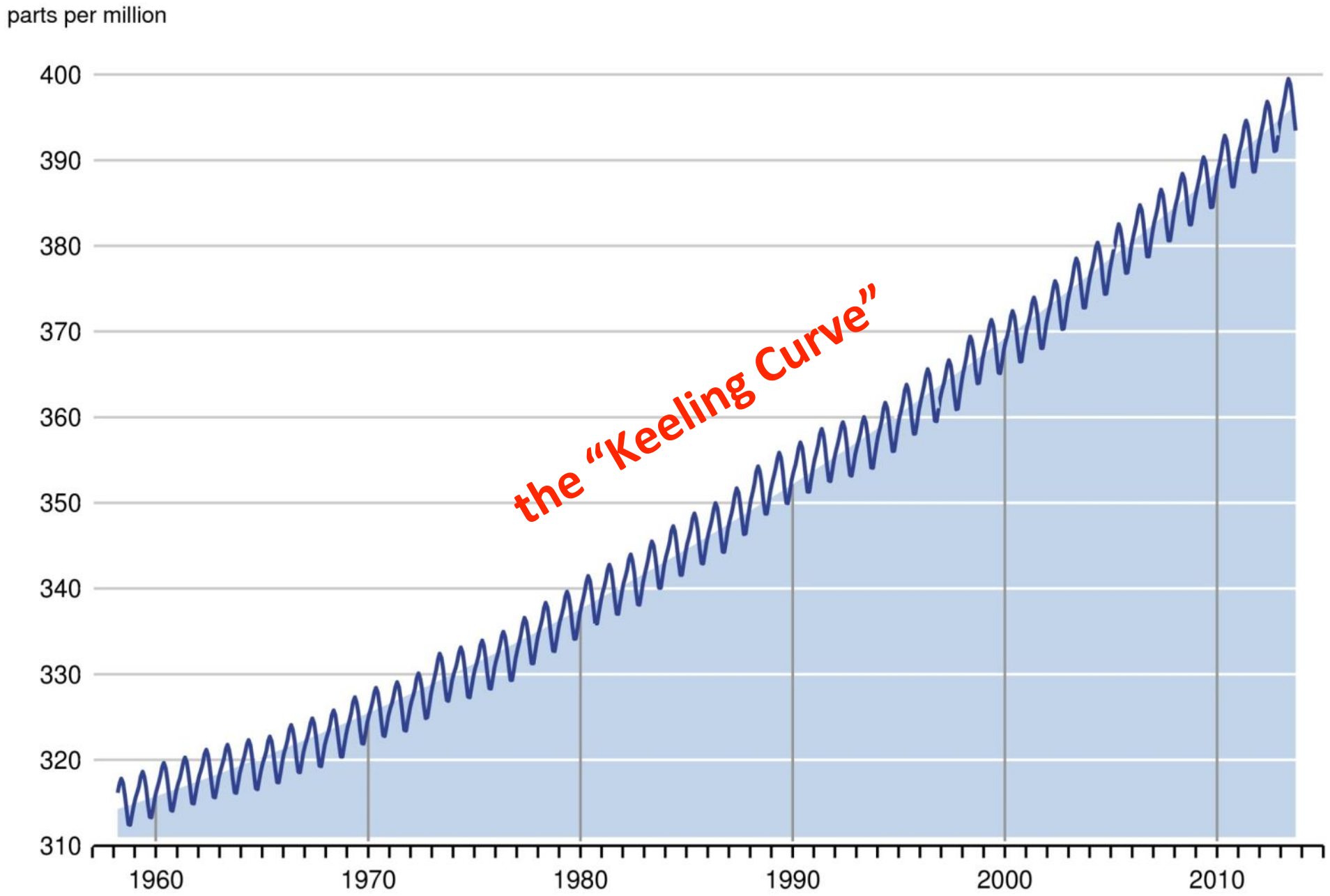


Fig. 55.—The "Rocket," 1829.

Monthly CO_2 Concentration, Mona Loa, Hawaii

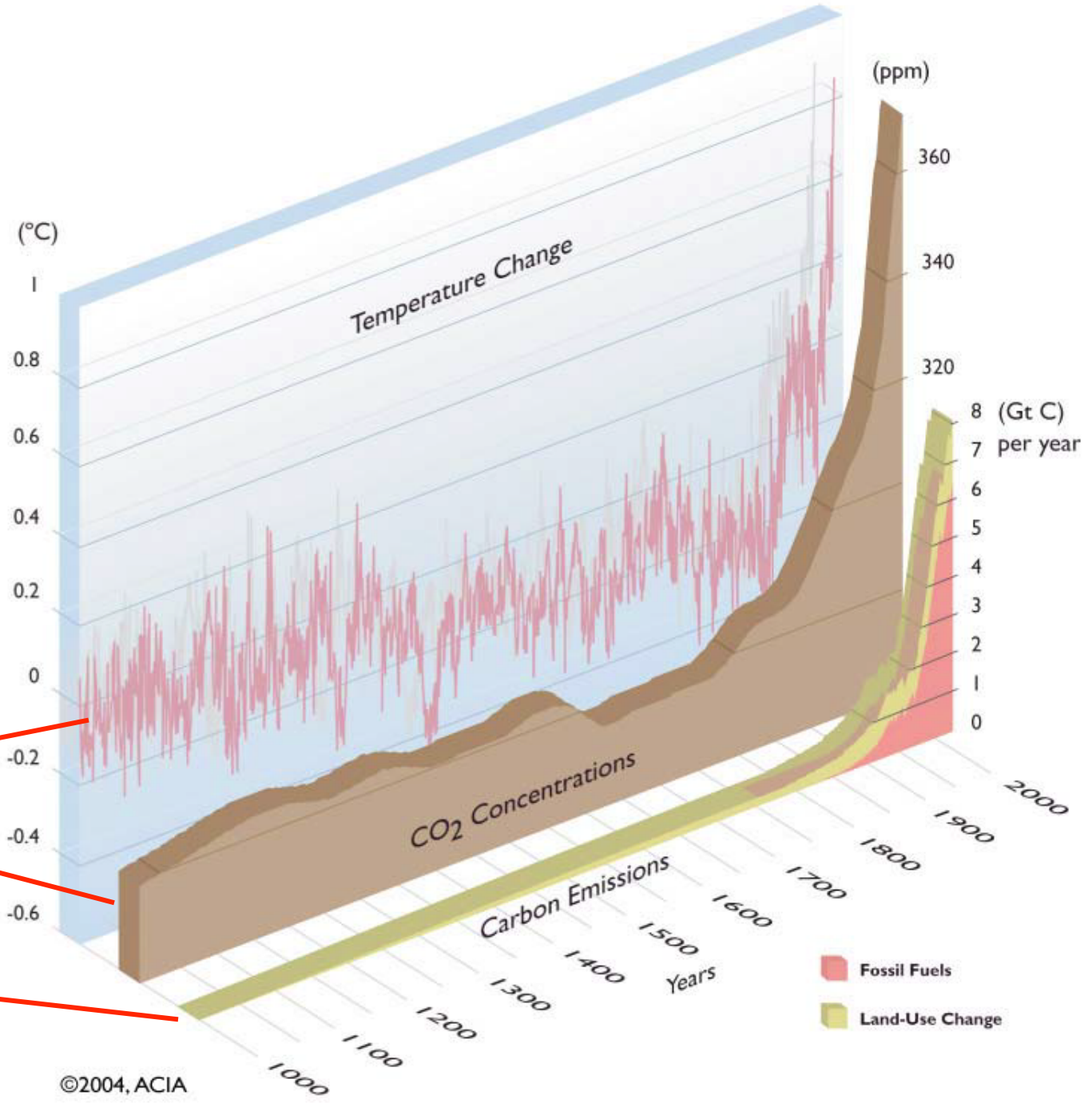


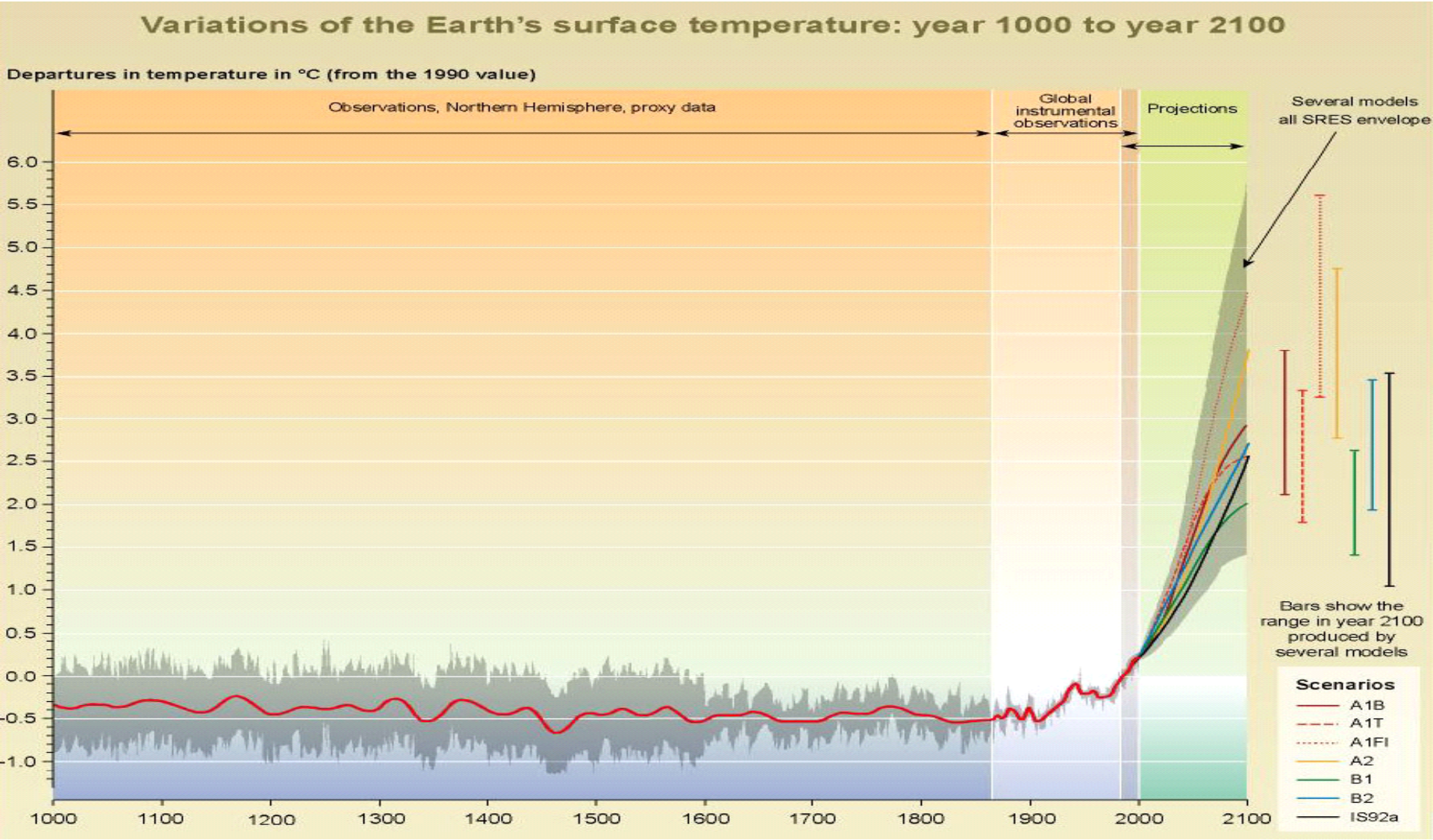
Strong Correlation!

