Assessing Candidate **Seeds of Success** Species for Vulnerability to Climate Change

Bruce Young

NatureServe

Seeds of Success

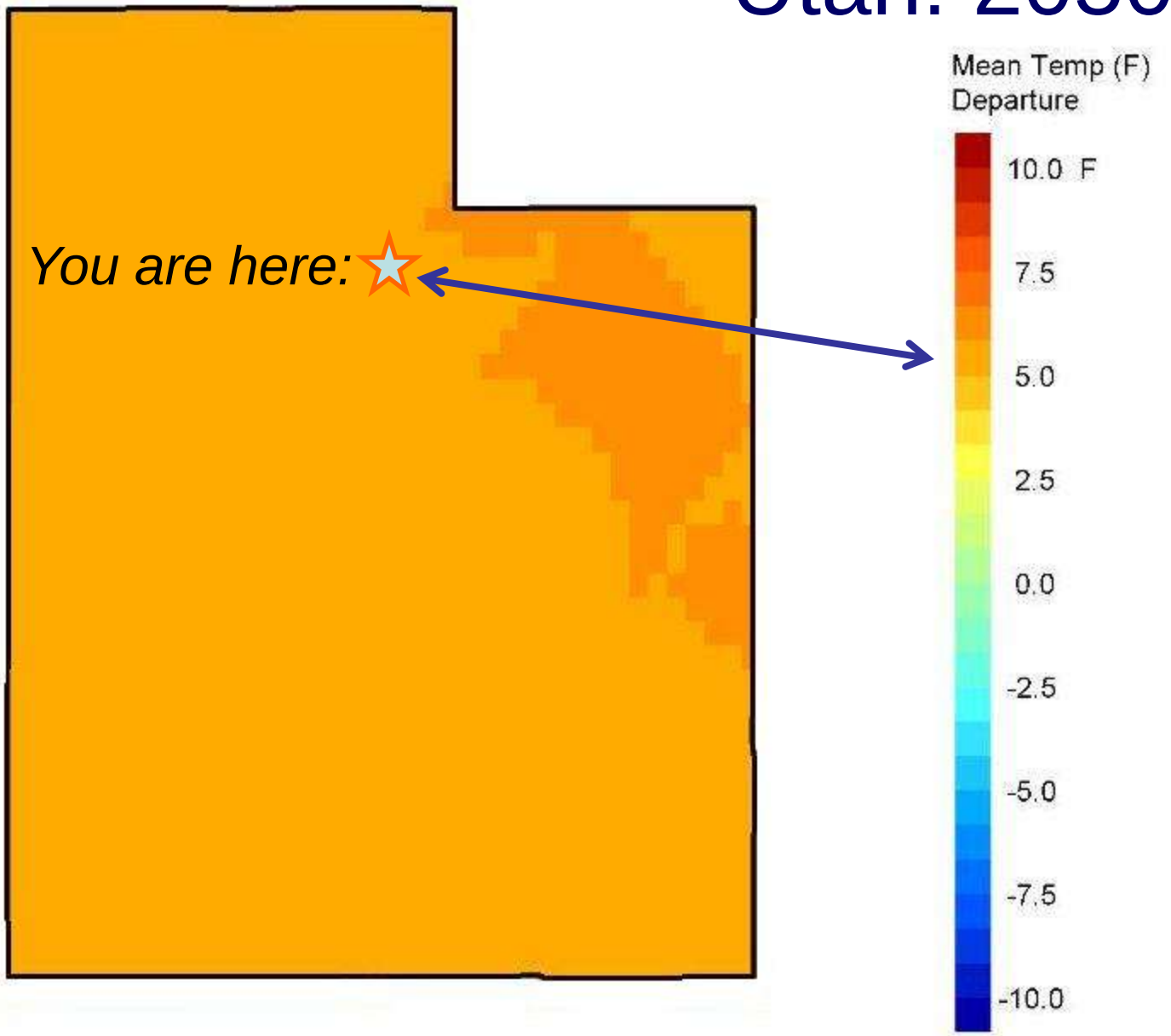
Most photos from Seeds of Success

>8,000 Collections to date
>1,000 in 2009

SoS Species Selection Criteria

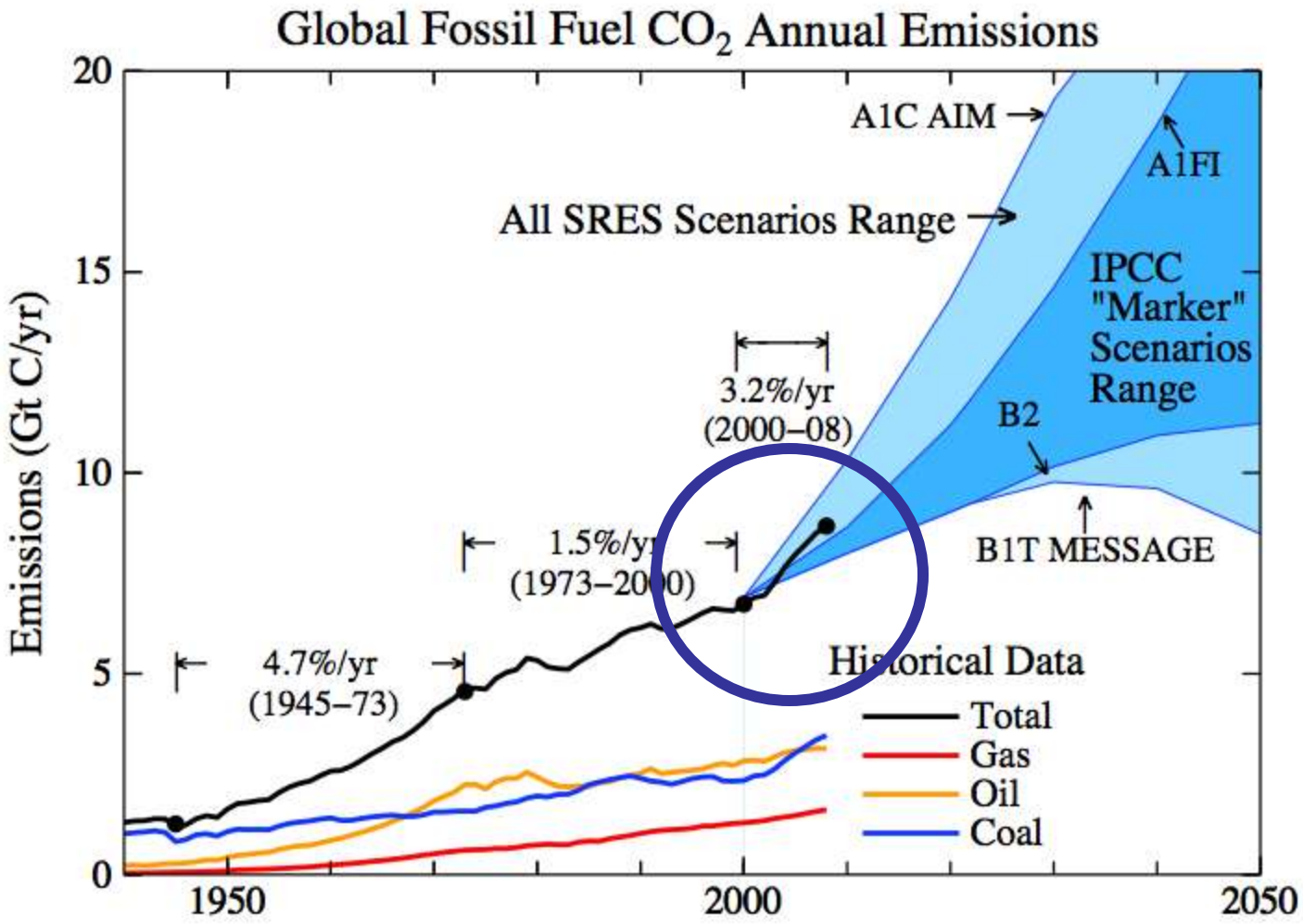
- Restoration value
- Ecoregional representation
- Nonthreatened status
- Occurrence on BLM lands

