Species Vulnerability Indices

Alternatives to “DIY”

Species are Important!

USFWS

Peter La Tourrette
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Audubon

Vulnerability Indices can...

... save R & D time

... remind you about vulnerability factors

... compare apples and oranges

... promote transparency

Vulnerability Indices cannot...

... turn garbage into gold

... replace in-depth VAs of species

System for Assessing `Vulnerability of Species (SAVS) to Climate Change
(Forest Service)

Framework for categorizing the relative vulnerability of threatened & endangered species to climate change
(EPA)

Climate Change Vulnerability Index
(NatureServe)

Climate Change Sensitivity Index
(University of Washington and TNC)

All:

- are potentially rapid
- score individual factors
- produce categories of relative vulnerability
- address uncertainty

SAVS

www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability

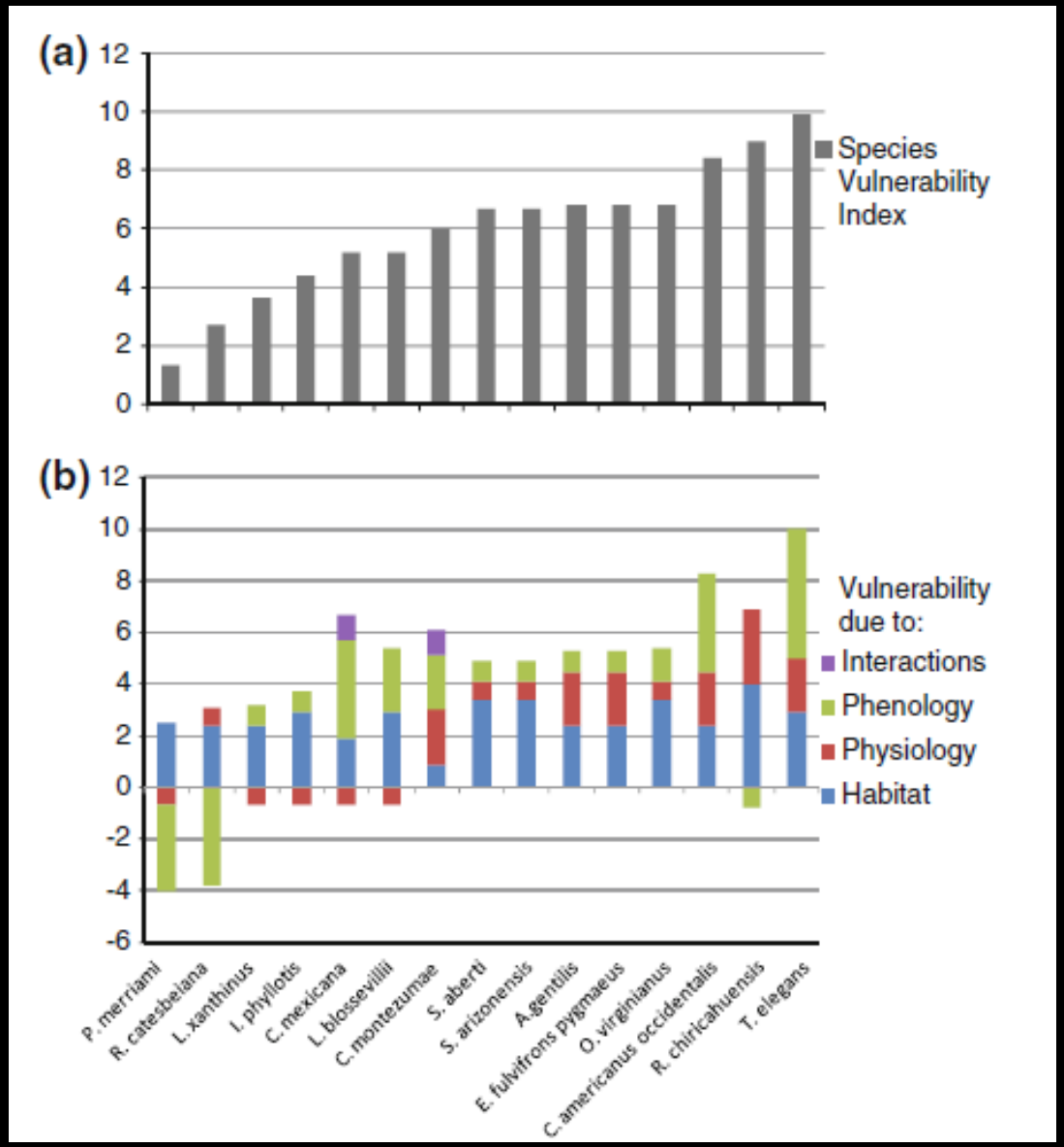
Terrestrial vertebrates

Questionnaire-based tool: Habitat, physiology, phenology, biotic interactions

Abundance, range, demographics considered implicitly

Scale: habitat/management area

Coronado National Forest



Less **Vulnerability** More

Davison et al. 2012

EPA Framework for categorizing the relative vulnerability of threatened & endangered species to climate change

