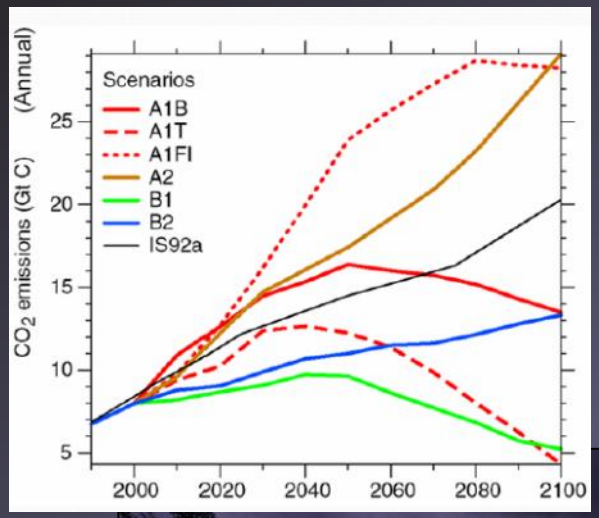
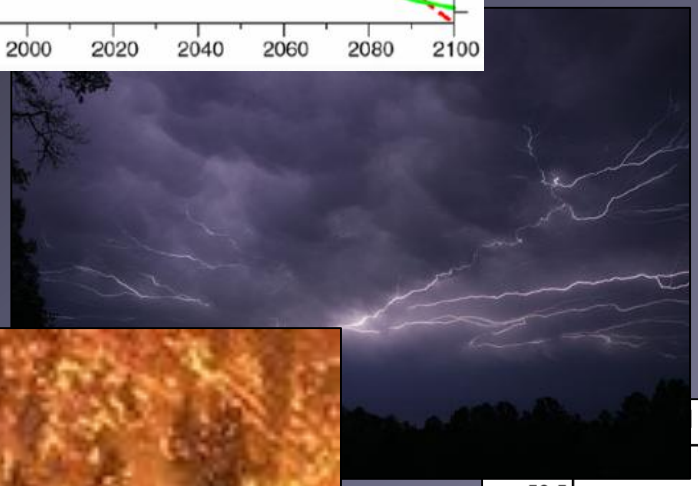