Utah: 2050s



A1B “Medium emissions scenario”

Source: Climate Wizard



Conclusion: Vulnerability to climate change should be another criterion

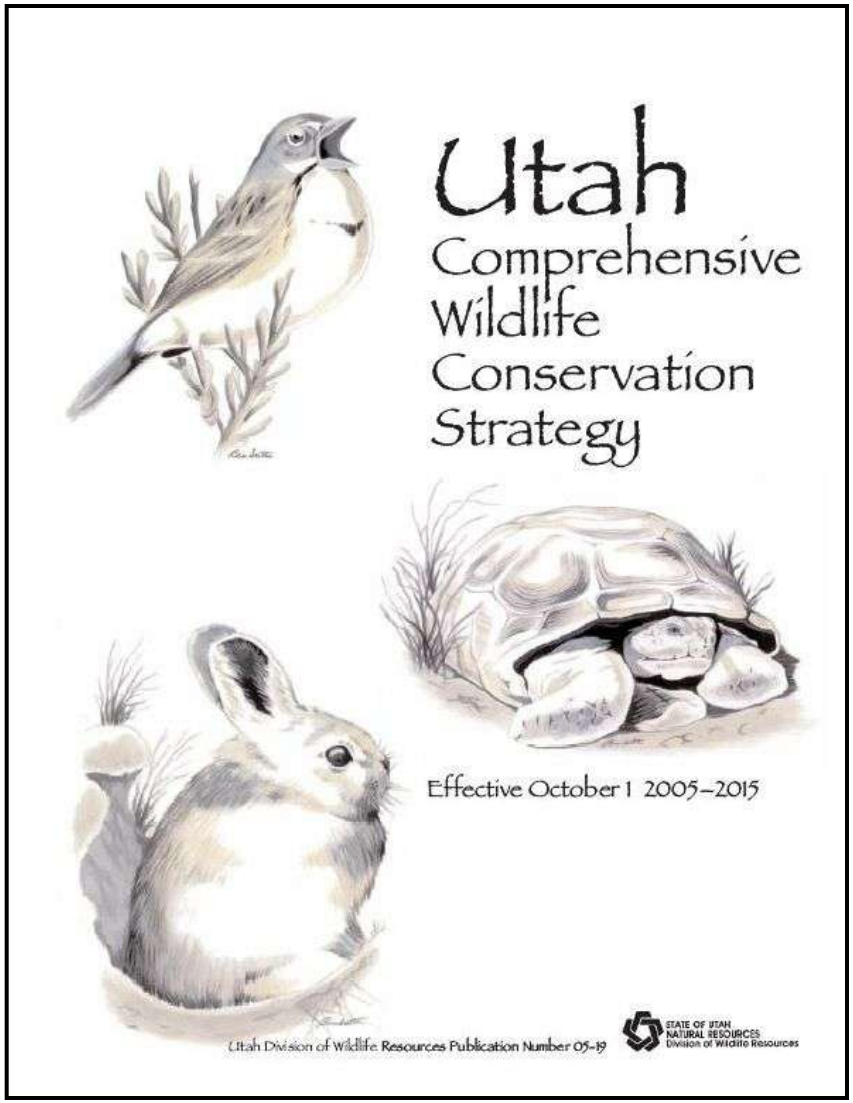
Source: Sato & Hanson, Columbia University

Proposal:

Adopt NatureServe's Climate Change Vulnerability Index to screen candidate species

Climate Change Vulnerability Index

- Designed primarily to help states revise their SWAPs to account for climate change