T&E Vertebrates Only

Baseline & climate change vulnerability

Abundance, range, demographics considered in baseline

Spatial Scale: any

http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=203743

NatureServe

www.natureserve.org/climatechange

Terrestrial/aquatic, plants/animals

Excludes conservation status factors – use in conjunction with G/S-ranks

Exposure and sensitivity sections

Scale: state or large conservation area

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
						X
						X
						X

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

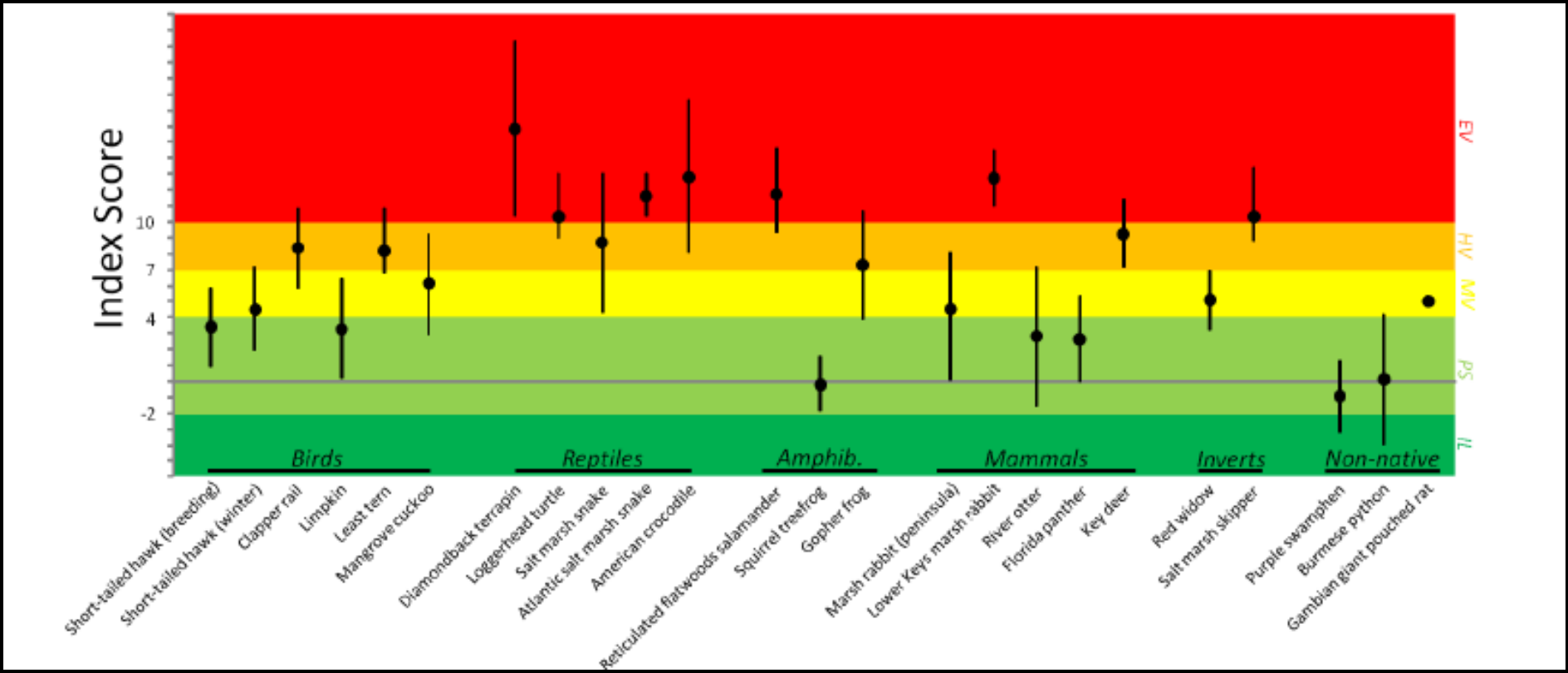
Mark an "X" in all boxes that apply.