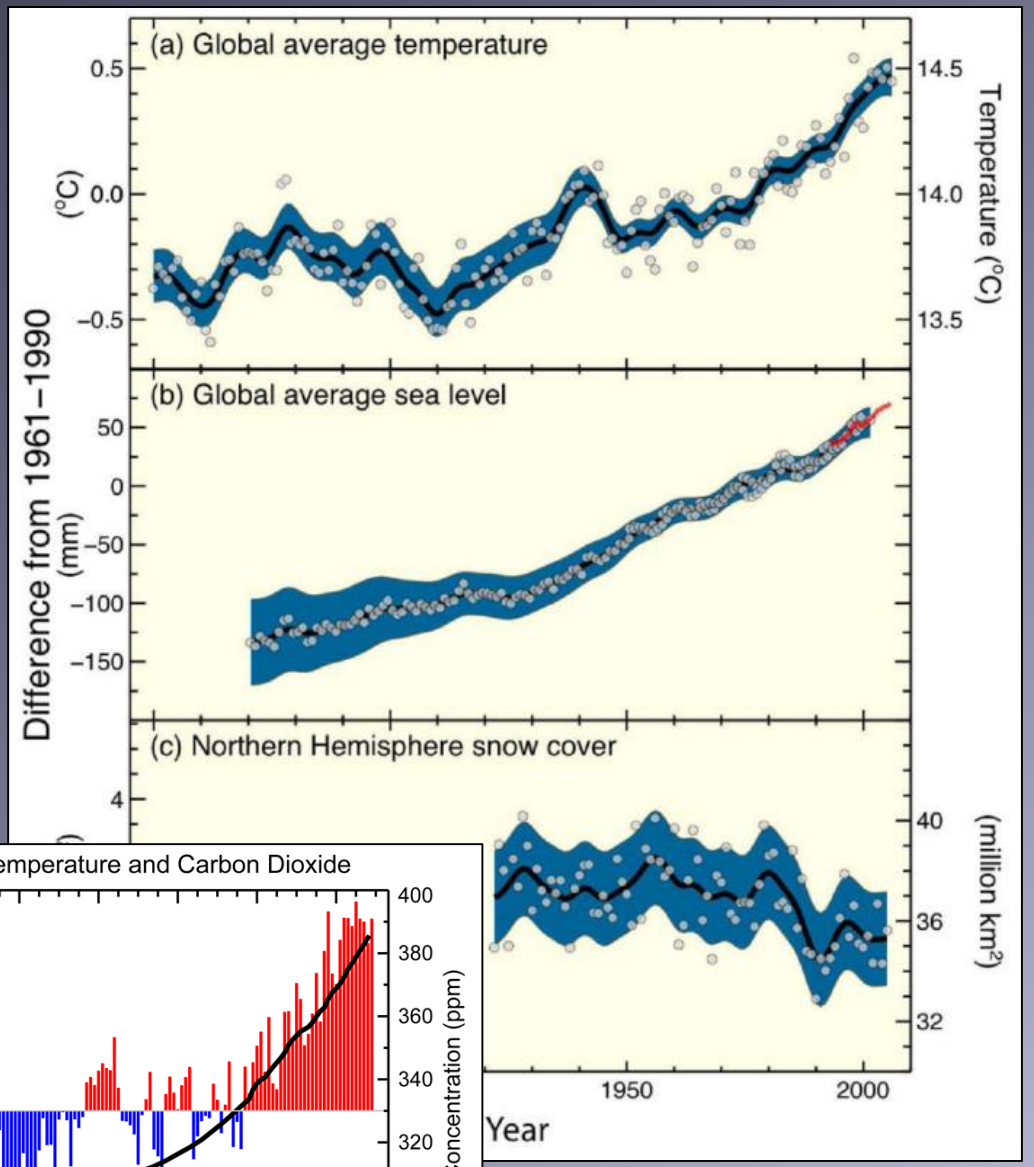
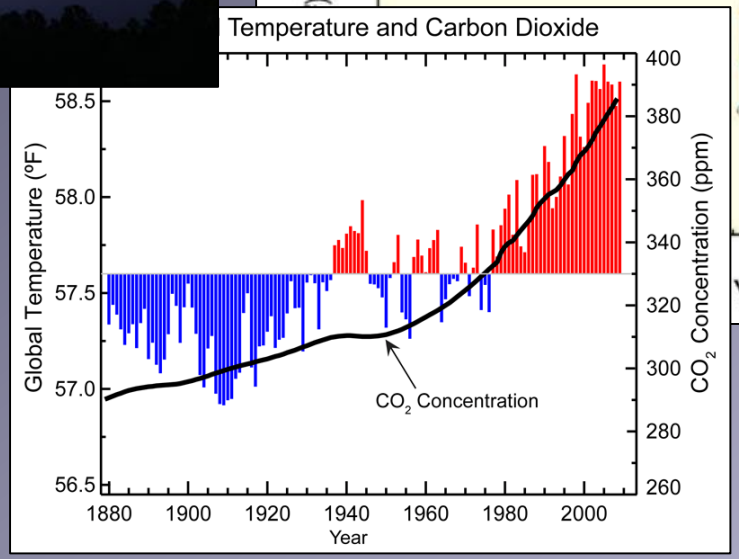