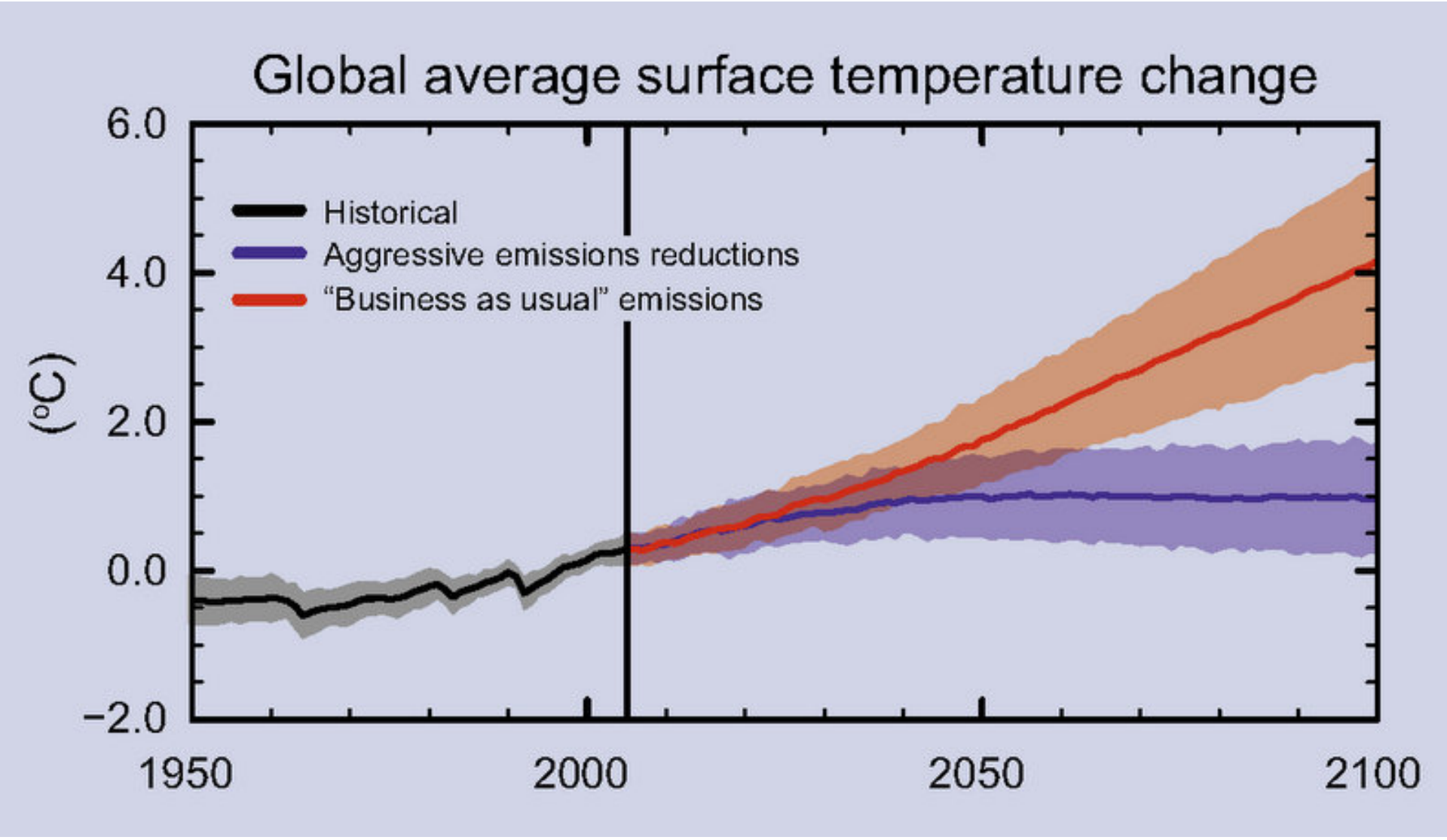
global temperature

atmospheric CO2

GHG emissions

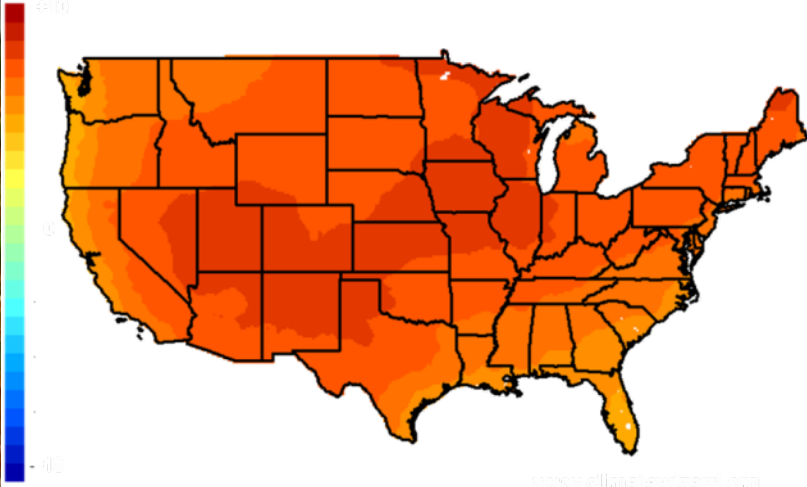



Variations of the Earth's surface temperature: year 1000 to year 2100
Departures in temperature in °C (from the 1990 value)
Observations, Northern Hemisphere, proxy data
Global instrumental observations
Projections
Several models all SRES envelope
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
Bars show the range in year 2100 produced by several models
Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a


Global average surface temperature change
6.0
4.0
2.0
0.0
−2.0
(°C)
Historical
Aggressive emissions reductions
“Business as usual” emissions
1950
2000
2050
2100

Direct Climate Change Effects

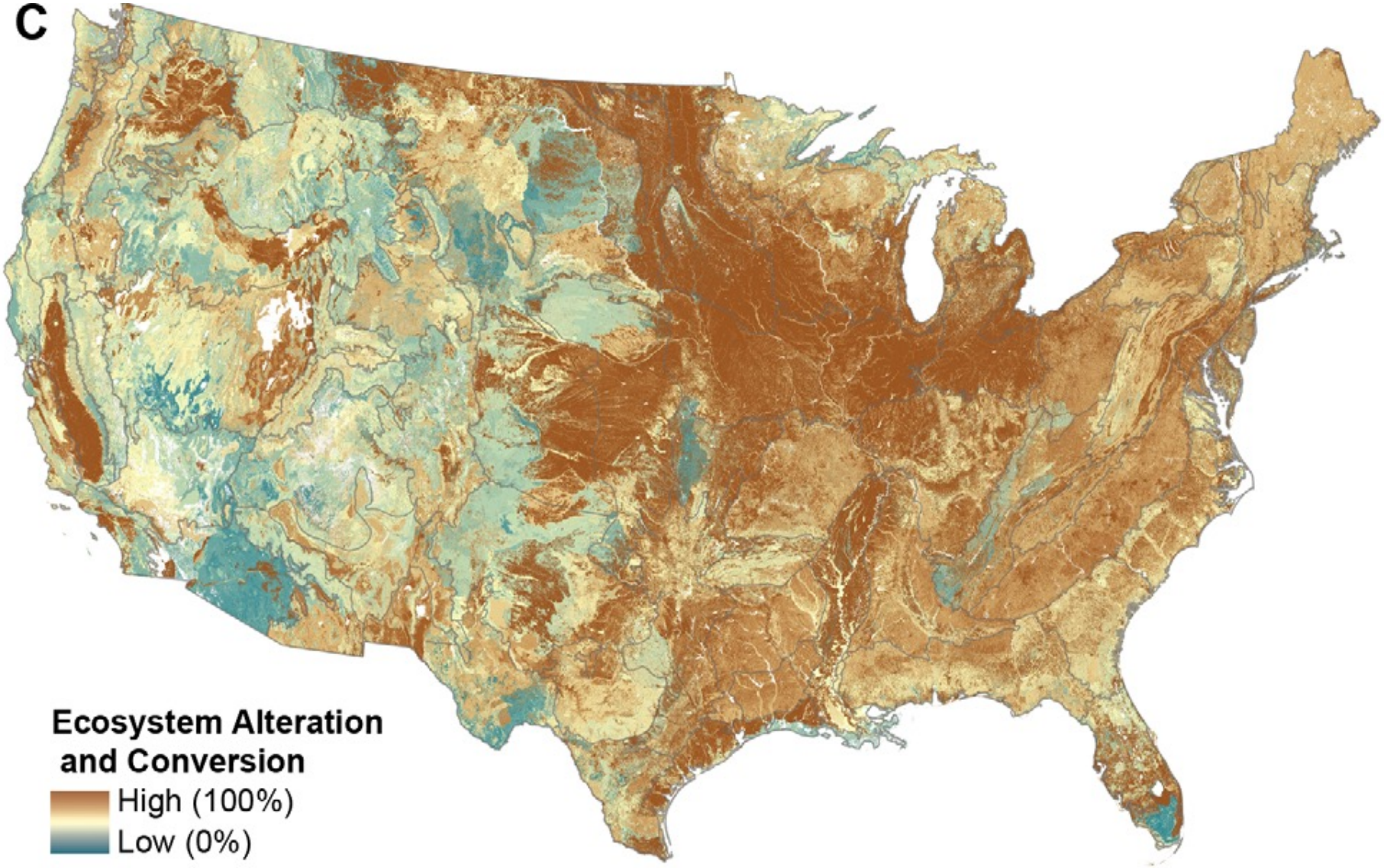
Louisville, IL, July 2012
Robert Ray/Assoc Press



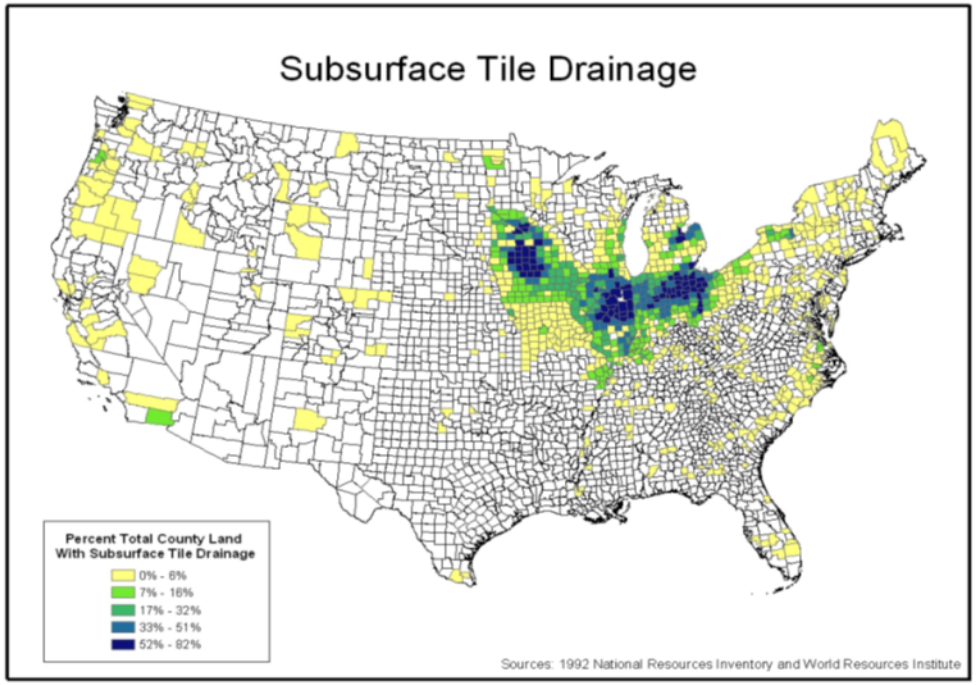
near Havana, IL, April 2013
K. Doug Blodgett, TNC