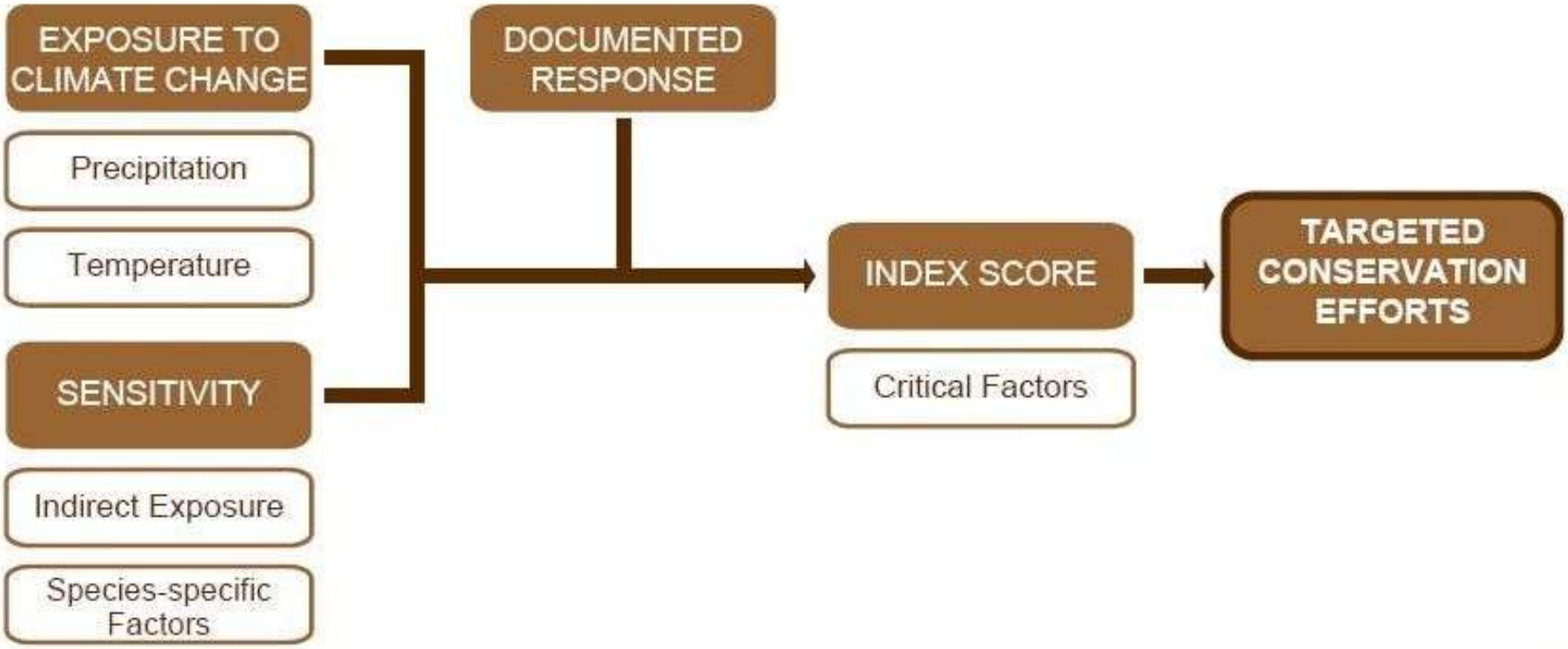
Climate Change Vulnerability Index

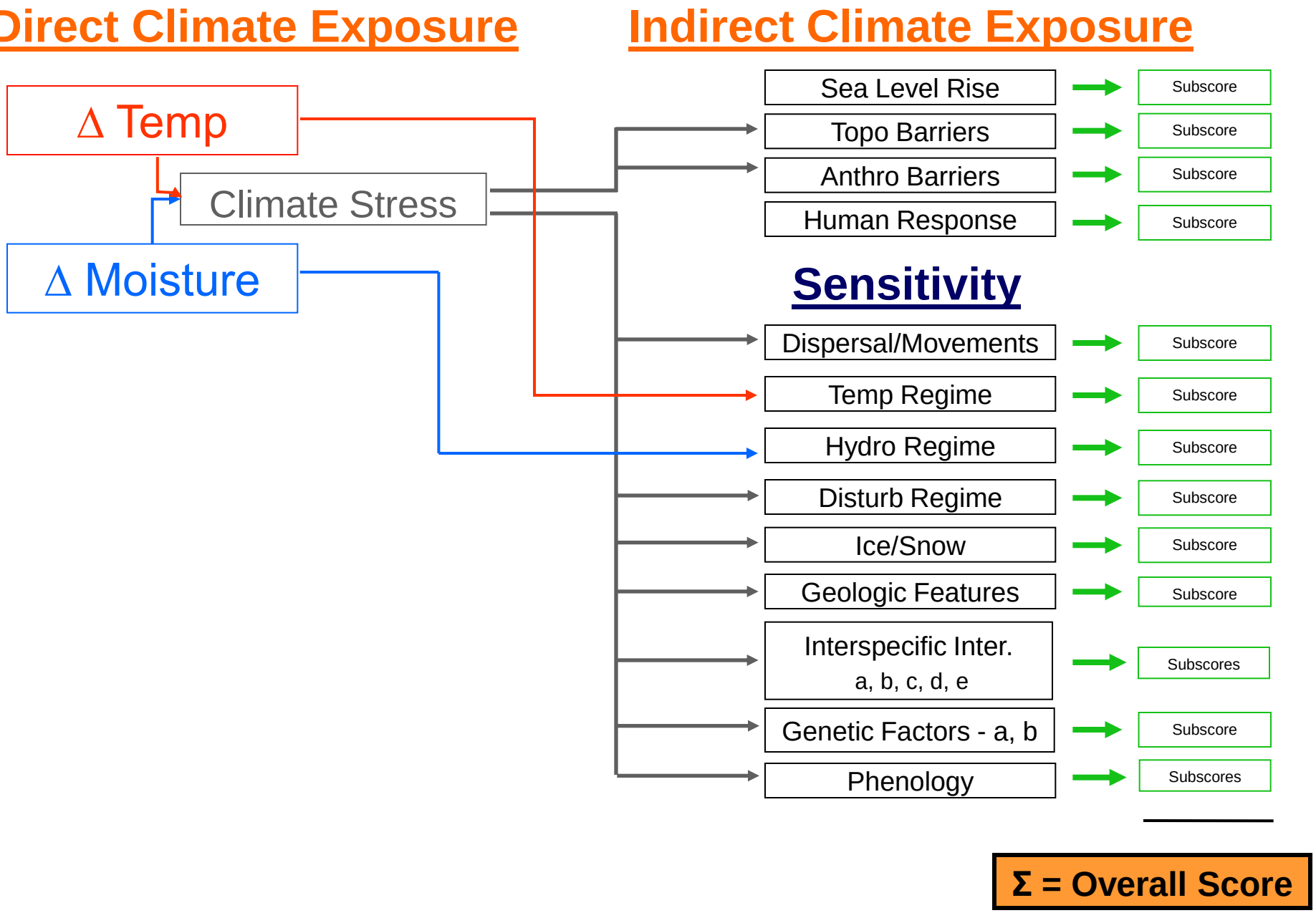
- Excel workbook
- Requires distribution & natural history info
- Rapid
- Predicts whether a species will decline, remain stable, or increase
- Identifies factors causing vulnerability
- Complementary to NatureServe Conservation Status Ranks