Managing Wildlife
in a
Changing Climate
Leona K. Svancara
IDAHO
FISH & GAME


Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a
CO_2 emissions (Gt C) (Annual)
25
20
15
10
5
2000
2020
2040
2060
2080
2100




(a) Global average temperature
(°C)
0.5
0.0
−0.5
14.5
14.0
13.5
Temperature (°C)
(b) Global average sea level
Difference from 1961–1990
(mm)
50
0
−50
−100
−150
(c) Northern Hemisphere snow cover
4
40
36
32
(million km²)
1950
2000
Year


Temperature and Carbon Dioxide
Global Temperature (°F)
58.5
58.0
57.5
57.0
56.5
400
380
360
340
320
300
280
260
CO_2 Concentration (ppm)
CO_2 Concentration
1880
1900
1920
1940
1960
1980
2000
Year

IDFG Mission…

"protect, preserve, perpetuate and manage"

% of Species Affected

100
80
60
40
20
0

Habitat Destruction
Exotic Species
Pollution
Overharvest
Disease

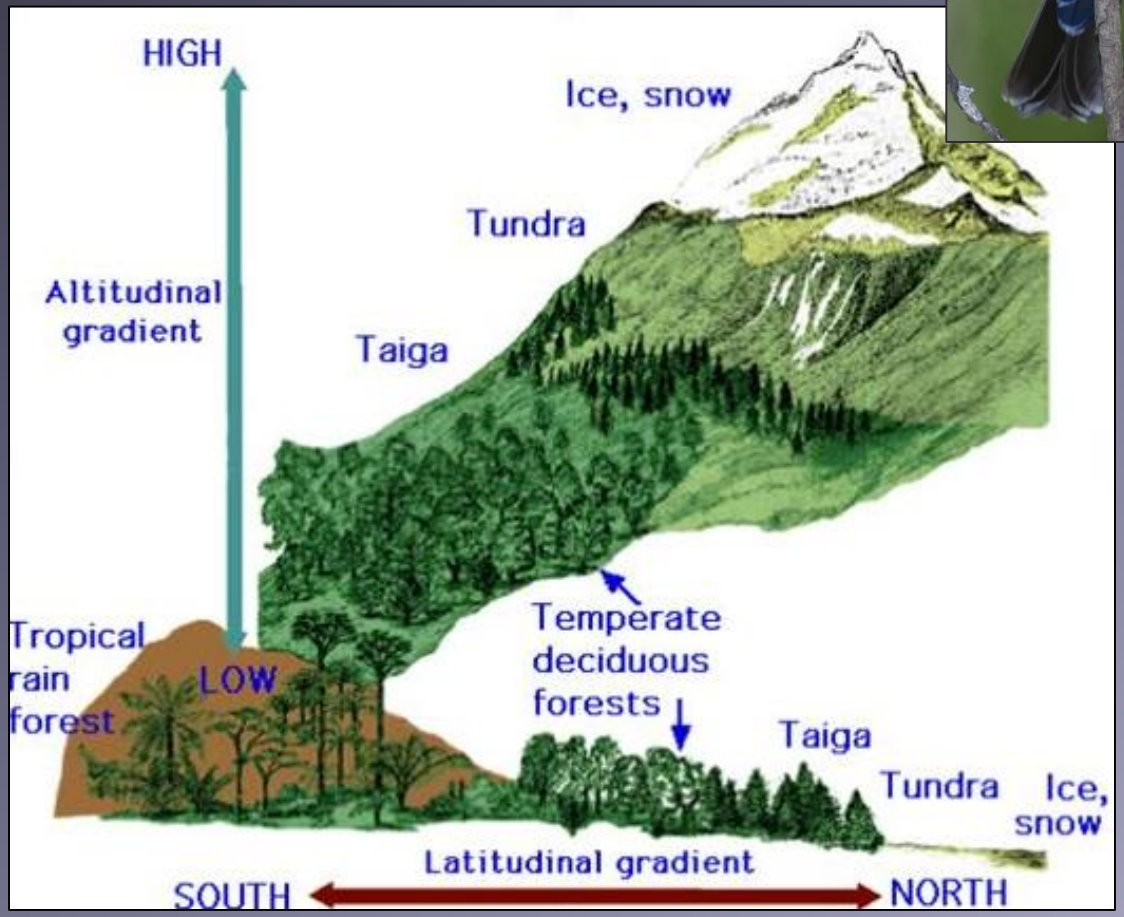
(Wilcove et al. 1998, 2000)