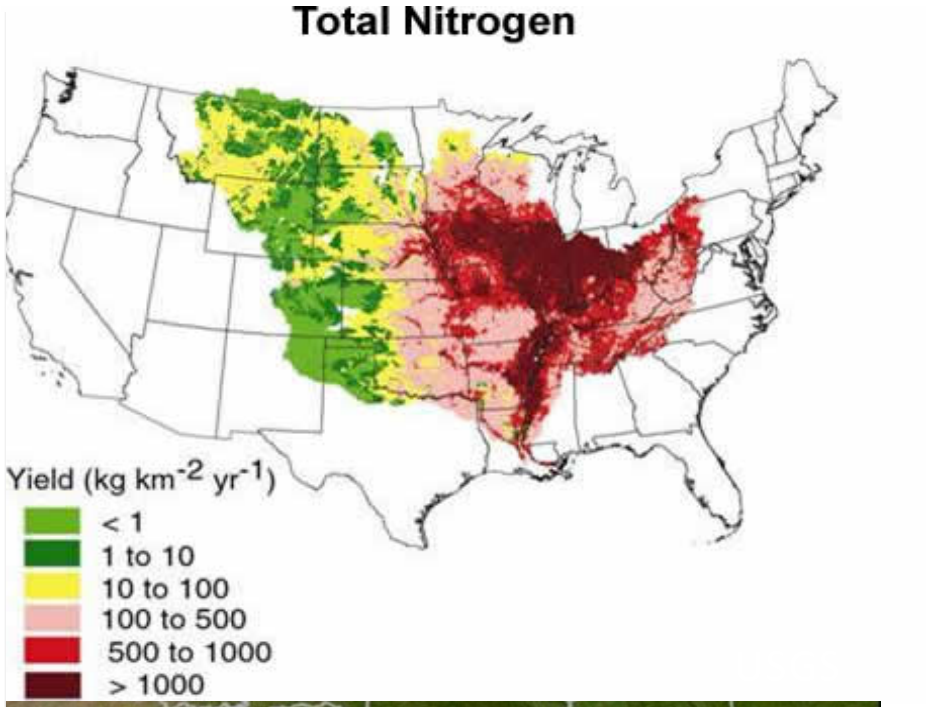
Indirect Climate Change Effects

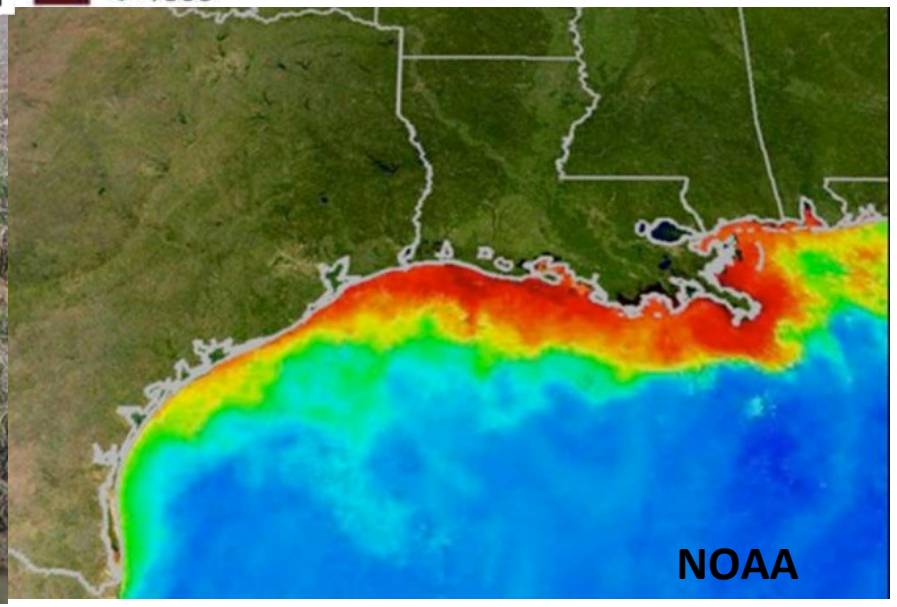
A Challenging Region, on the Land…



…Under the Land…





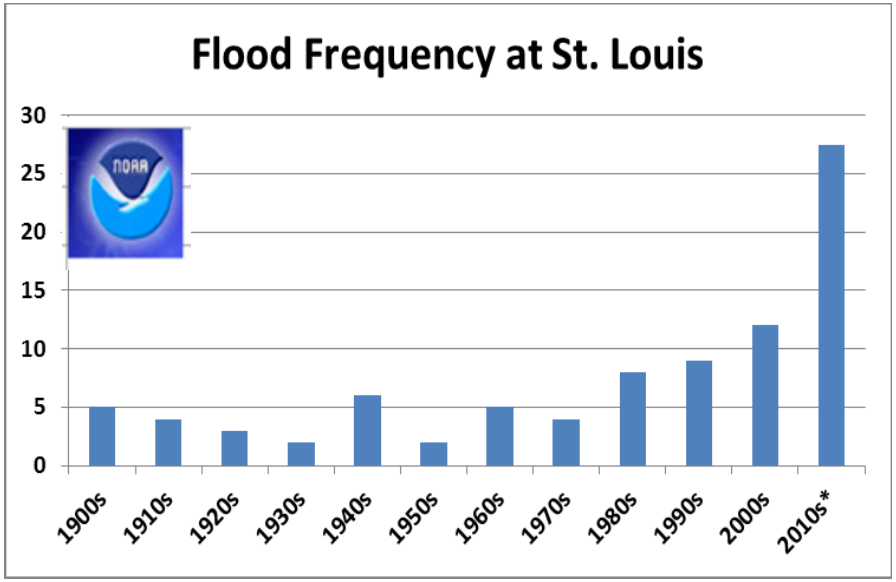


…And in the Water

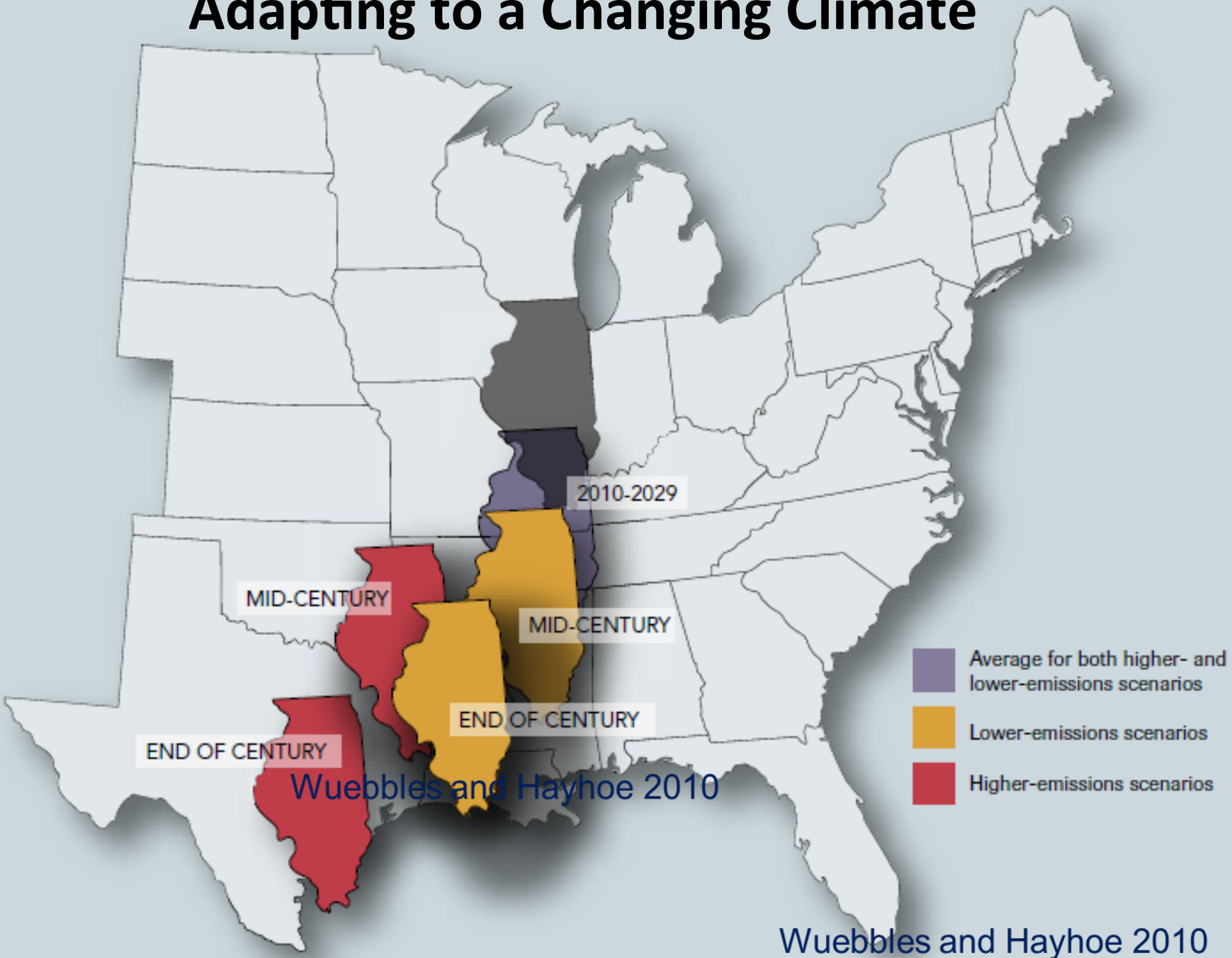

Lock & Dam #7 La Crescent MN;
mvp.usace.army.mil


Illinois River sediment;
dnr.illinois.gov


Winchester Dam, Monroe,
MI



Adapting to a Changing Climate



Wuebbles and Hayhoe 2010

USGS
science for a changing world

Climate Research and Development Program

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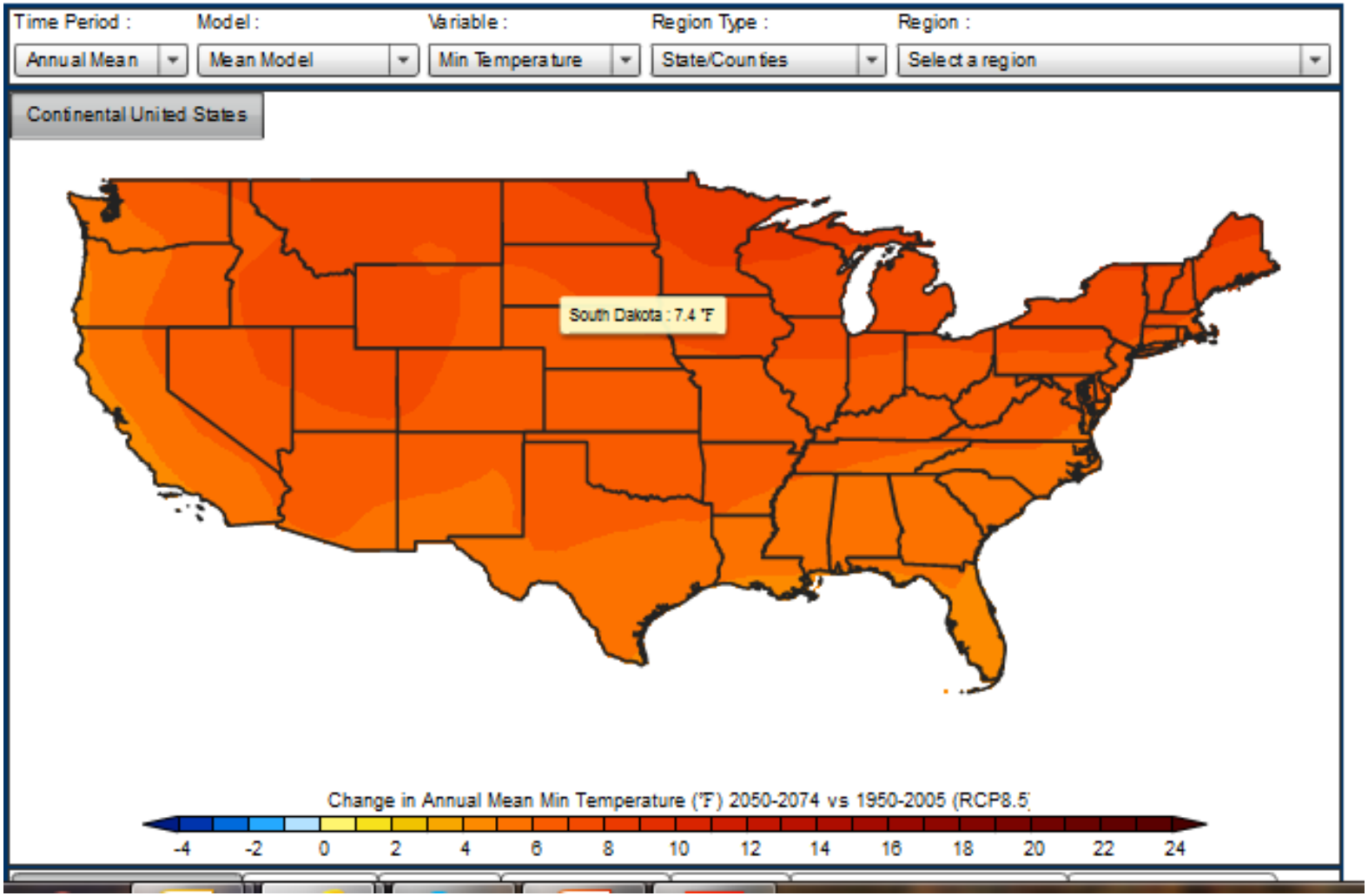
National Climate Change Viewer (NCCV)



CONSERVATION TOOLS
NatureServe Learning Center
Standards & Methods
Data, Maps & Tools
Why NatureServe Data?
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Projects

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Climate Change Vulnerability Index

Standards & Methods

Overview

The NatureServe **Climate Change Vulnerability Index** identifies plant and animal species that are particularly vulnerable to the effects of climate change. Using the Index, you apply readily available information about a species' natural history, distribution and landscape circumstances to predict whether it will likely suffer a range contraction and/or population reductions due to climate change. You can use the Index as part of a variety of analyses, including assessing the relative risk of species listed in State Wildlife Action Plans or part of any assessment of the vulnerability of **species** to climate change.

The American pika thrives in the cooler temperatures and alpine vegetation of rocky slopes near the tops of mountains. As temperatures rise, the pika is forced to move farther up the mountain—constricting its natural range and crowding into existing habitats.