Index Scores

↓↓↓	Extremely Vulnerable
↓↓	Highly Vulnerable
↓	Moderately Vulnerable
≈	Not Vulnerable/Presumed Stable
↑	Not Vulnerable/Increase Likely
?	Insufficient Evidence

NatureServe Climate Change Vulnerability Index




Direct Climate Exposure
Indirect Climate Exposure
Δ Temp
Climate Stress
Δ Moisture
Sea Level Rise
Topo Barriers
Anthro Barriers
Human Response
Subscore
Subscore
Subscore
Subscore
Sensitivity
Dispersal/Movements
Temp Regime
Hydro Regime
Disturb Regime
Ice/Snow
Geologic Features
Interspecific Inter.
a, b, c, d, e
Genetic Factors - a, b
Phenology
Subscore
Subscore
Subscore
Subscore
Subscore
Subscore
Subscores
Subscore
Subscores
Σ = Overall Score

Microsoft Excel - CCVI_release_1.94 Working.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

Type a question for help

K65

The NatureServe Climate Change Vulnerability Index

Release 2.0 *20 April 2010; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*

With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

** = Required field*

Geographic Area Assessed: *

Clear Form

Assessor:

Species Scientific Name: * **English Name:**

Major Taxonomic Group: *

G-Rank:

Relation of Species' Range to Assessment Area: * **S-Rank:**

Check if species is an obligate of caves or groundwater aquatic systems: *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	
5.1-5.5° F (2.8-3.1° C) warmer	
4.5-5.0° F (2.5-2.7° C) warmer	
3.9-4.4° F (2.2-2.4° C) warmer	
< 3.9° F (2.2° C) warmer	
Total:	0 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	
-0.097 - -0.119	
-0.074 - -0.096	
-0.051 - -0.073	
-0.028 - -0.050	
>-0.028	
Total:	0 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X

Factors that influence vulnerability *(* at least three required)*

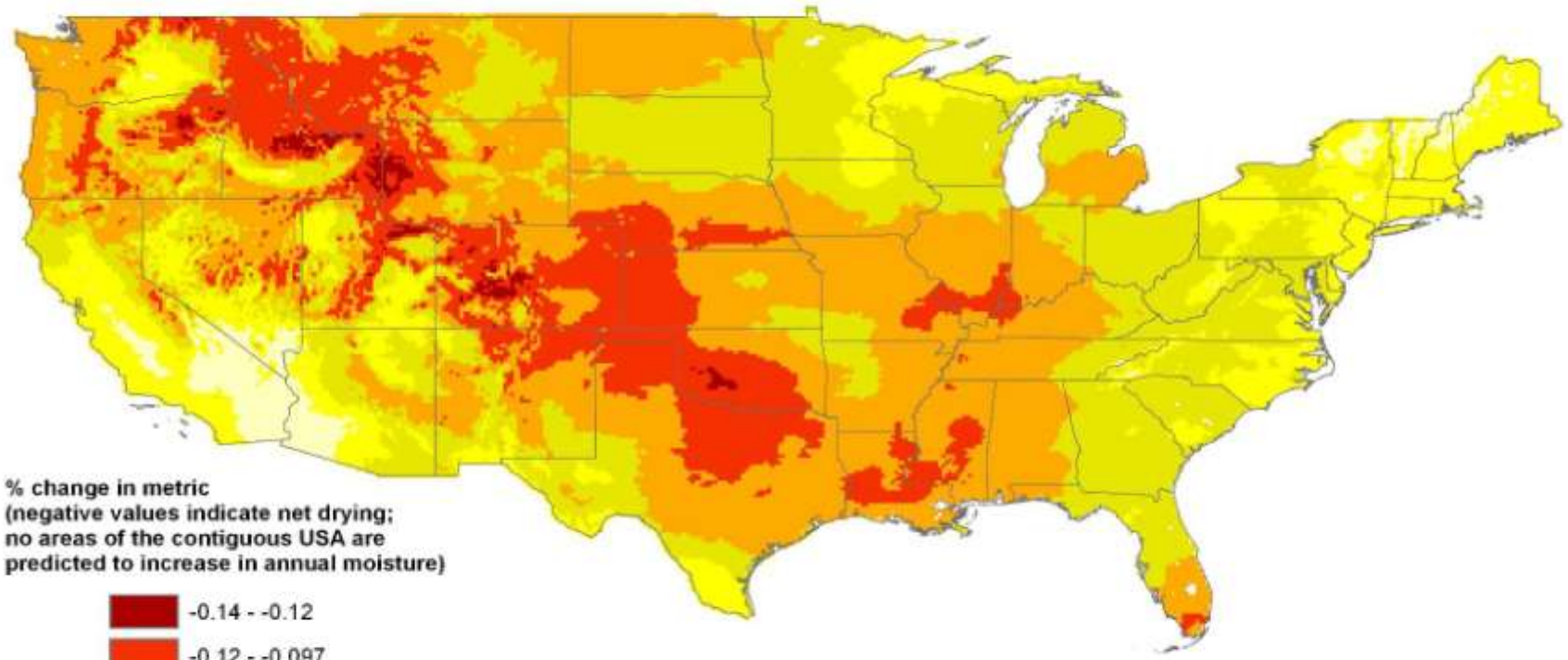
1) Exposure to **sea level rise**

Calculator | Results Table | A. Climate Exposure | B. Climate-Indirect | C. Sp-spec | D. Docum | License | Calculatio