Factors Affecting Changes…

- Elevation
- Topography
- Latitude
- Land cover types
- Wind patterns

In Theory

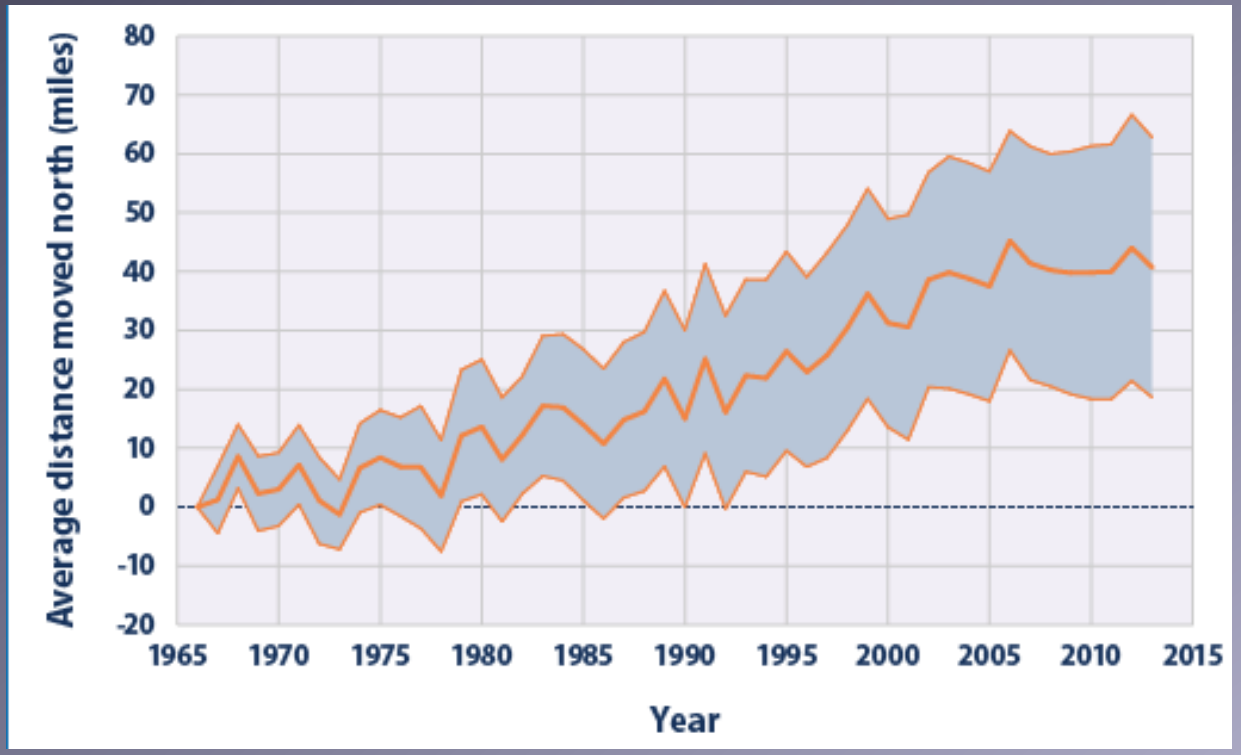
Up in elevation



Pole-ward in latitude

In Reality

- Center of abundance for 305 widespread bird species in North America has shifted northward by ~35miles (56 km)



- Current estimates of 11 meters / decade in elevation and 16.9 km / decade in latitude