Contact

Bruce Young

NatureServe
Director, Species Science
bruce_young@natureserve.org
703-908-1805

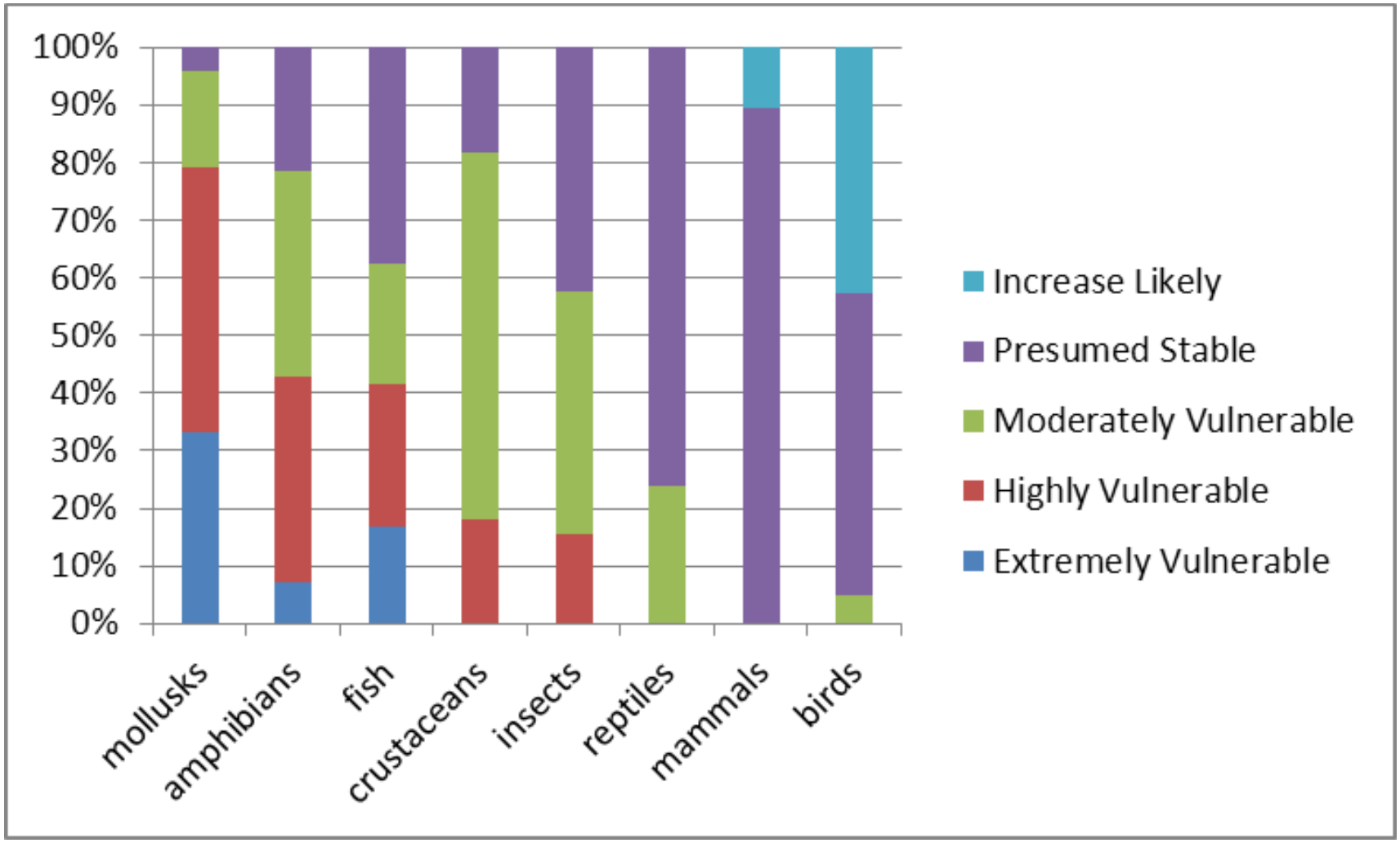
At A Glance

- Download the Index

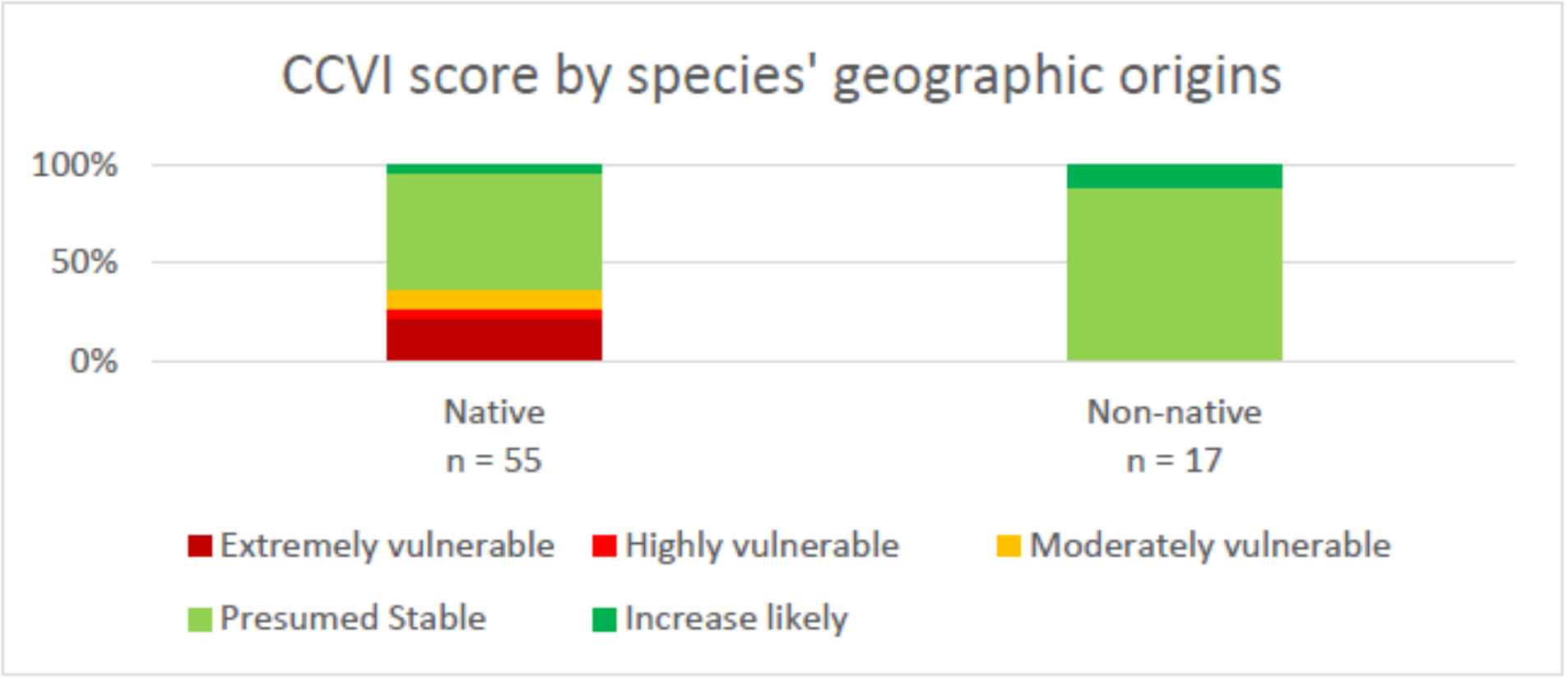
Use
- Conservation Expertise & Analysis

Conservation Topic
- Imperiled Species
- Climate Change

Aquatic Wildlife Are More Vulnerable to Climate Change

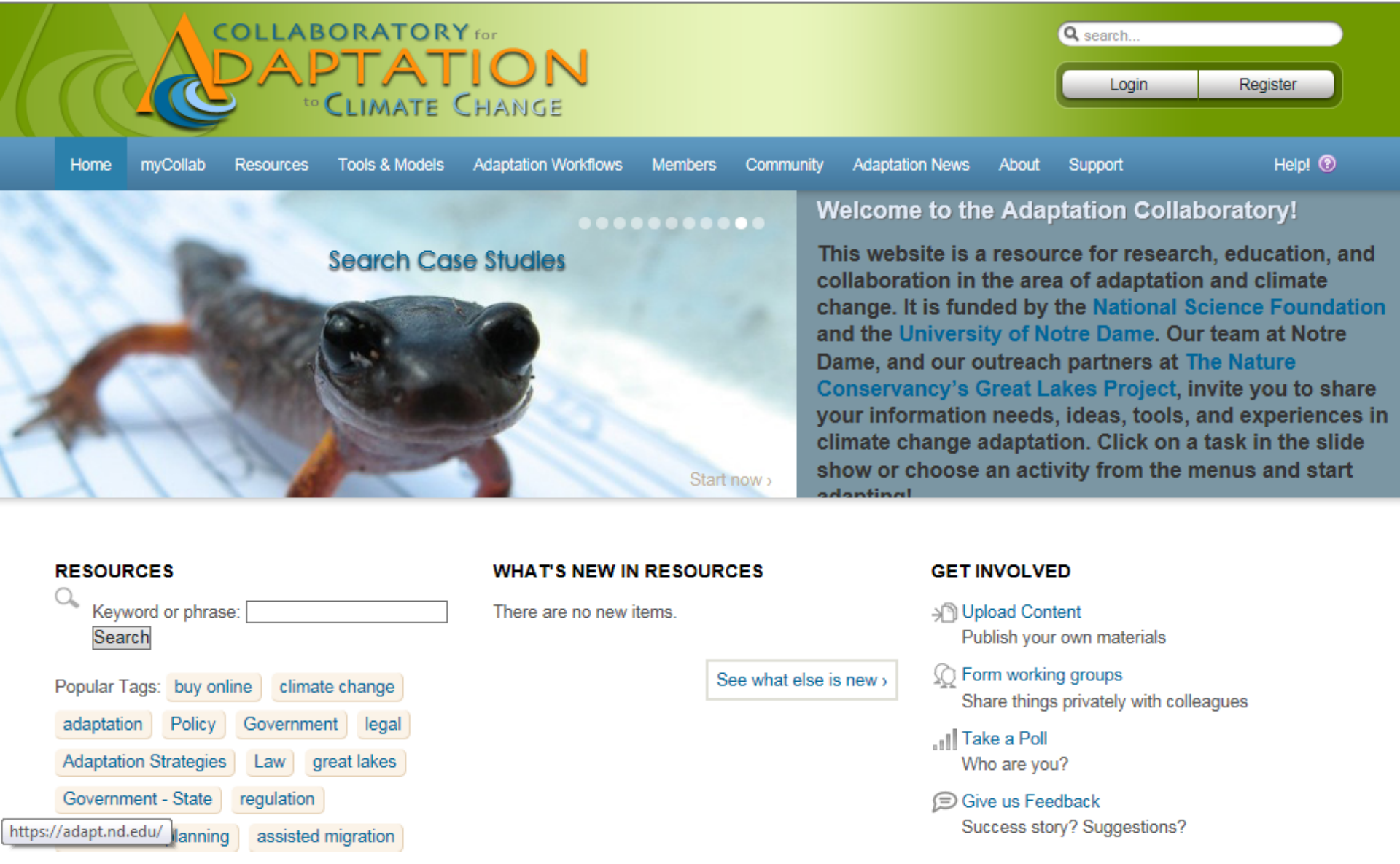


Native Plants are More Vulnerable than Non-Native Plants

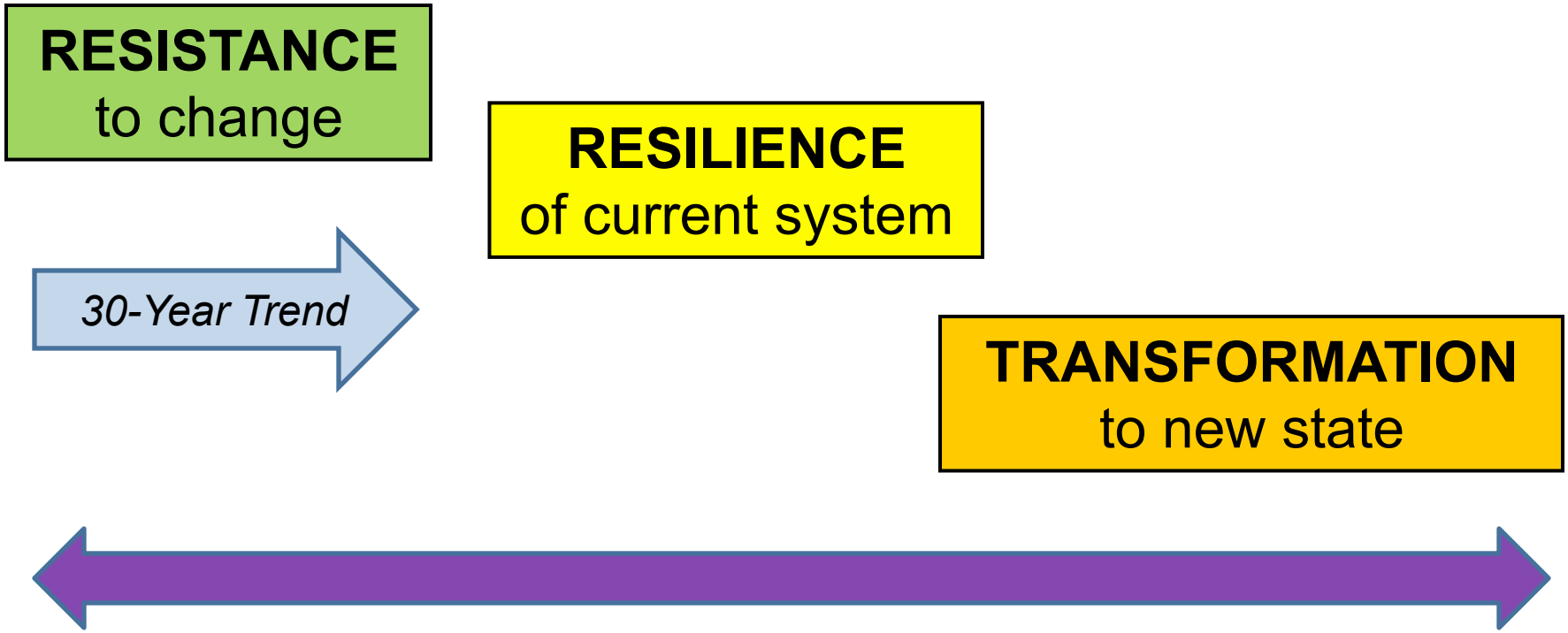


Baty et al. 2015. INHS Tech Report 2015(32).