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

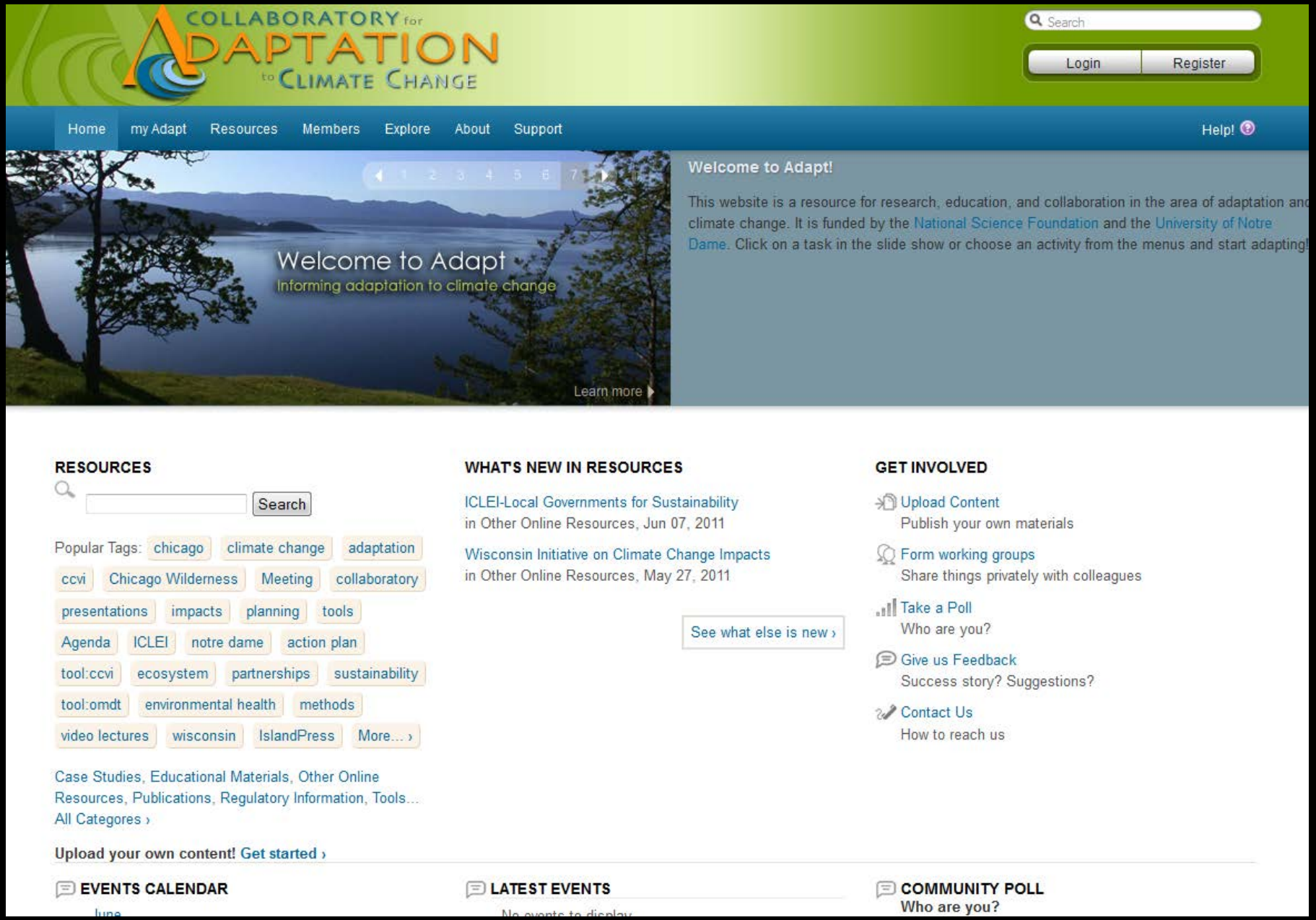
Factors that influence vulnerability *(* at least 10 required)*