National Audubon Society 2014, Chen et al. 2011

In Reality

Up…


White-headed Woodpecker


Western Scrub-jay

Down…


Lesser Goldfinch

Up & Down…


Red-breasted Merganser

North…


Western Bluebird

… some stay put…

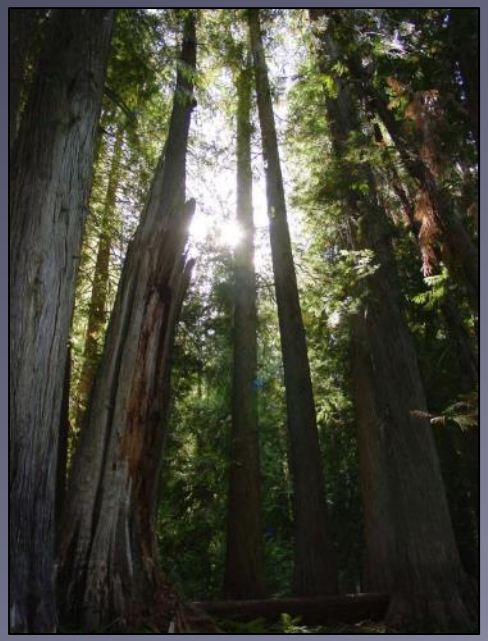

Western Meadowlark

South…

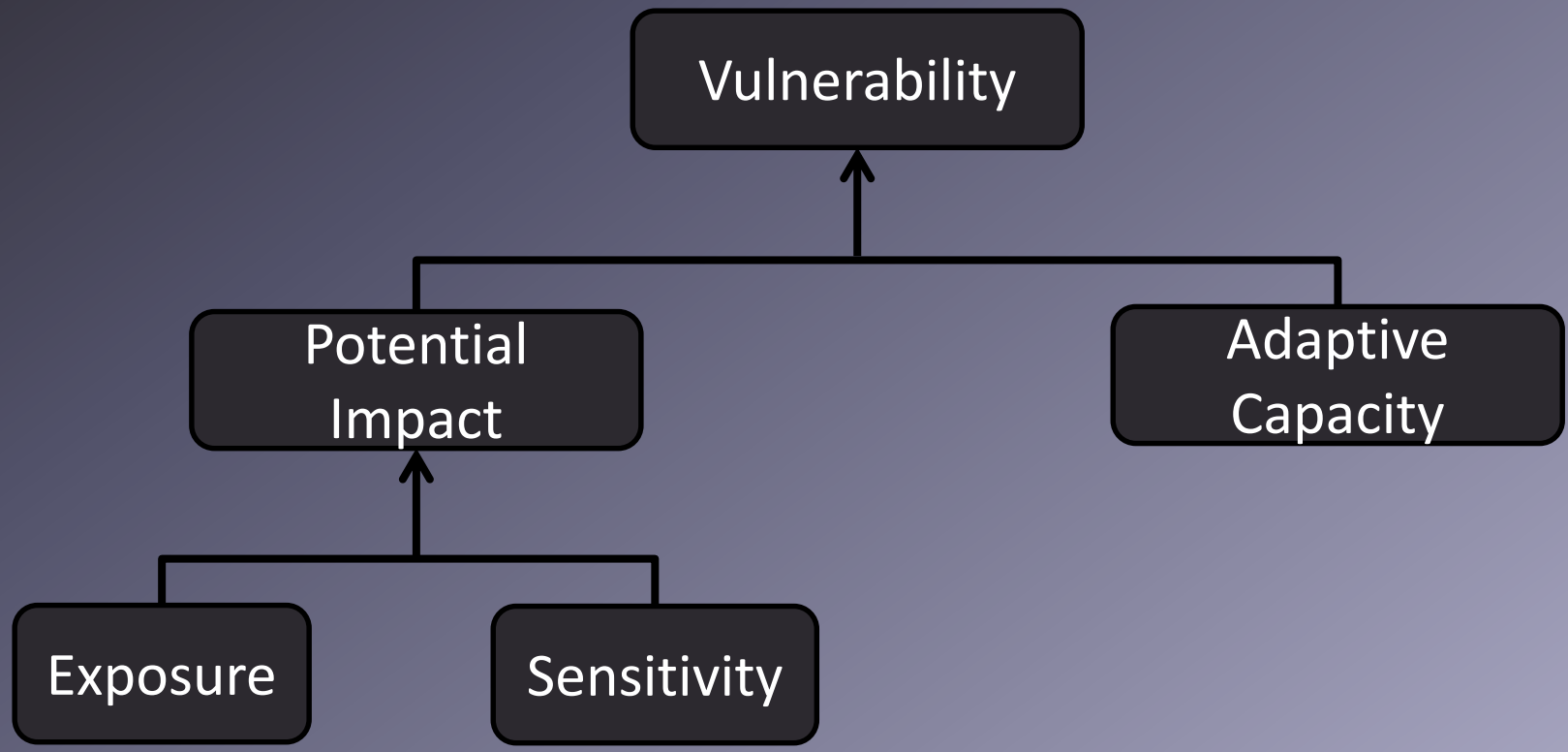
Chen et al. 2011, EPA 2012, Tingley et al. 2012

In Reality

Linking changes
in climate conditions
to changes in biodiversity
requires several assumptions
of
climate exposure,
species sensitivity,
and
adaptive capacity.



Vulnerability Components



Exposure + Sensitivity +- Adaptive Capacity = ?