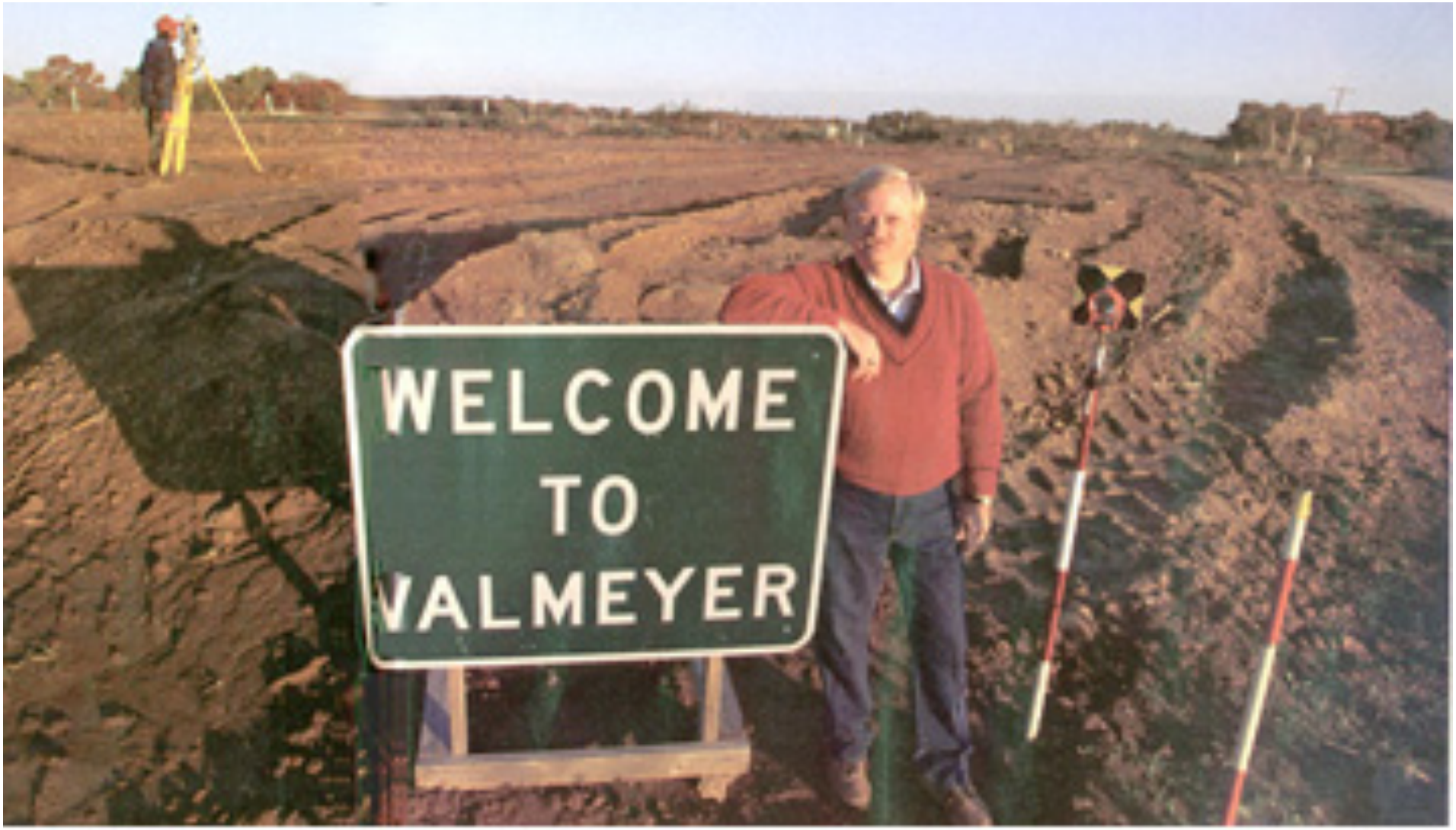
Collaboratory for Adaptation to Climate Change: **adapt.nd.edu**



Adaptation Strategies

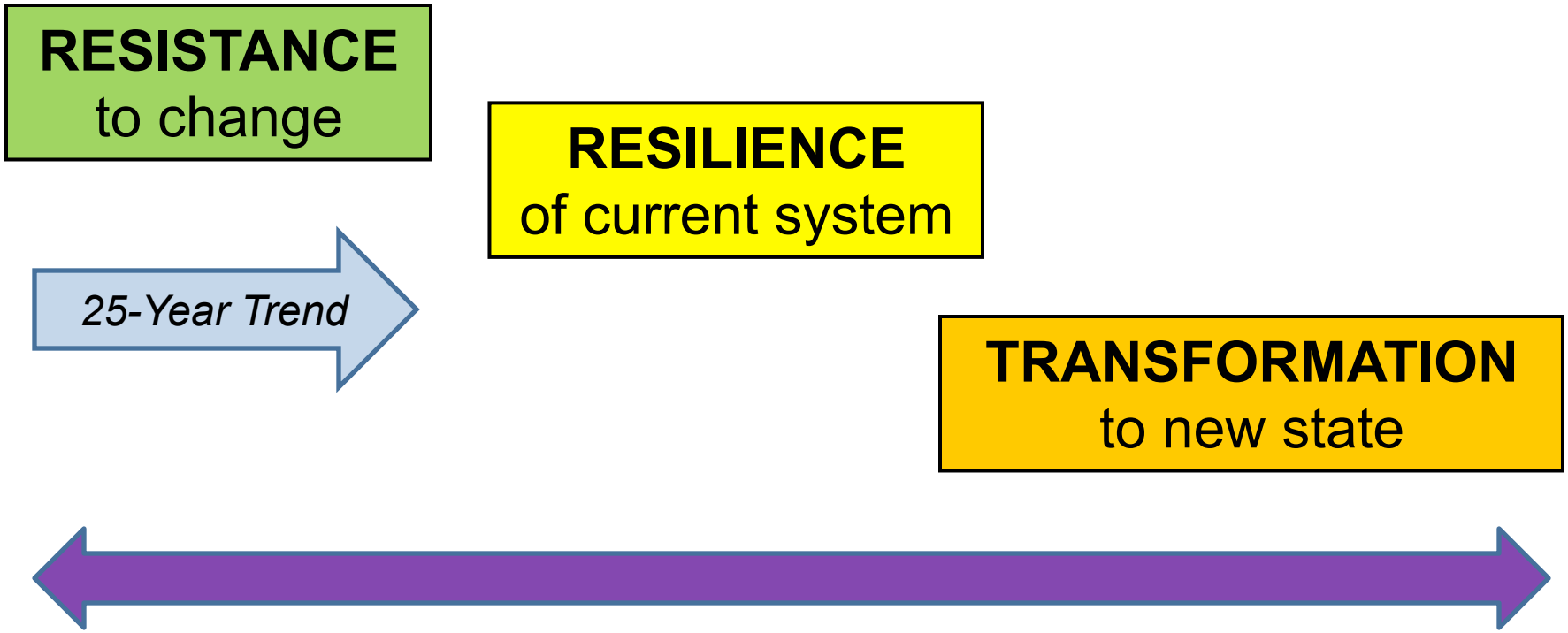


Modified from Heller and Zavaleta 2009



Mayor Dennis Knobloch, Valmeyer's civic spark plug, gets moral support from an optimistic sign in 1994, shortly after work began on the new townsite. Behind him a surveyor measures ground elevations.

Adaptation Strategies



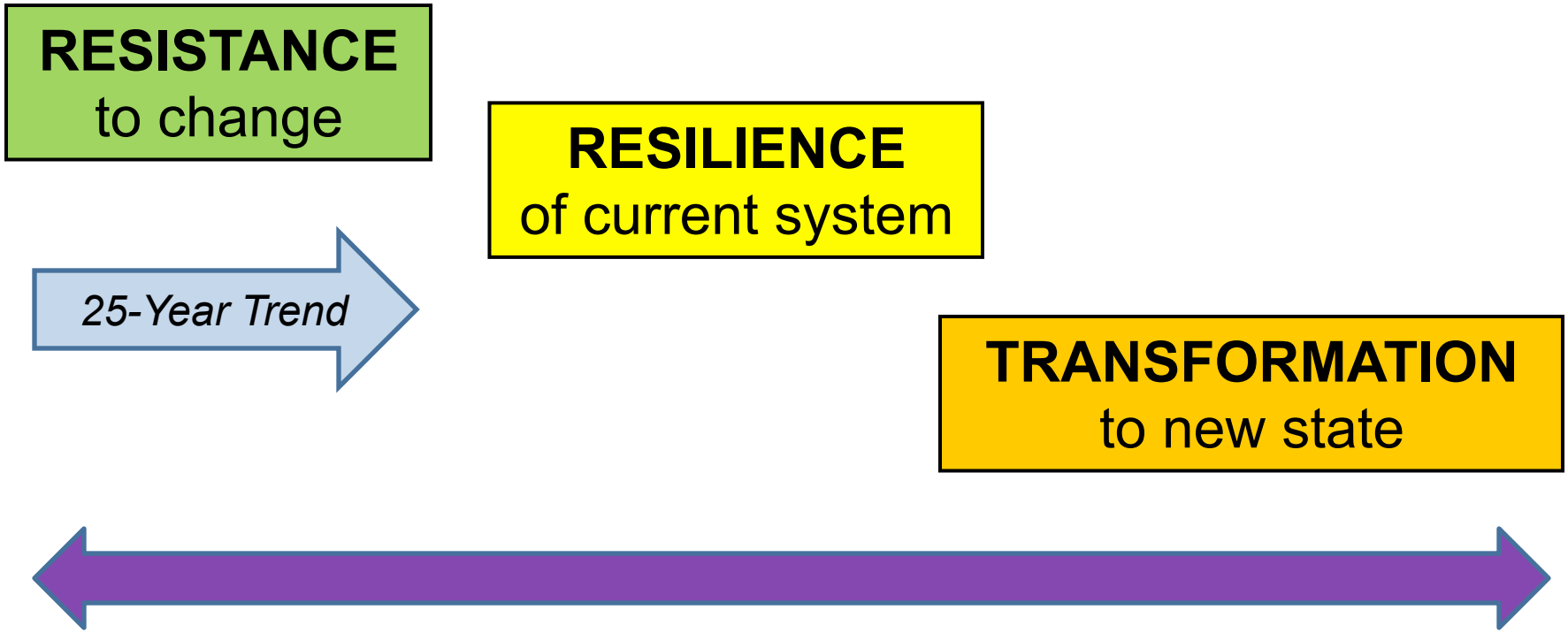
Modified from Heller and Zavaleta 2009


ARKive
www.arkive.org
© Allen Blake Sheldon / Animals Animals

Climate-Informed Conservation Actions:
Cool-Water Streams

RESISTANCE **RESILIENCE** **TRANSFORMATION**

Adaptation Strategies



Modified from Heller and Zavaleta 2009

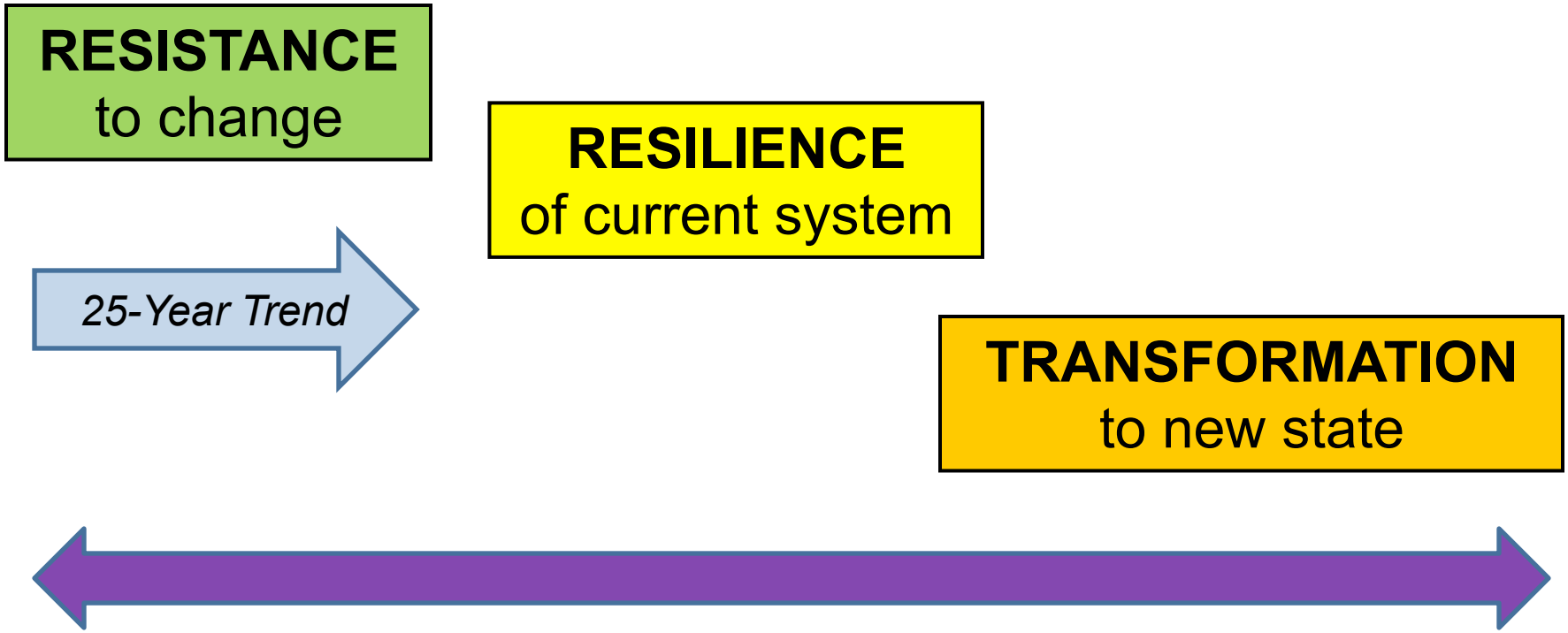
Improving Resilience

- Enhance connectivity, reduce fragmentation
- Restore natural processes
- Reduce pollution, invasive species, other stressors
- Increase population size