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**

CCVI scores plus uncertainty



Dubois et al. 2011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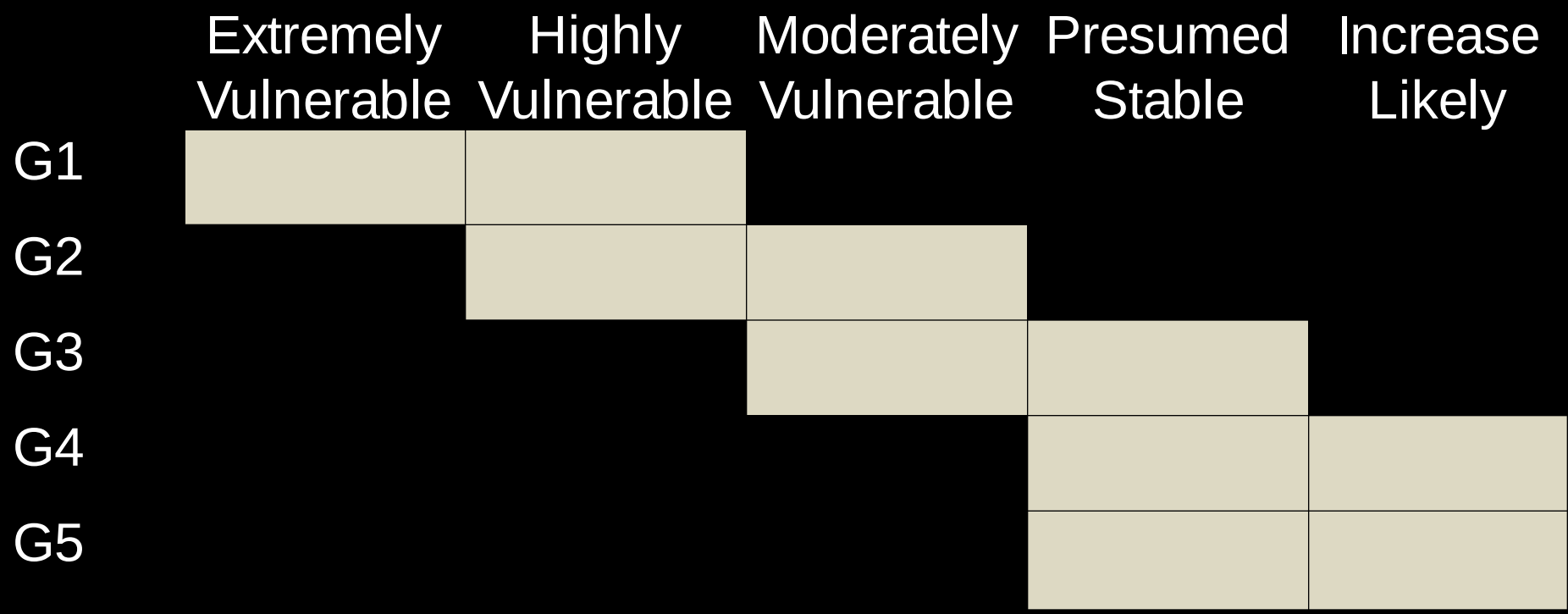
adapt.nd.edu

Duplicate Conservation Status Assessments?

	Extremely Vulnerable	Highly Vulnerable	Moderately Vulnerable	Presumed Stable	Increase Likely
G1					
G2					
G3					
G4					
G5					

NatureServe

Duplicate Conservation Status Assessments?