Ready NUM

Predicted Annual Change in Hamon AET:PET Moisture Metric, 2040-2069

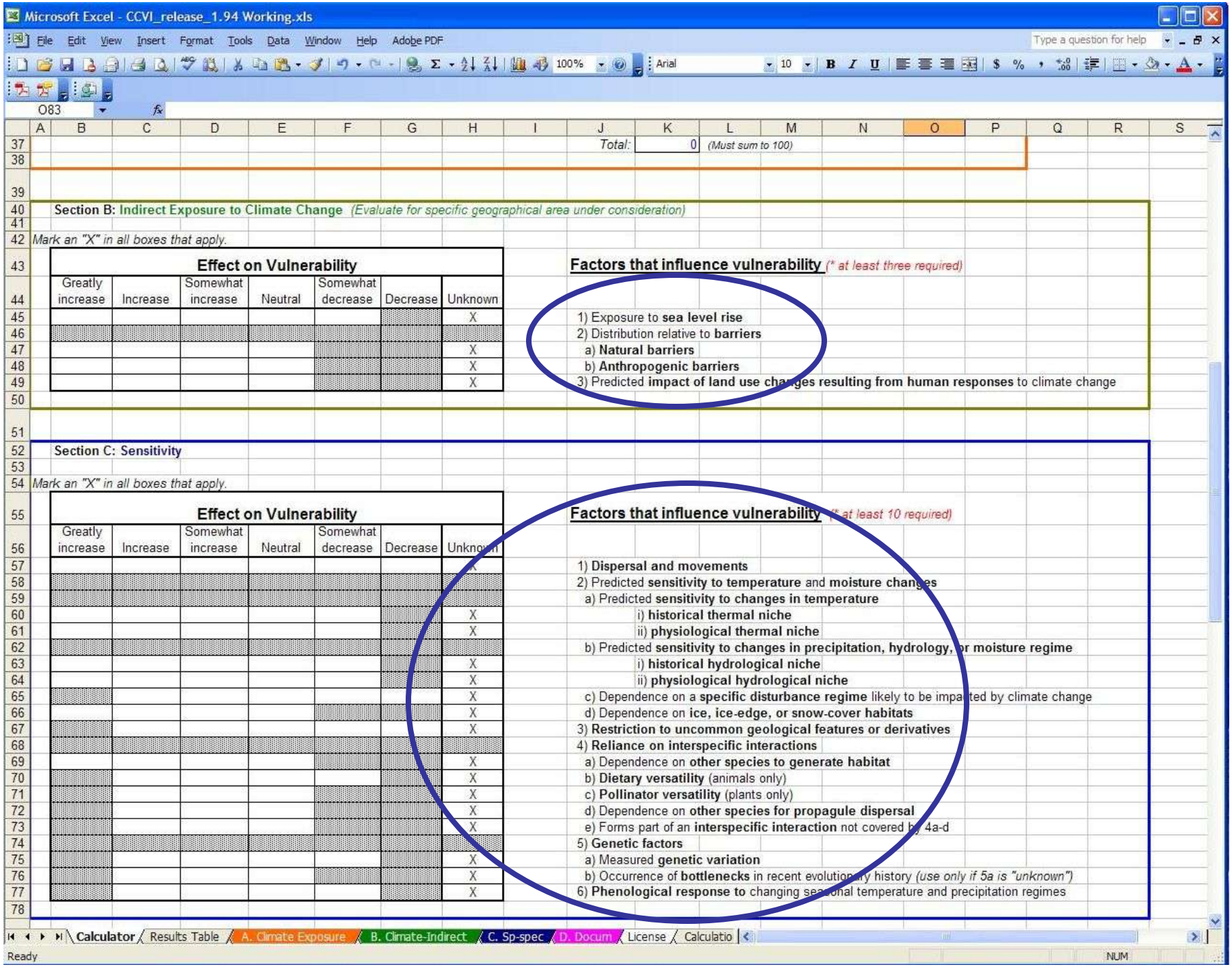
Medium emissions A1B, 16-model ensemble average
based on ClimateWizard.org analysis



% change in metric
(negative values indicate net drying; no areas of the contiguous USA are predicted to increase in annual moisture)

- -0.14 - -0.12
- -0.12 - -0.097
- -0.097 - -0.074
- -0.074 - -0.051
- -0.051 - -0.028
- -0.028 - -0.004

This map is designed for use with NatureServe's Climate Change Vulnerability Index factors A and C2bii.
Map created on 14 April, 2010.


Microsoft Excel - CCVI_release_1.94 Working.xls
File Edit View Insert Format Tools Data Window Help Adobe PDF
Type a question for help
Arial 10
100%
O83
Total: 0 (Must sum to 100)
Section B: Indirect Exposure to Climate Change (Evaluate for specific geographical area under consideration)
Mark an "X" in all boxes that apply.
Effect on Vulnerability
Greatly increase | Increase | Somewhat increase | Neutral | Somewhat decrease | Decrease | Unknown
Factors that influence vulnerability (* at least three required)
1) Exposure to sea level rise
2) Distribution relative to barriers
a) Natural barriers
b) Anthropogenic barriers
3) Predicted impact of land use changes resulting from human responses to climate change
Section C: Sensitivity
Mark an "X" in all boxes that apply.
Effect on Vulnerability
Greatly increase | Increase | Somewhat increase | Neutral | Somewhat decrease | Decrease | Unknown
Factors that influence vulnerability (* at least 10 required)
1) Dispersal and movements
2) Predicted sensitivity to temperature and moisture changes
a) Predicted sensitivity to changes in temperature
i) historical thermal niche
ii) physiological thermal niche
b) Predicted sensitivity to changes in precipitation, hydrology, or moisture regime
i) historical hydrological niche
ii) physiological hydrological niche
c) Dependence on a specific disturbance regime likely to be impacted by climate change
d) Dependence on ice, ice-edge, or snow-cover habitats
3) Restriction to uncommon geological features or derivatives
4) Reliance on interspecific interactions
a) Dependence on other species to generate habitat
b) Dietary versatility (animals only)
c) Pollinator versatility (plants only)
d) Dependence on other species for propagule dispersal
e) Forms part of an interspecific interaction not covered by 4a-d
5) Genetic factors
a) Measured genetic variation
b) Occurrence of bottlenecks in recent evolutionary history (use only if 5a is "unknown")
6) Phenological response to changing seasonal temperature and precipitation regimes
Calculator Results Table A. Climate Exposure B. Climate-Indirect C. Sp-spec D. Docum License Calculatio
Ready
NUM

Microsoft Excel - CCVI_release_1.94 Working.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