Climate-Informed Conservation Actions: *Farmland*

RESISTANCE **RESILIENCE** **TRANSFORMATION**

Adaptation Strategies



Modified from Heller and Zavaleta 2009

Climate-Informed Conservation Actions:
Forests

Carol Freeman

Forest Stewardship Council

RESISTANCE **RESILIENCE** **TRANSFORMATION**

Conserving Nature's Stage

Create arenas for evolution not museums of the past

Sedimentary

Granite

Coarse Sand

Limestone

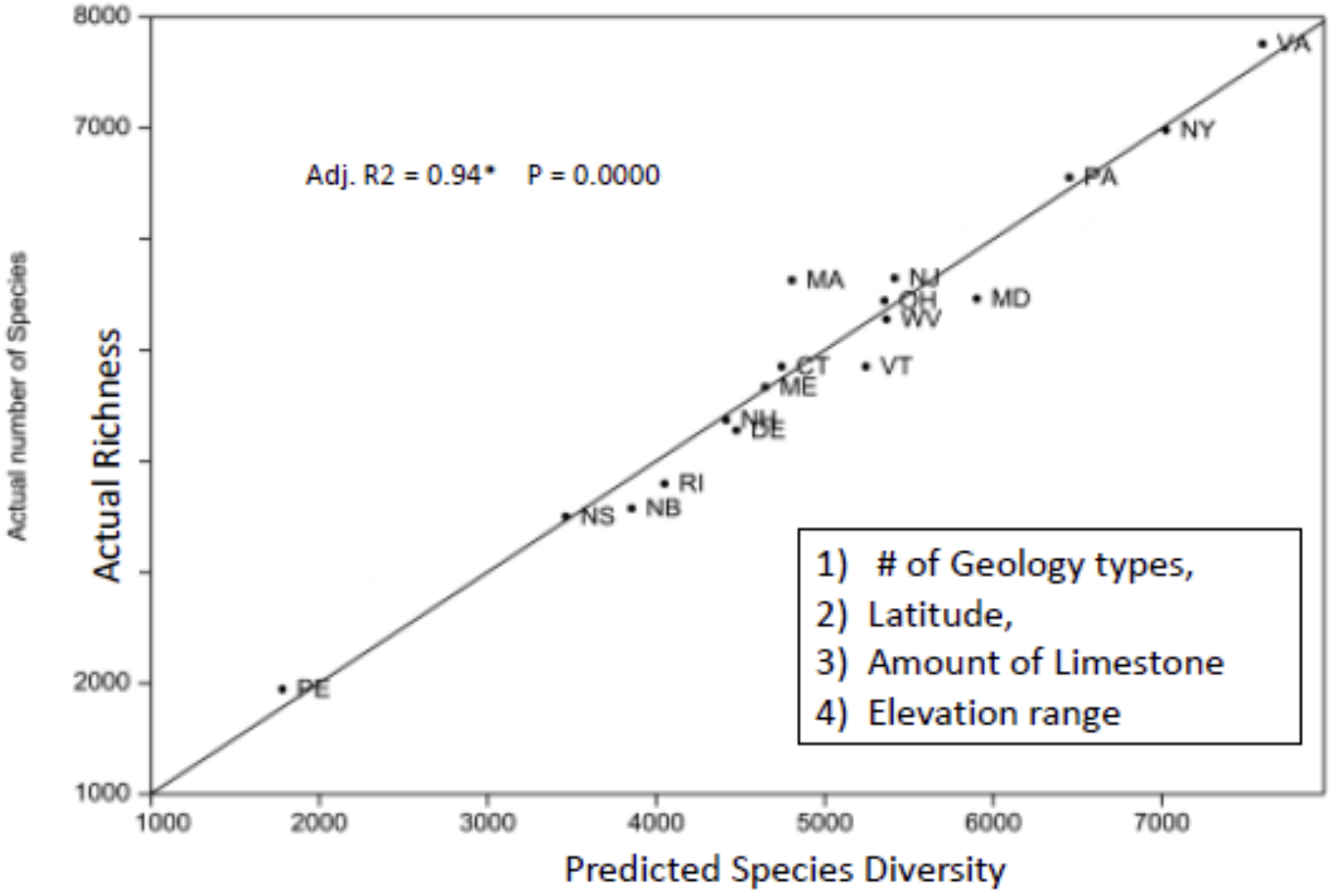
Fine Silt/Organic

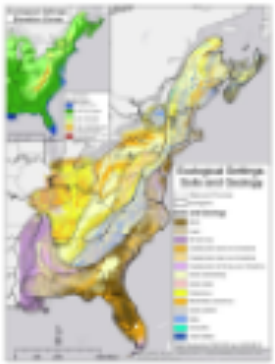
Mafic

Moderately Calcareous

Granite

Predicted vs. Actual Species Diversity



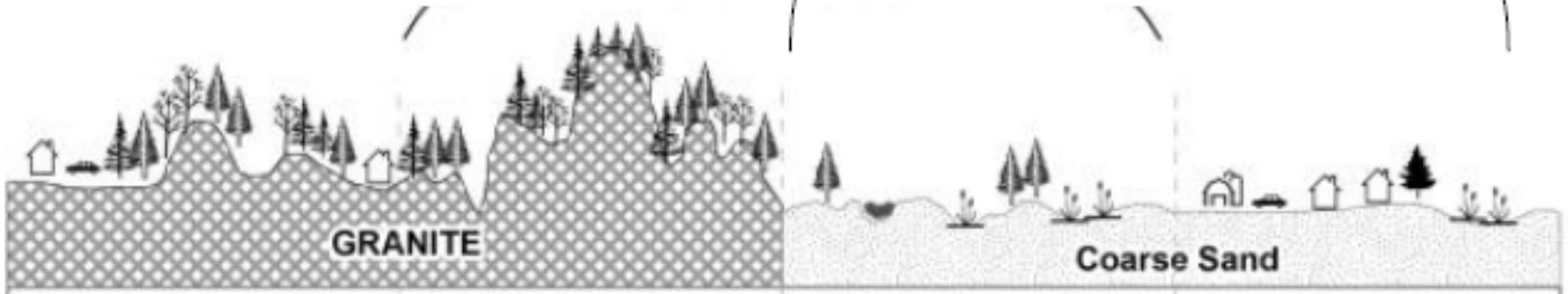


Anderson and Ferree. 2010. Conserving the Stage: Climate change and the geophysical underpinnings of species diversity

Resilience Index: Relative to Geophysical Setting

Granite to Granite

Sand to Sand



Landscape Complexity
Landform Variety = 5
*n sideslope
*s sideslope
*low hill
*wet flat
*dry flat
Elevation Range = 100 - 300 m
Wetland Density = medium

Local Connectivity
Low (26 out of 100)

Landscape Complexity
Landform Variety = 7
*summit
*cliff
*n sideslope
*s sideslope
*slope bottom flat
*wet flat
*dry flat
Elevation Range = 100 - 400 m

Local Connectivity
High (75 out of 100)

Landscape Complexity
Landform Variety = 4
*hummuck
*low hill
*wet flat
*dry flat
Elevation Range = 0 - 22 m
Wetland Denisty = medium/high

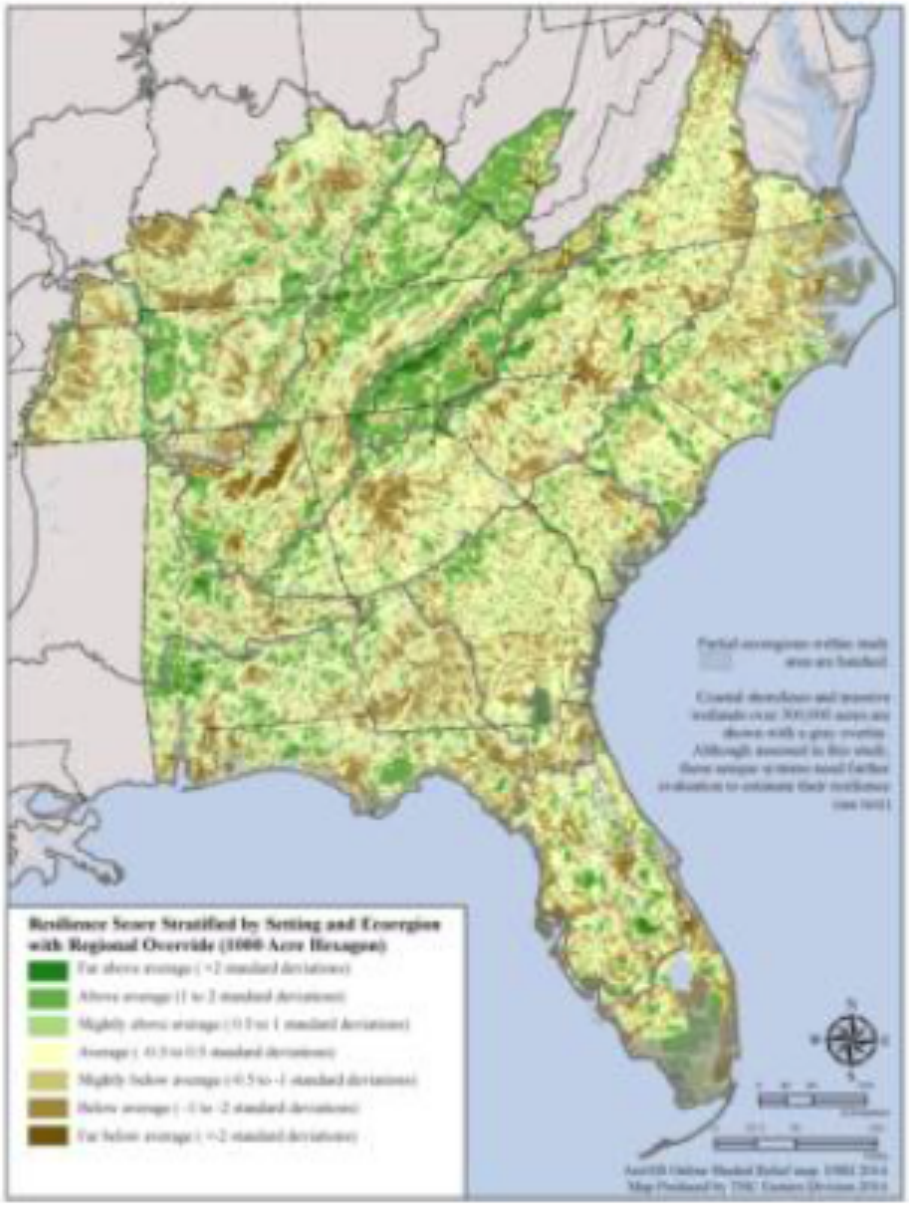
Local Connectivity
High (57 out of 100)