NatureServe

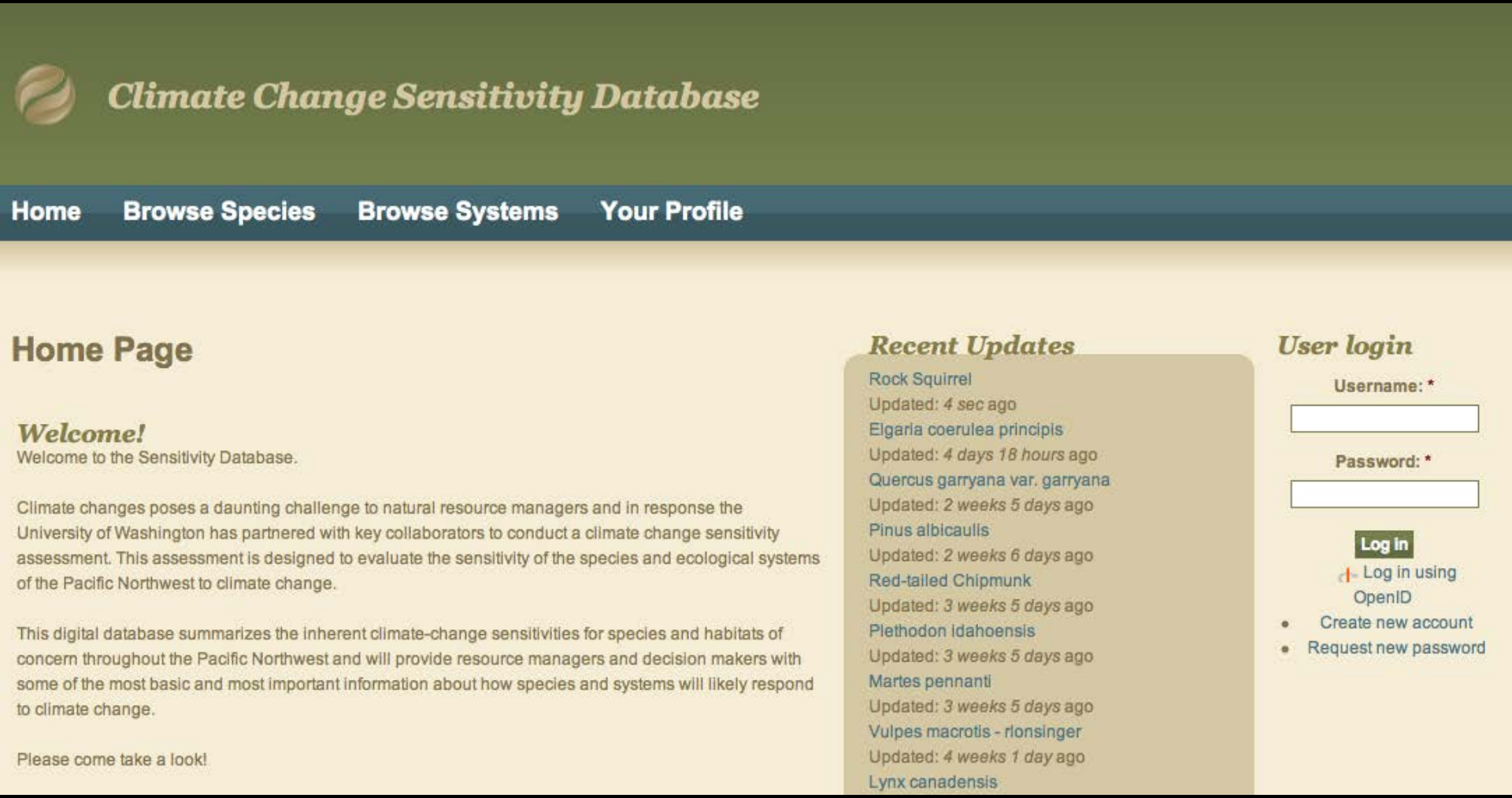
209 spp

	Extremely Vulnerable	Highly Vulnerable	Moderately Vulnerable	Presumed Stable	Increase Likely
G1	10	11	25	9	0
G2	2	4	5	3	1
G3	0	4	3	11	1
G4	1	1	6	24	3
G5	0	2	7	61	15

$p<0.001$

NatureServe

Climate Change Sensitivity Index (University of Washington and TNC)



http://climatechangesensitivity.org/

Ardea herodias - Rangewide with emphasis on the PNW

September 5, 2009 by Josh Lawler
Author(s) Expertise:

✓ This species is complete.

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Sensitivity Factor	Sensitivity	Confidence
Generalist/Specialist	3 Medium	4 Good
Physiology	2 Medium-Low	2 Poor
Life History	4 Medium-High	4 Good
Habitat	7 Extremely High	4 Good
Dispersal Ability		
Disturbance Regimes		
Ecology		
Non-Climatic		
Other (weight)		

Sensitivity Score: 44 Medium

Confidence Score: 3 Fair

Overall User Ranking: 3 Medium

Common Name: Great Blue Heron

Is this Species completed: Yes

- Taxonomy
- Generalist/Specialist
- Physiology
- Life History
- Sensitive Habitats

Is this Species completed: Yes

- Taxonomy
- Generalist/Specialist
- Physiology
- Life History
- Sensitive Habitats

▾ Dispersal Ability

Maximum annual dispersal distance: >100 km

Confidence in maximum annual dispersal distance: 4 Good

Within the context of dispersal distance above, do barriers to dispersal exist?: 1 None

Confidence in barriers to dispersal exists: 4 Good

Specific dispersal distance (if known), and dispersal type (juvenile, adult, etc.): Juvenile dispersal up to 758 Km (Gewlik and Melvin 1999)

Comments: Dispersal data based on recovery of banded birds between 1914 and 1994 (Gawlik and Melvin 1999).

Citations: Gawlik, D. and Melvin, S. 1999. Long-term movement patterns for seven species of wading birds. Waterbirds 22(3): 411 - 416.

- Disturbance Regimes
- Ecological Relationships
- Interacting non-climatic stressors
- Overall User Ranking