Type a question for help

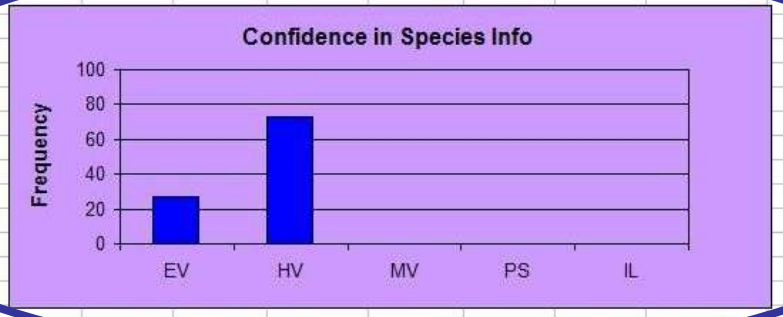
E64

88							X		4) Occurrence of **protected areas in modeled future (2050) distribution**										
89																			
90																			
91				**Climate Change Vulnerability Index**															
92				for Ovis canadensis in Nevada															
93																			
94				Highly Vulnerable															
95																			
96				Notes:															
97																			
98																			
99				**Definitions of Index Values**															
100				Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.															
101																			
102				Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.															
103																			
104				Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.															
105																			
106				Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.															
107																			
108				Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.															
109																			
110				Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.															
111																			
112																			
113																			
114																			
115																			
116																			
117																			
118																			
119																			
120																			
121																			
122																			
123																			
124																			
125																			
126																			
127																			
128																			
129																			
130																			
131																			

Confidence in Species Information
Moderate

* Histogram below

Copy Data to Results Table



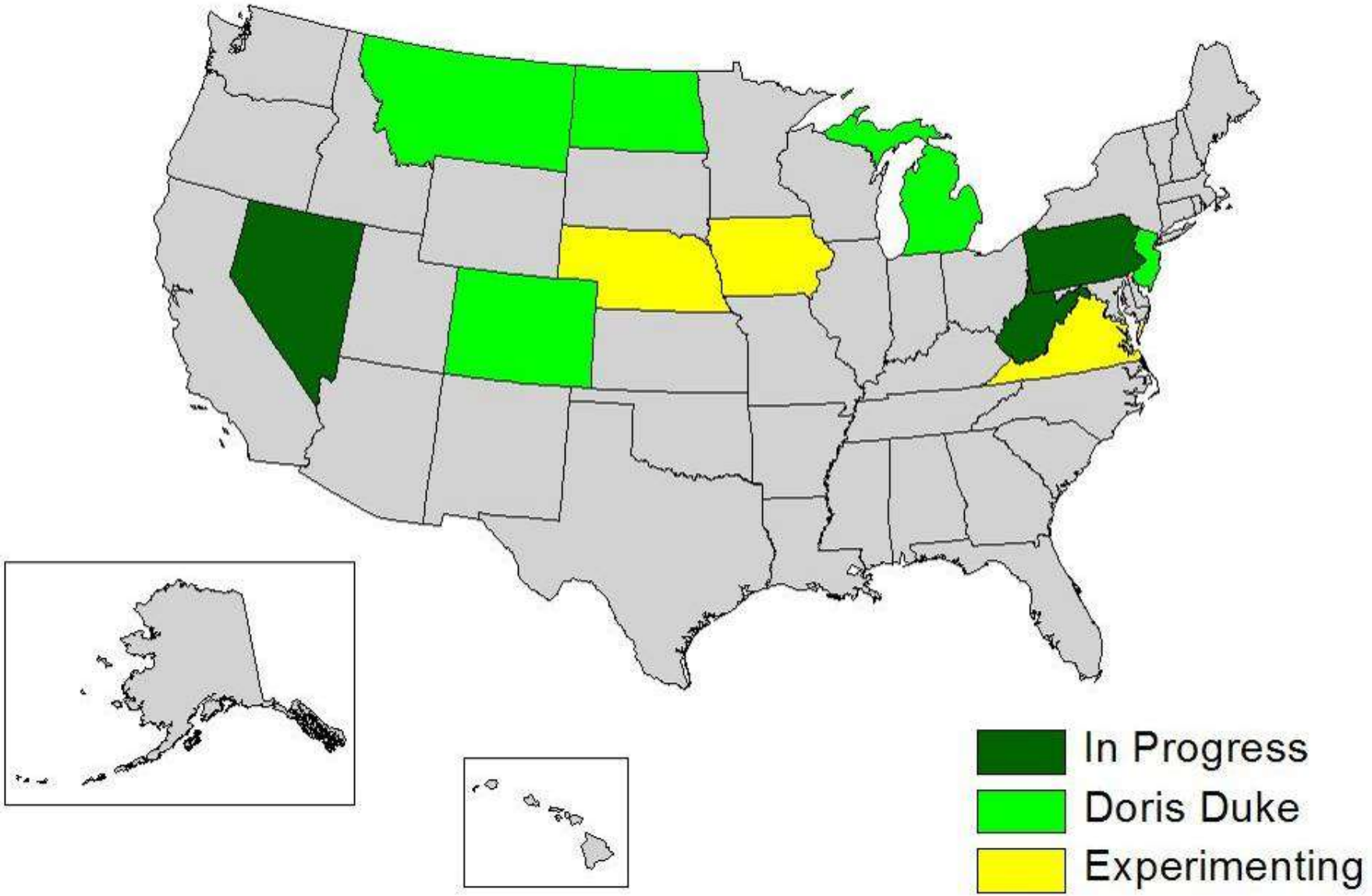
Results of a Monte Carlo simulation (1000 runs) of the data entered in the index.

Calculator | Results Table | A. Climate Exposure | B. Climate-Indirect | C. Sp-spec | D. Docum | License | Calculatio