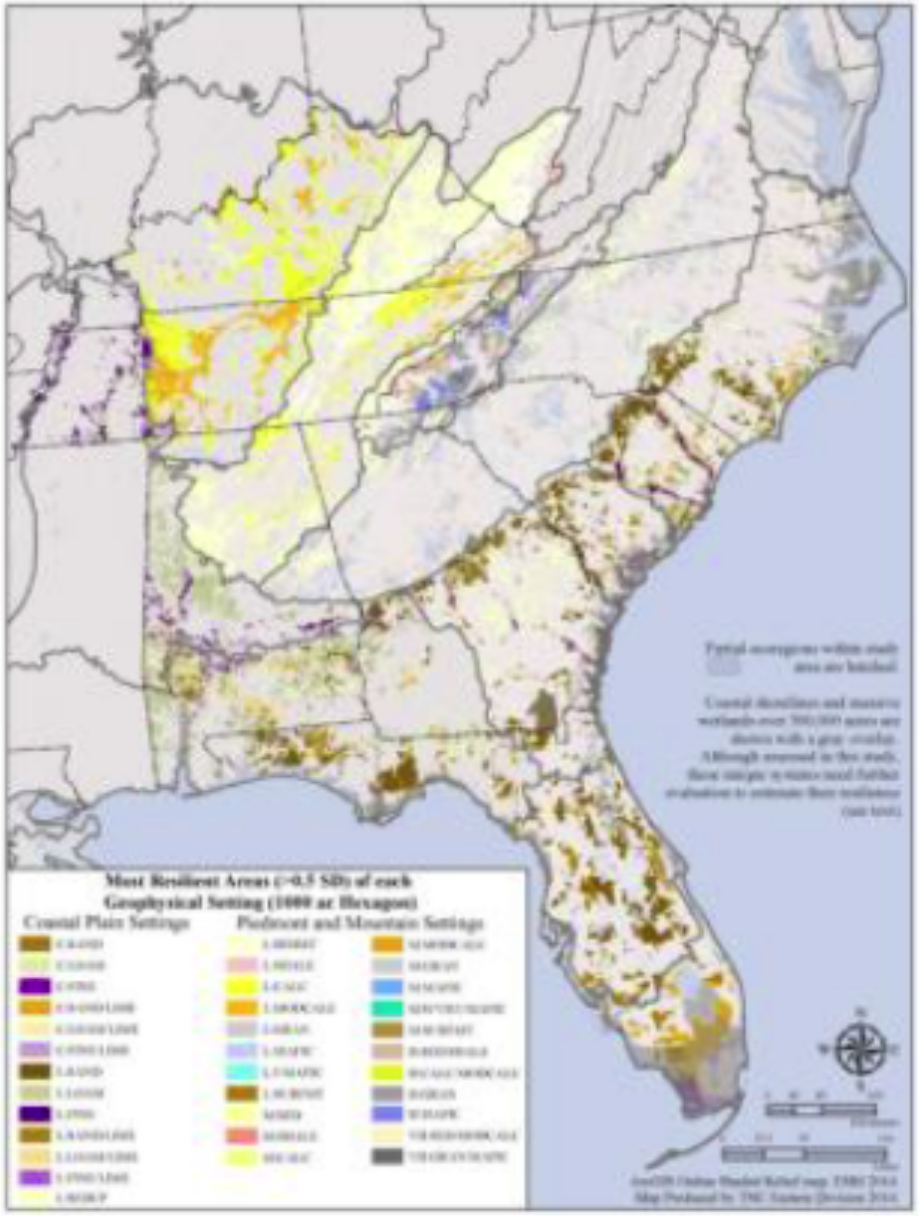
Landscape Complexity
Landform Variety = 2
*wet flat
*dry flat
Elevation Range = 0 - 10 m
Wetland Denisty = low

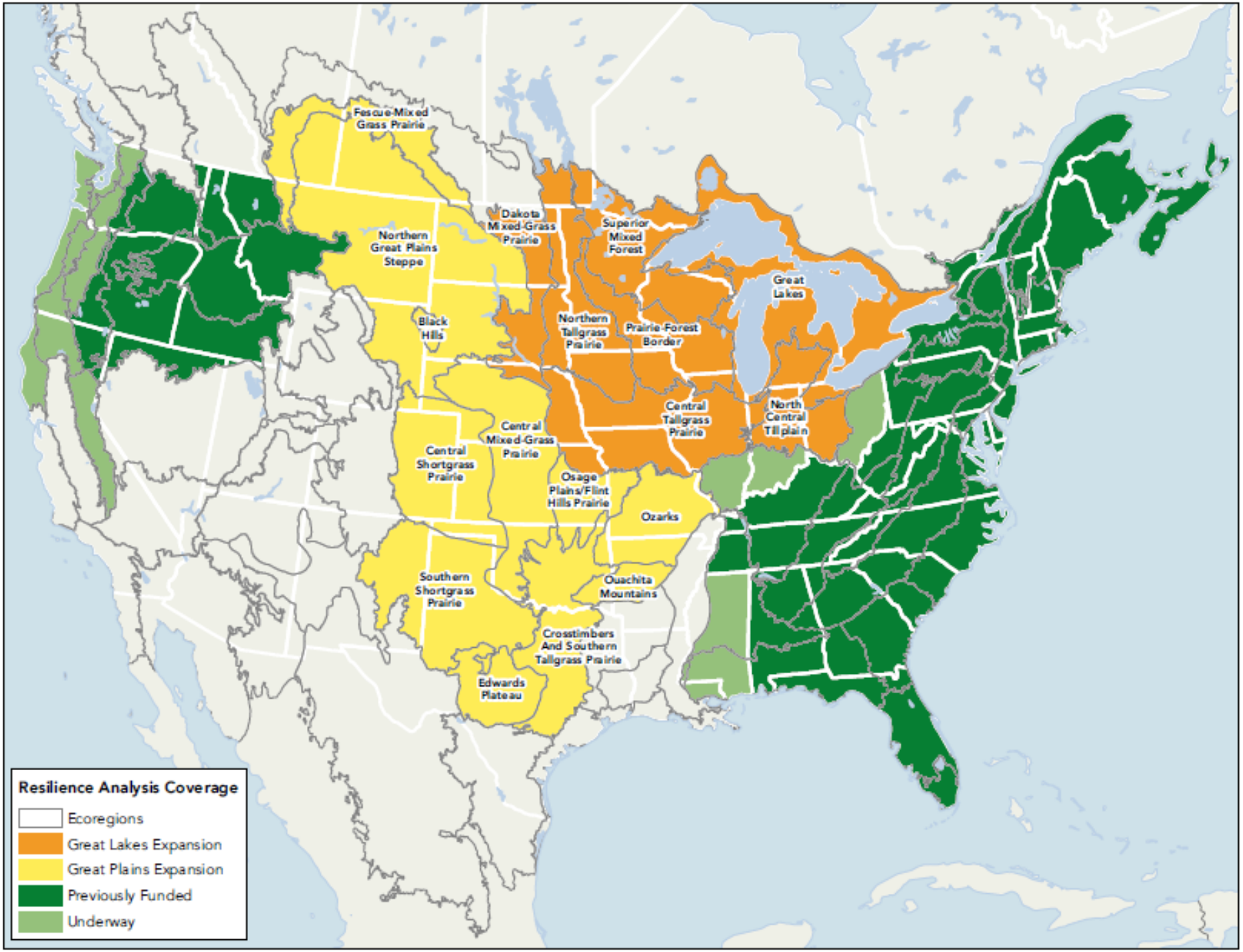
Local Connectivity
Low (8 out of 100)

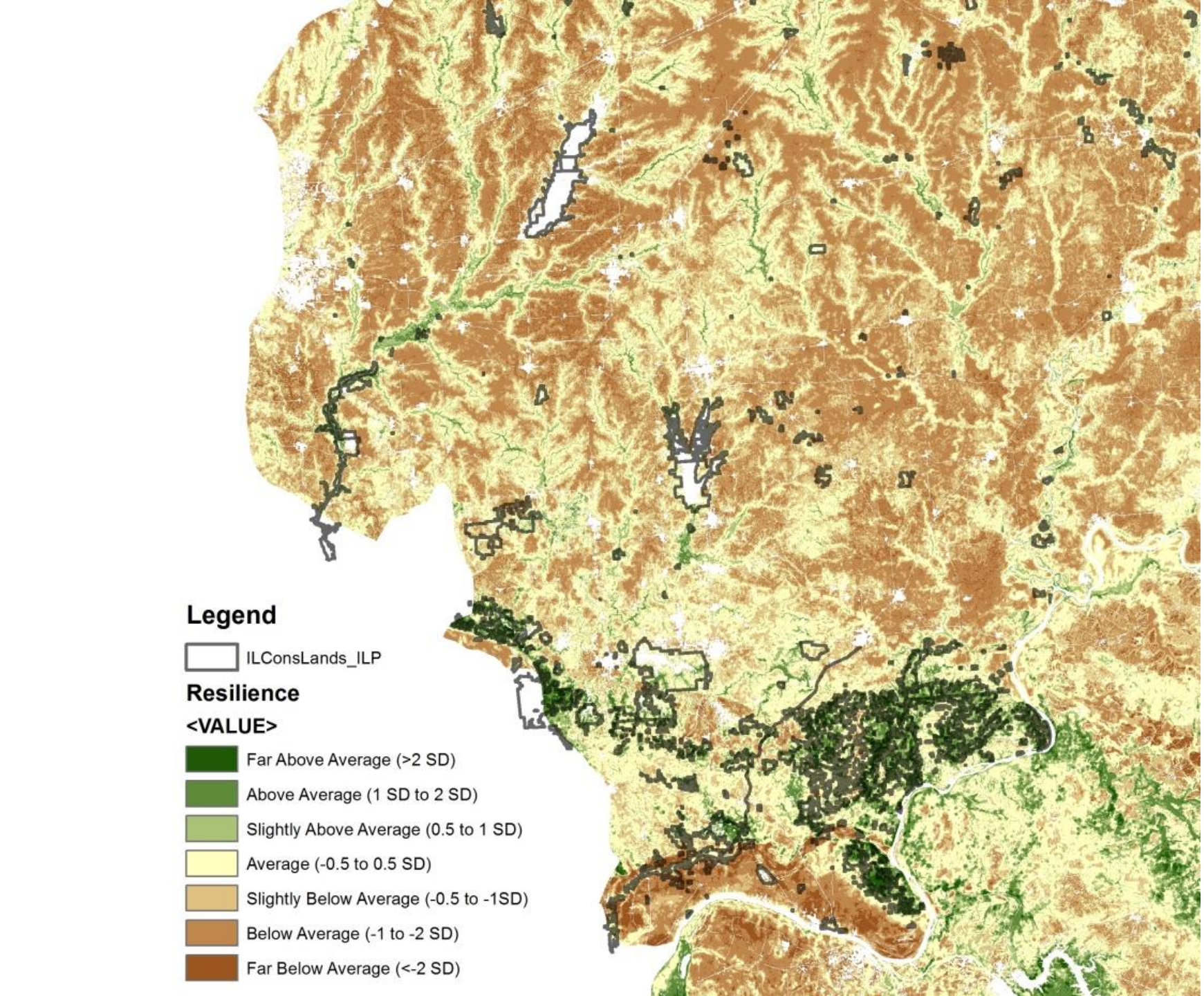
Resilience = many options

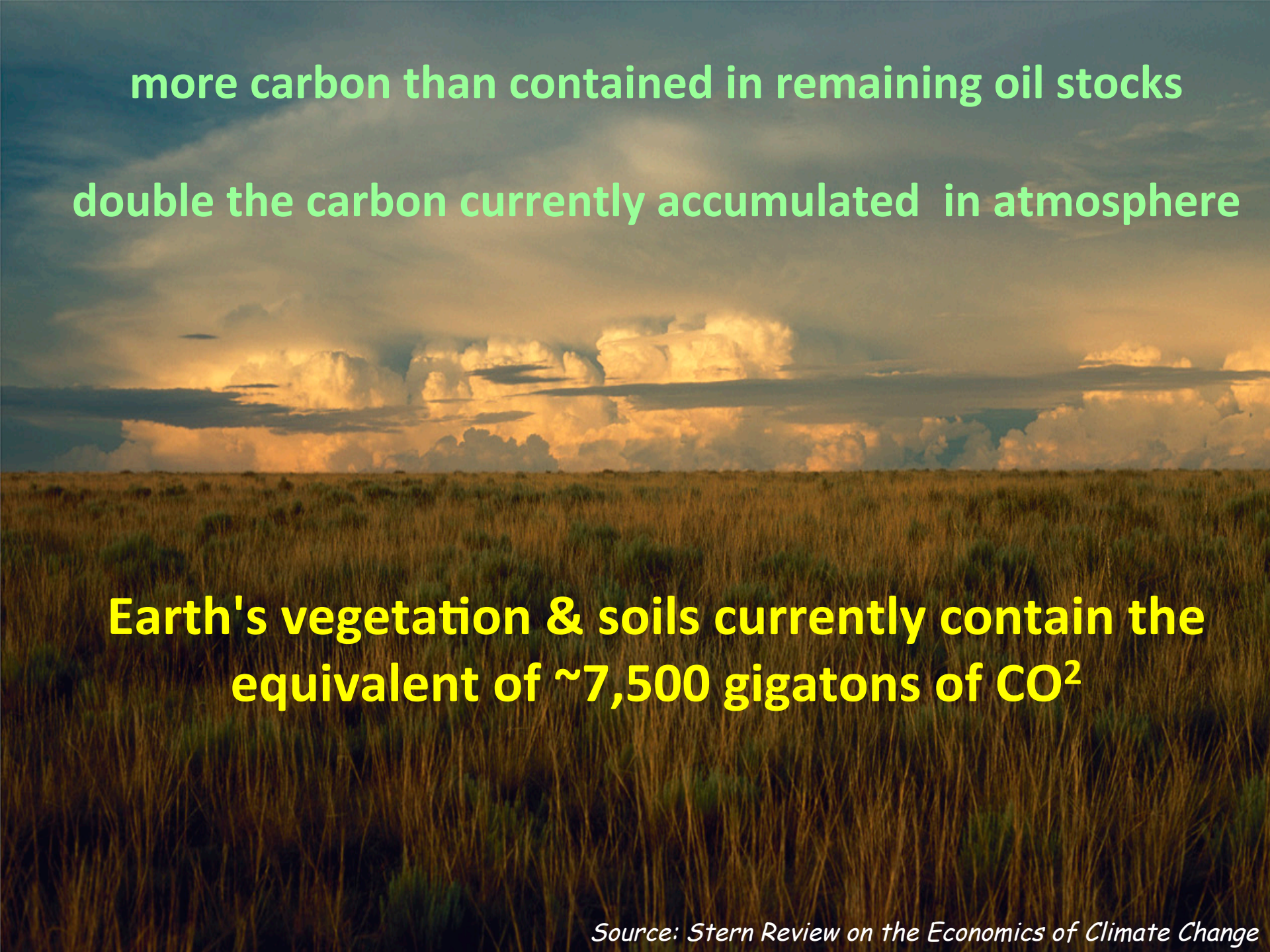
Resilience Map: Highest scoring for each setting