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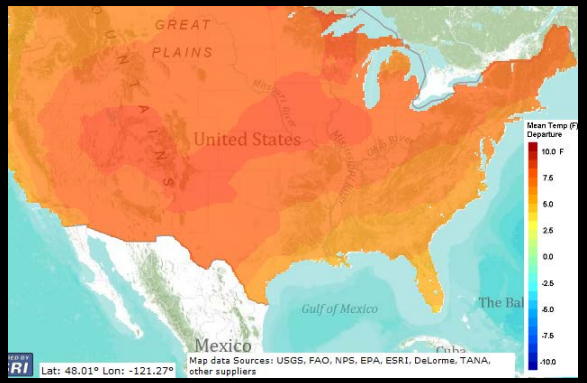
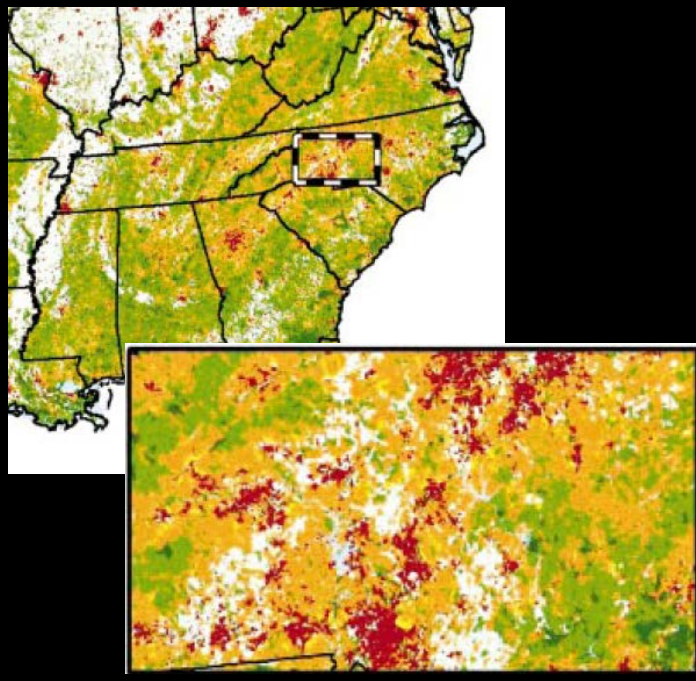
Finding data for the index

- **Exposure:** Climate Wizard; WorldClim
- **Sensitivity/adaptive capacity:** literature reviews and expert elicitation, existing web-based tools (ex: GAP, WUI)

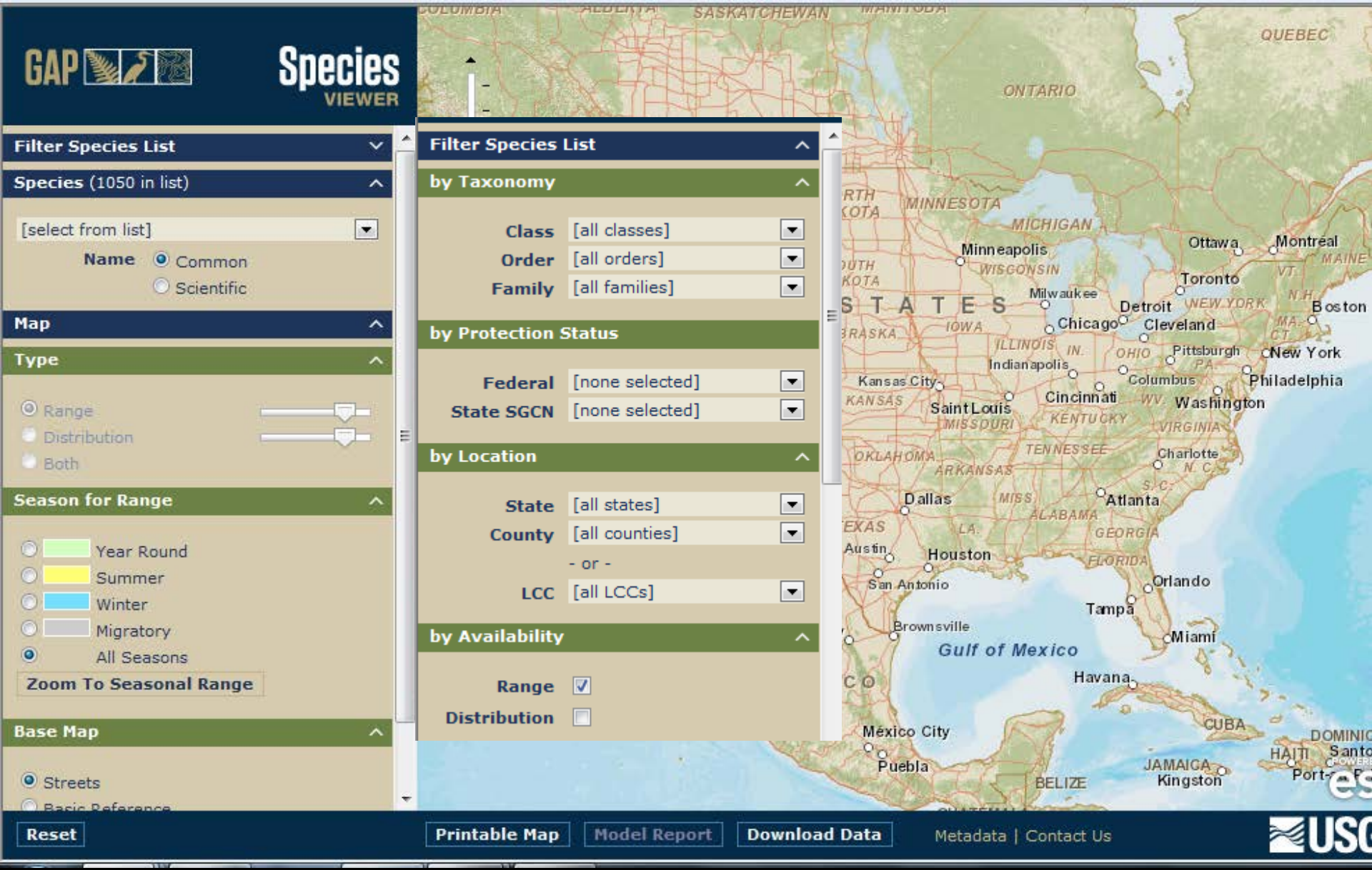
- Uncertainty
  - Explore various climate models
  - Can explicitly address during input by omitting responses or providing multiple responses