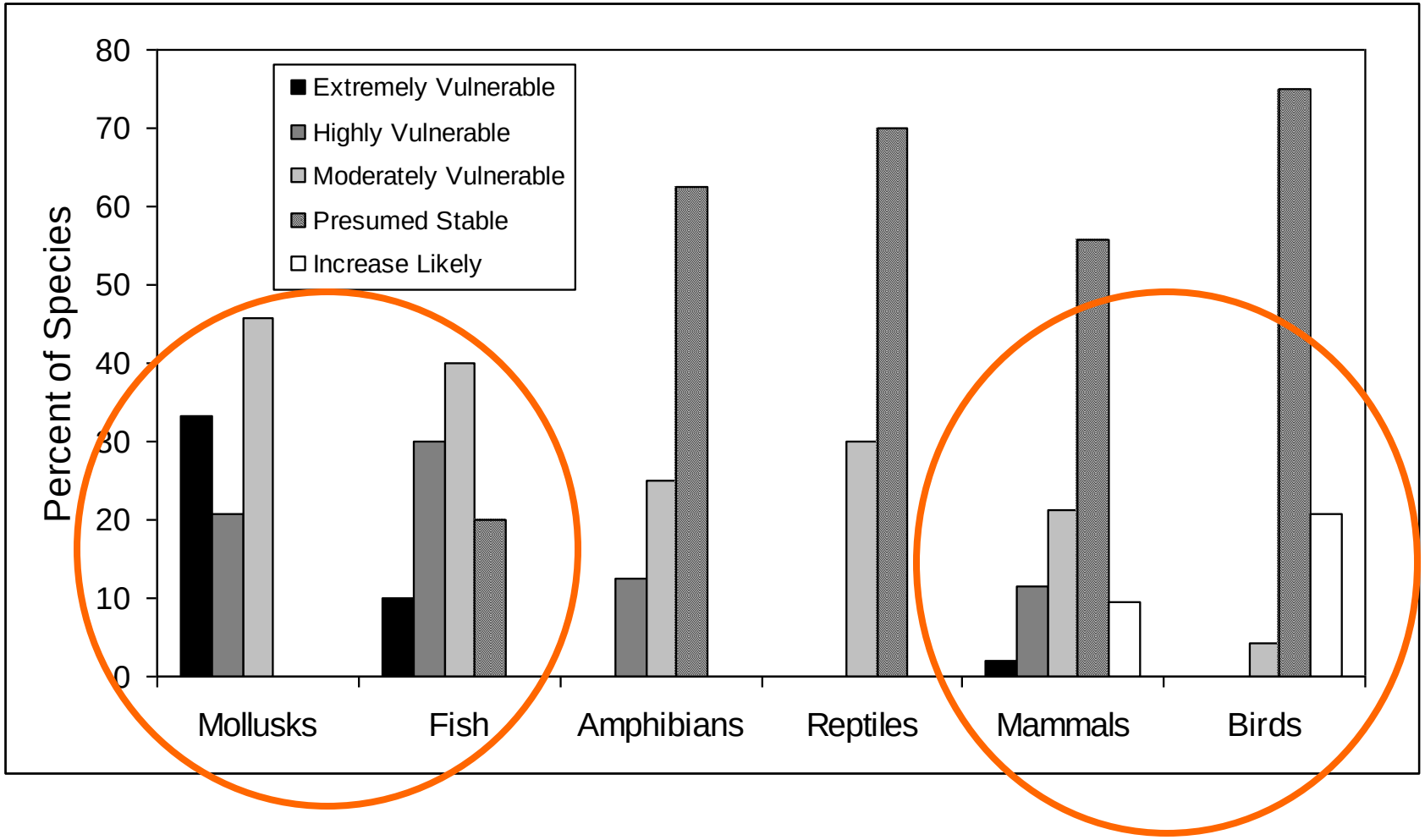
Ready

NUM

Who's Using the Index?