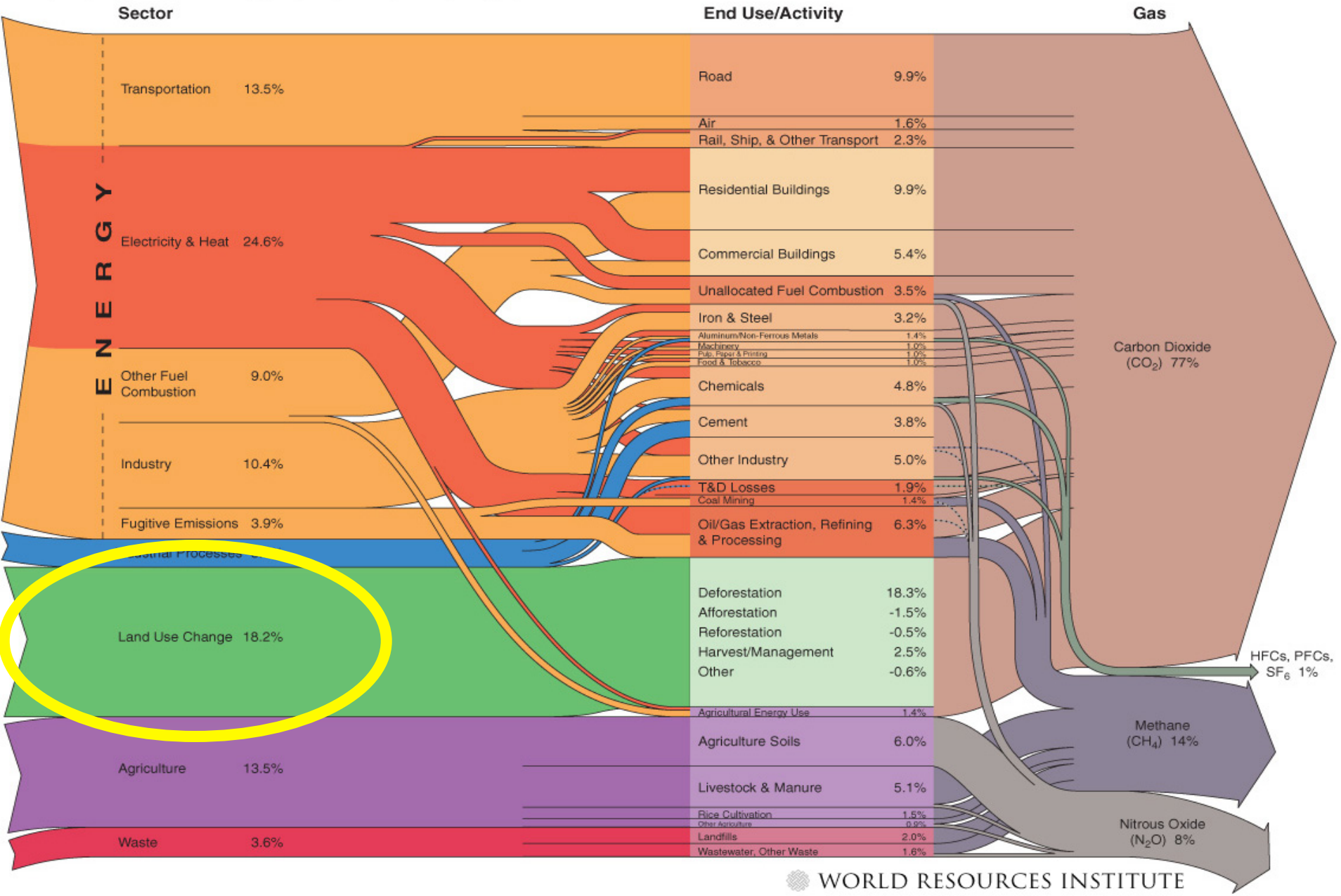



Fescue-Mixed Grass Prairie
Dakota Mixed-Grass Prairie
Superior Mixed Forest
Northern Great Plains Steppe
Great Lakes
Black Hills
Northern Tallgrass Prairie
Prairie-Forest Border
Central Tallgrass Prairie
North Central Tillplain
Central Mixed-Grass Prairie
Central Shortgrass Prairie
Osage Plains/Flint Hills Prairie
Ozarks
Southern Shortgrass Prairie
Ouachita Mountains
Crosstimbers And Southern Tallgrass Prairie
Edwards Plateau
Resilience Analysis Coverage
Ecoregions
Great Lakes Expansion
Great Plains Expansion
Previously Funded
Underway


Legend
ILConsLands_ILP
Resilience
<VALUE>
Far Above Average (>2 SD)
Above Average (1 SD to 2 SD)
Slightly Above Average (0.5 to 1 SD)
Average (-0.5 to 0.5 SD)
Slightly Below Average (-0.5 to -1SD)
Below Average (-1 to -2 SD)
Far Below Average (<-2 SD)


more carbon than contained in remaining oil stocks
double the carbon currently accumulated in atmosphere
Earth's vegetation & soils currently contain the equivalent of ~7,500 gigatons of CO^2
Source: Stern Review on the Economics of Climate Change

sources human-caused global greenhouse gas emissions for 2000



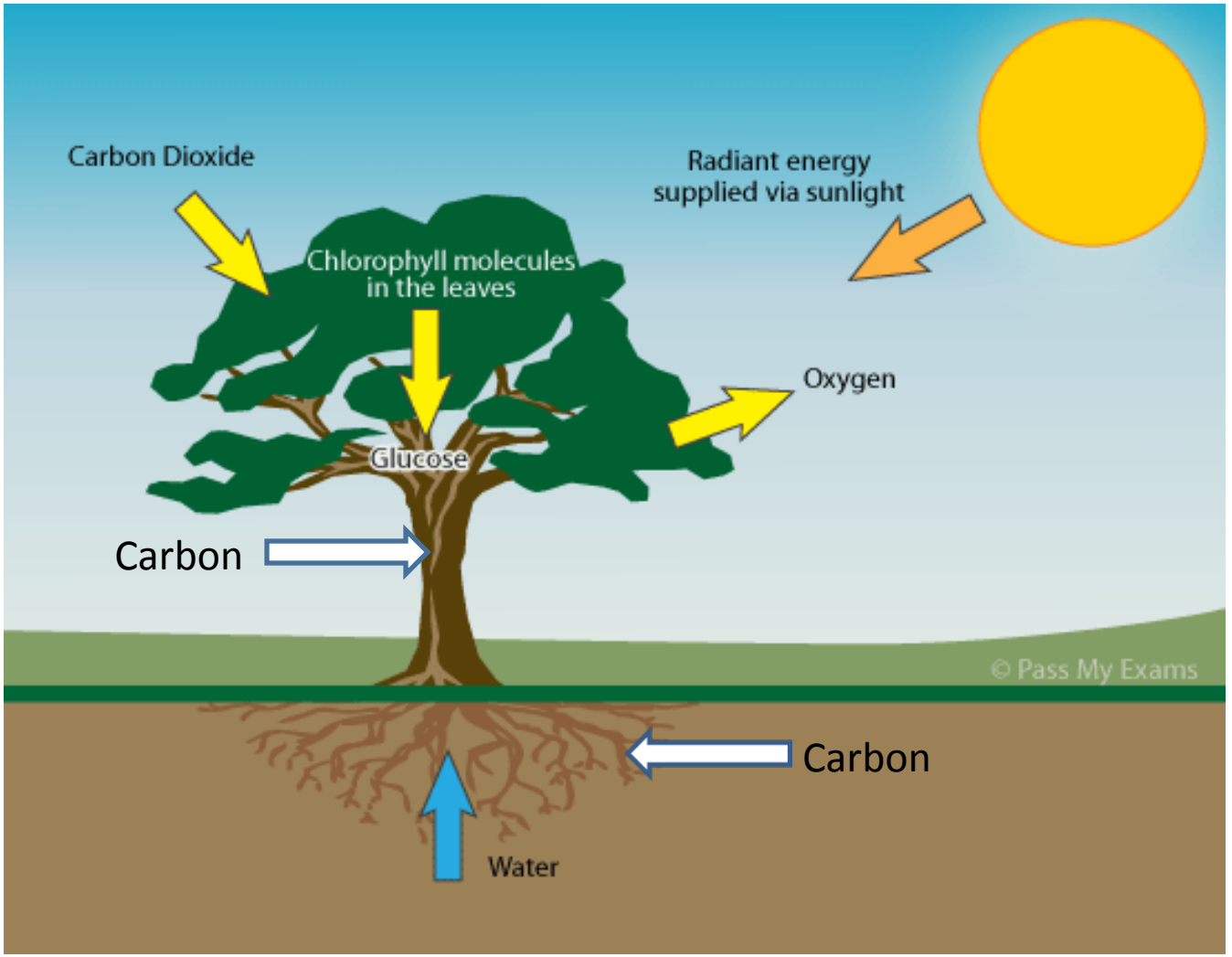
WORLD RESOURCES INSTITUTE

Avoided Conversion

Chicago Wilderness: Avoided emission of 53 million tons of carbon dioxide into the atmosphere!

Mitigation By Biosequestration

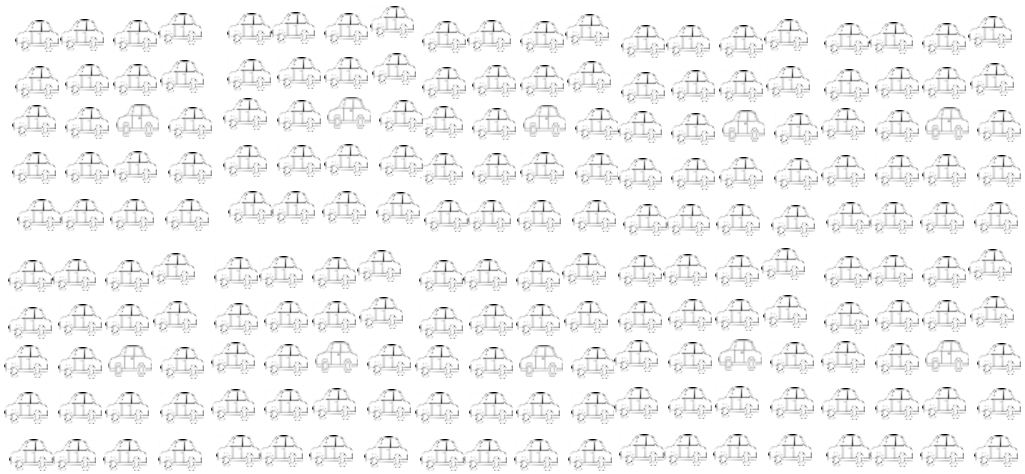
(Or Photosynthesis is Our Friend)



Restoration

Restored Prairies at Nachusa Grasslands

=



Emissions of 190 cars

Tree Plantings at Emiquon

=

Electricity for 350 households

Enhancement and Rehabilitation

healthier soils and larger plants store more carbon

Surprising Strategies…

More and more studies are documenting how "good fire" increases long-term biosequestration

No-till farming and managed grazing can minimize loss of - and even rebuild – soil organic matter

Resources

- USGS National Climate Change Viewer
- Land Trust Alliance: Conservation in a Changing Climate
- Climate Change Adaptation Collaboratory adapt.nd.edu
- NatureServe Climate Change Vulnerability Index
- Conservation Gateway: Conserving Nature's Stage