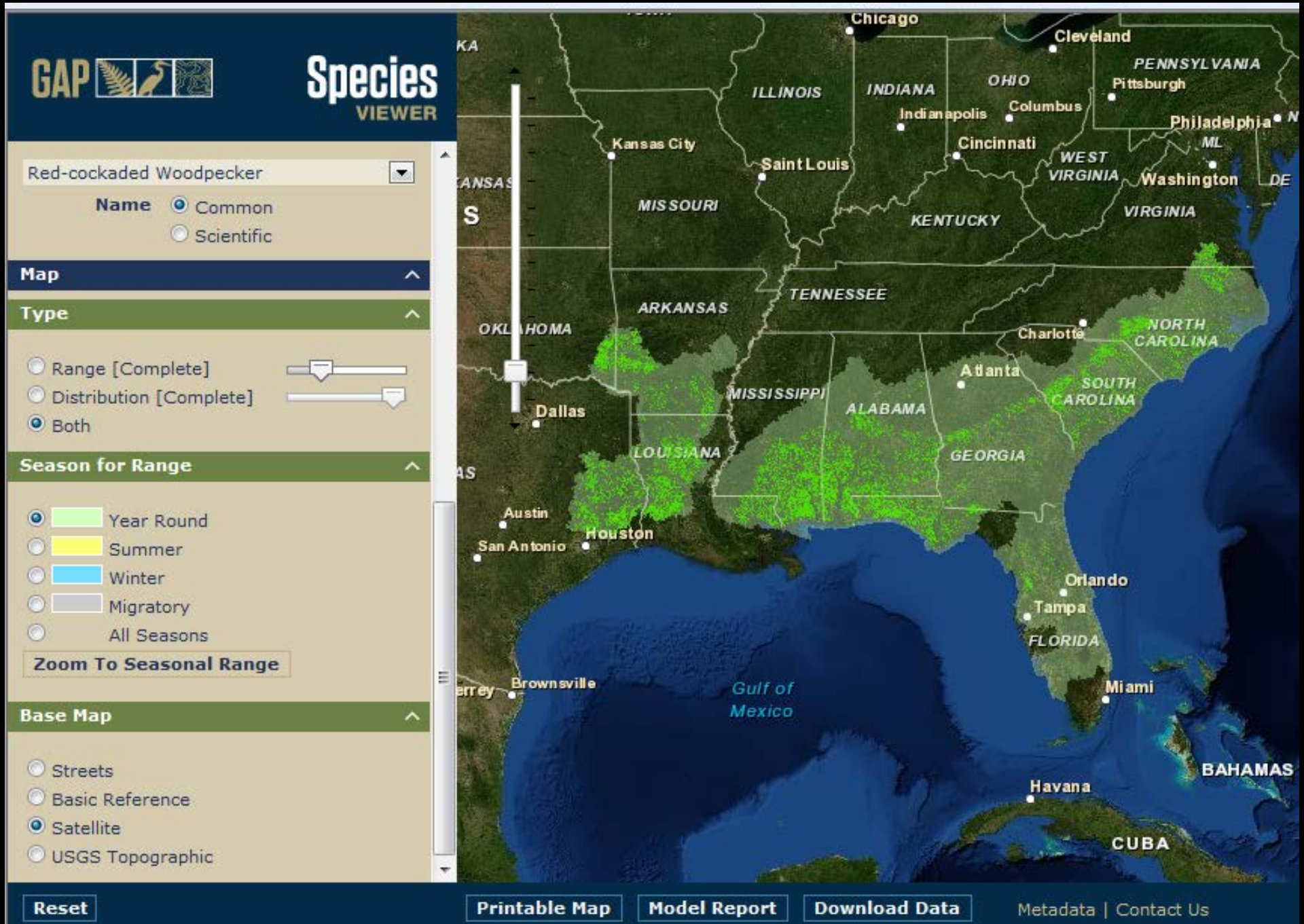


Wildland-Urban Interface
Silvus Lab, U of WI

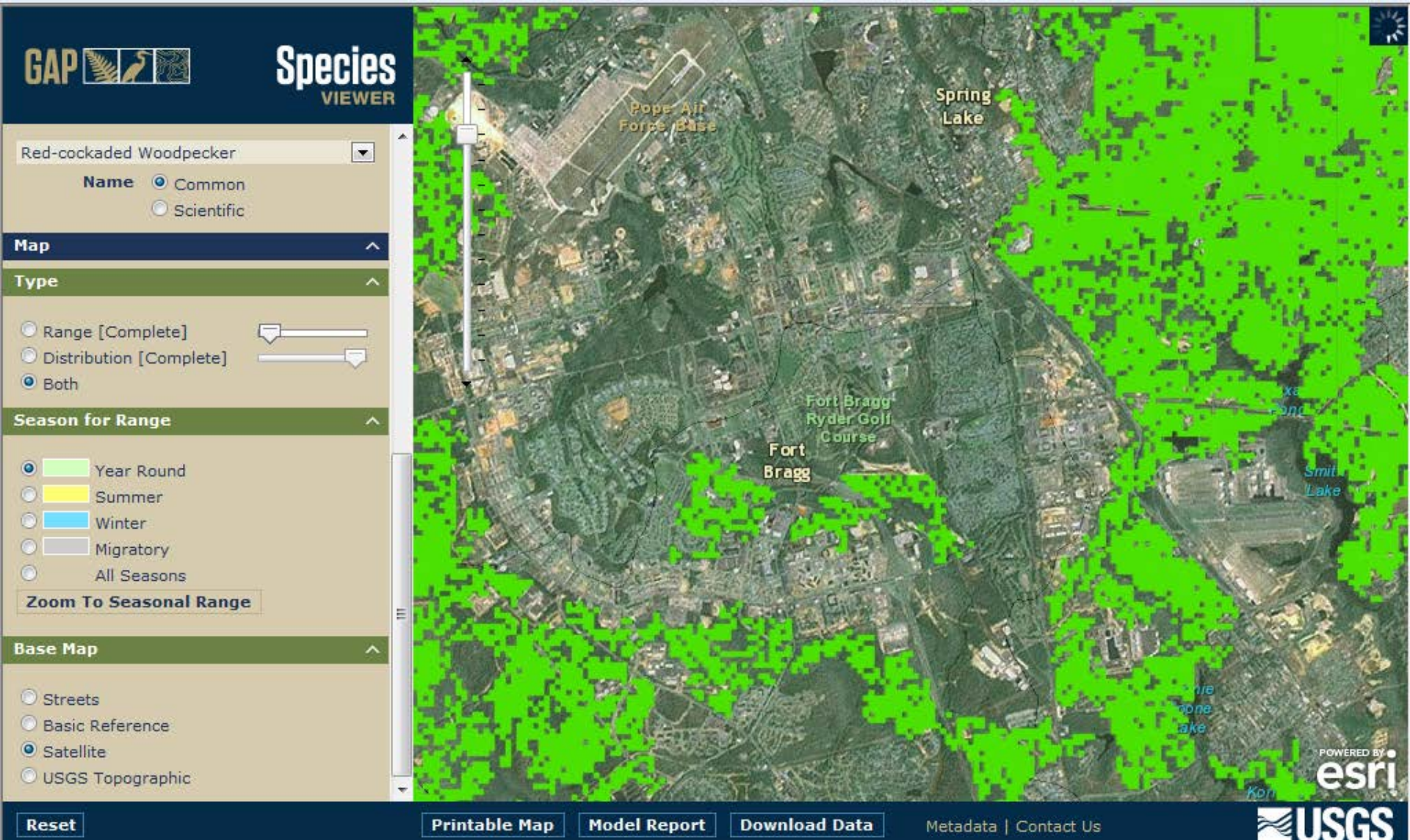
Sources of Species Distribution Data … GAP Species Viewer (http://www.gap.uidaho.edu/species_viewer.html)



Red-cockaded Woodpecker example (range and distribution



Fort Bragg, NC … Red-cockaded Woodpecker Modeled Distribution



Sources of Senstivity/Adaptive Capacity data
GAP PAD Viewer (http://www.gap.uidaho.edu/padusmap.html)