Nevada: 216 Species



Surprises

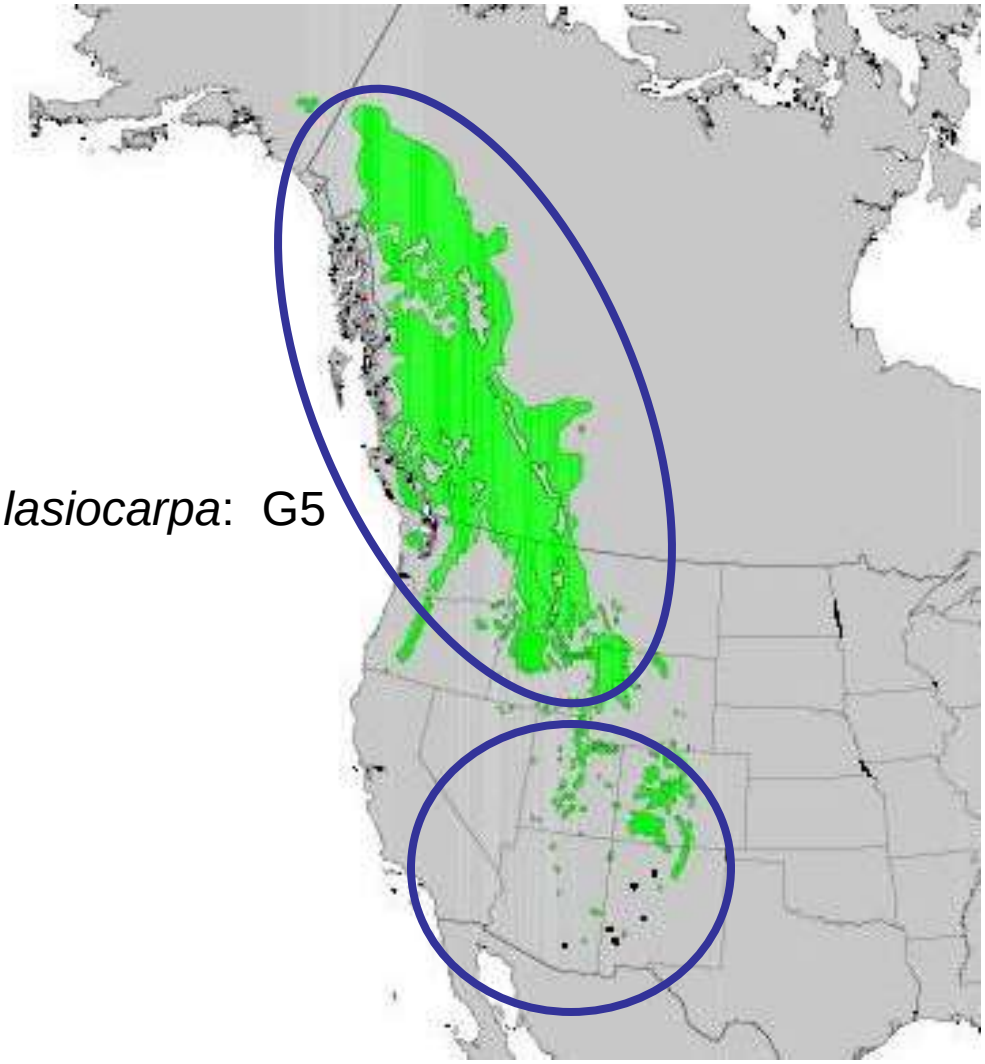
All Highly Vulnerable in Nevada

… Back to Plants

Several challenges present themselves

Challenge # 1: Range-wide Assessment

Abies lasiocarpa: G5

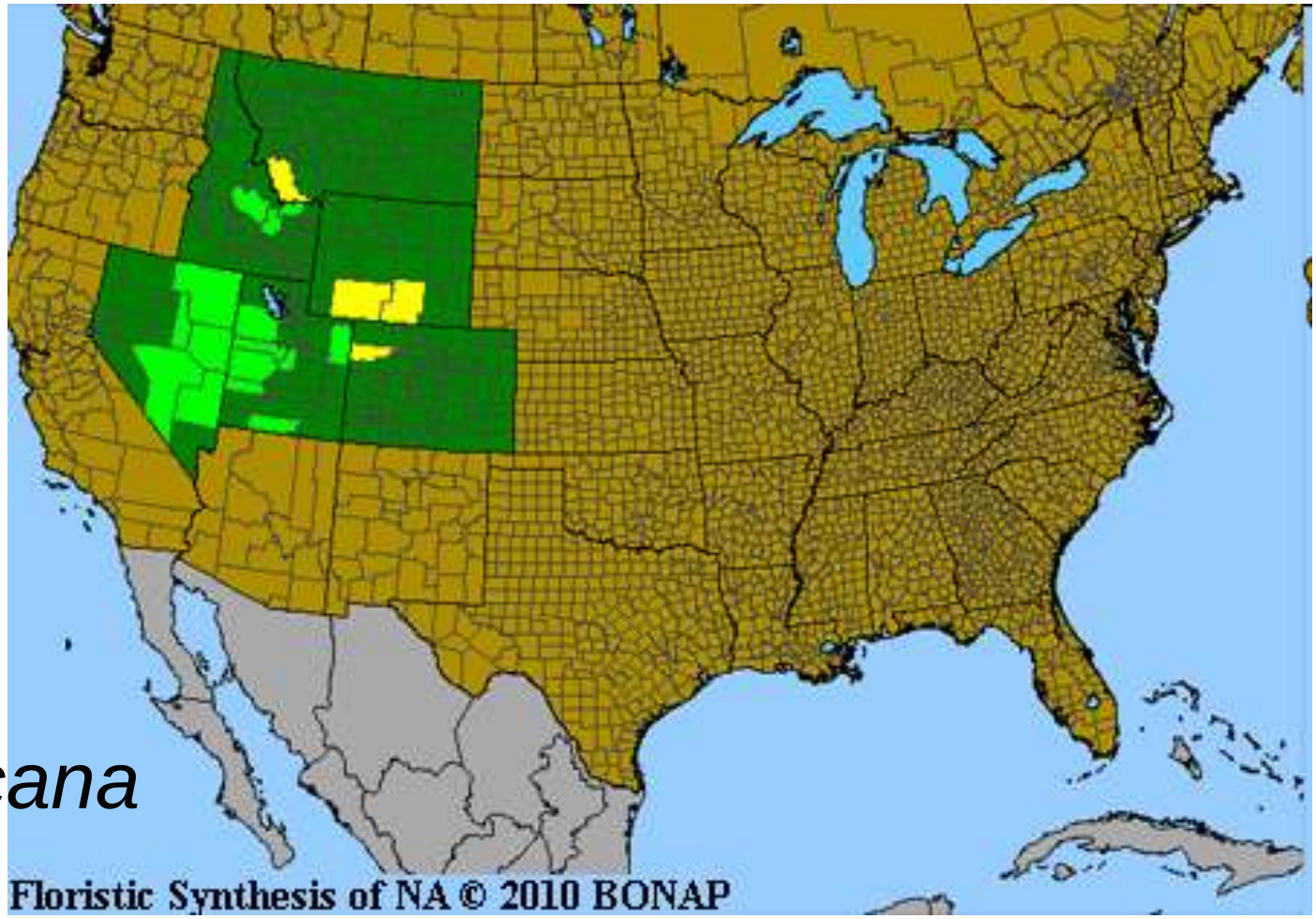


USGS

Walter Siegmund

Challenge #2: Lack of Detailed Range Maps

Phacelia incana



Challenge #3: Availability of Natural History Information

- Index requires knowledge of
  - Microhabitats
  - Moisture regime
  - Dependence on geological features
  - Pollinators
  - Seed dispersers
  - Genetic variability

Phacelia incana - Brand
Western Phacelia
Related ITIS Name(s): *Phacelia incana* Brand (TSN 31543)
Unique Identifier: ELEMENT_GLOBAL.2.140602
Element Code: PDHYD0C270
Informal Taxonomy: Plants, Vascular - Flowering Plants - Waterleaf Family

View image report from CalPhoto

Kingdom	Phylum	Class	Order	Family	Genus
Plantae	Anthophyta	Dicotyledoneae	Solanales	Hydrophyllaceae	Phacelia

Check this box to expand all report sections: ☐

Concept Reference

Conservation Status

Distribution

Ecology & Life History

General Description: Hoary Phacelia is an annual with erect, branched stems that are up to 10 cm high. The alternate leaves have well-developed petioles and broadly elliptic, entire-margined blades that are 3-15 mm long. The foliage is covered with spreading, often gland-tipped hairs. Short-stalked flowers are borne in sparse, narrow, 1-sided, curved spikes that unwind as they mature. The white to bluish flowers have 5 strap-shaped sepals that are 3-4 mm long and a 5-lobed tubular corolla that is scarcely longer than the calyx. Stamens are held within the tube. The fruit is a many-seeded capsule.
Diagnostic Characteristics: The combination of annual habit, entire leaves, and white flowers separate this species from other members of the family in our area. Members of the Boraginaceae have 1-4 nutlets rather than capsules.
Habitat Comments: Desert hills (Weber and Wittmann 1996). Stony often calcareous slopes in the sagebrush and pinyon-juniper zones (Intermountain Flora draft).

Next Steps

- Finalize modifications to Index
- Determine species list
- Assess pilot species
- Workshop to vet method, ID info sources
- Crank through assessments

Outcomes

- Species rank ordered for vulnerability to climate change
- Factors causing vulnerability identified
- Data available for:
  - Species selection for SoS
  - Management activities