Exposure – More than just Temperature & Precipitation

For Example…

↓ Snowpack & Cover

↑ Spring Temperature

↑ Pests & Disease

↑ Growing Season

↑ Frost-free Days

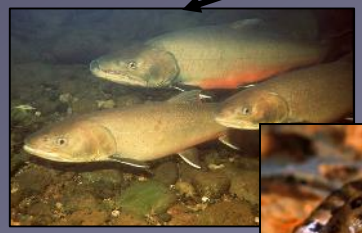
↑ Phenology / Green-up

Changes in Timing & Duration of Streamflow

↑ Snow Melt

Earlier Insect Emergence

Earlier Blooming Dates



Sensitivity

Physiology

Ecological interactions

Inter-specific dependency

Sensitive habitat

Disturbance regimes

Adaptive Capacity

Trophic level

Population growth rate

Dispersal ability

Generalist/ specialist

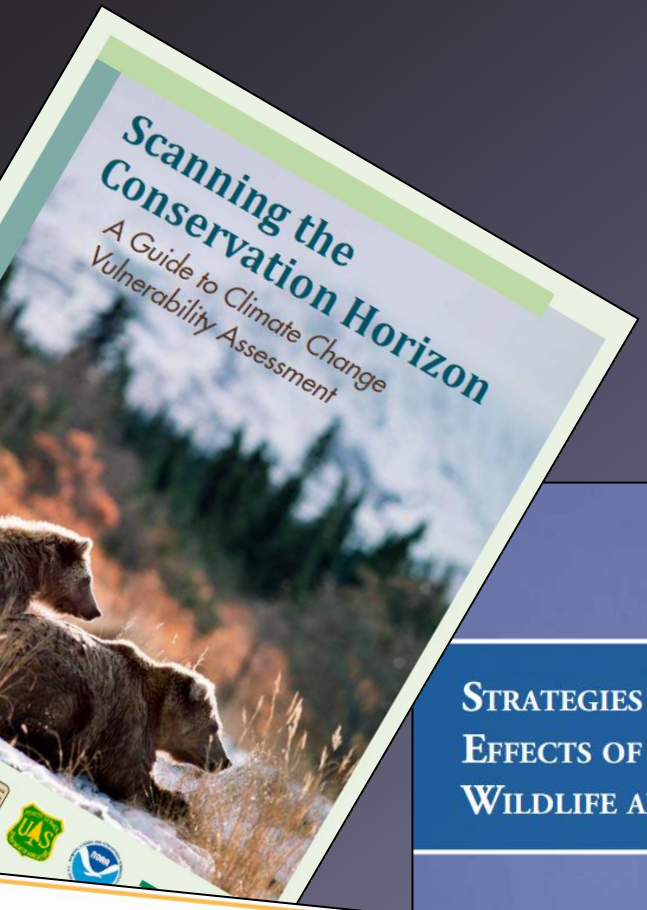
Dispersal barriers

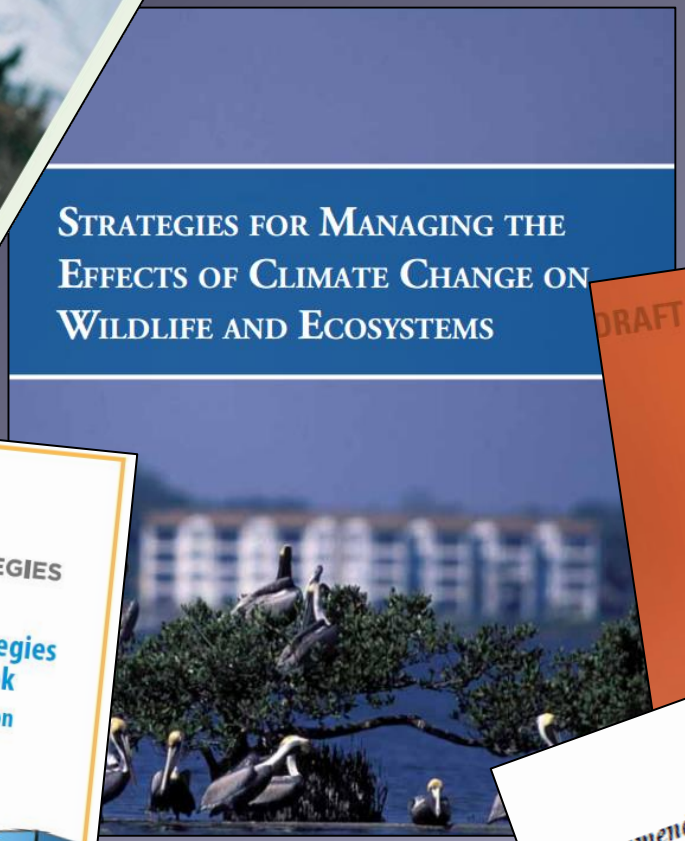
Implications for Management

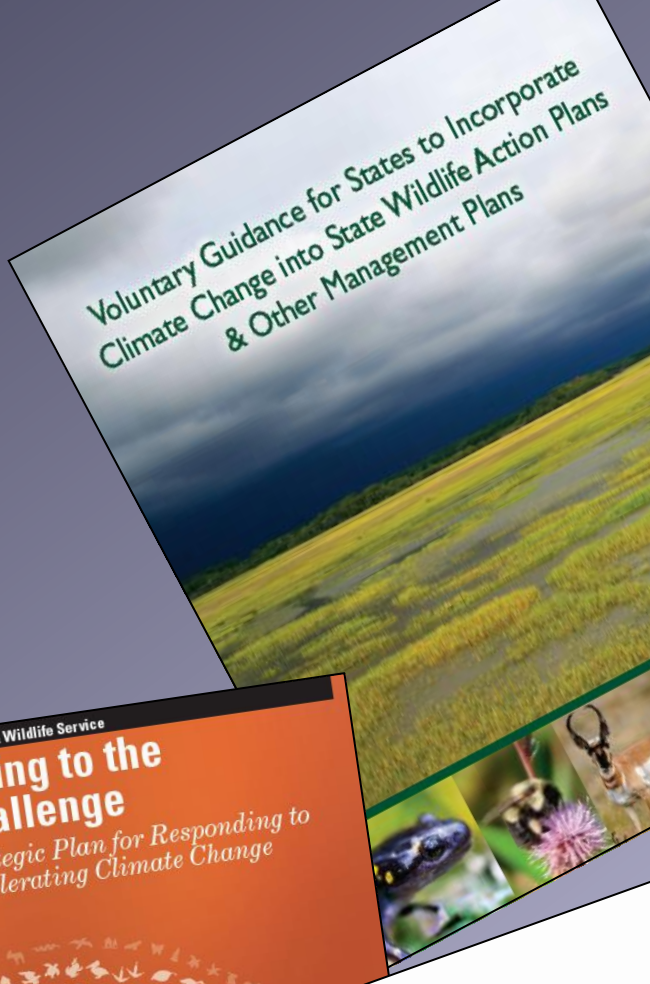
- "protect, preserve, perpetuate and manage"
- Individual species management plans
- Idaho's State Wildlife Action Plan

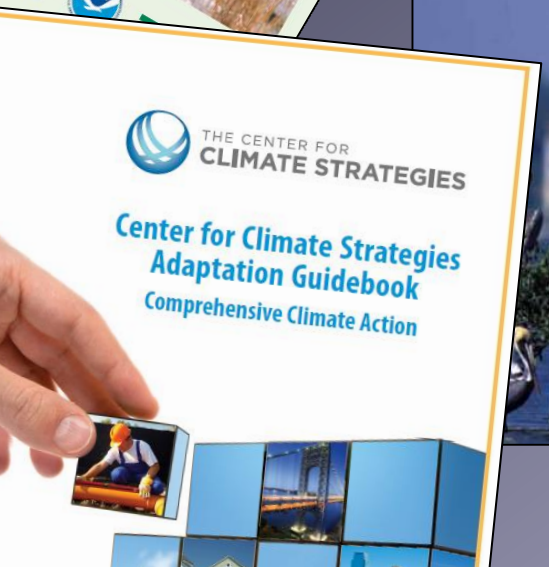


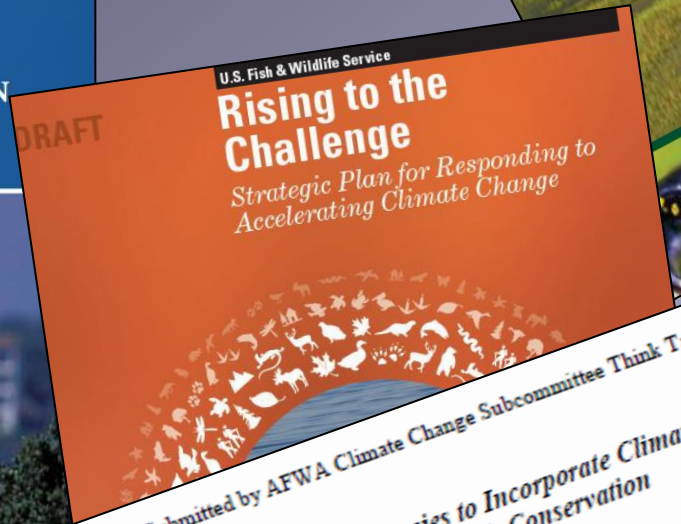

How?


Scanning the Conservation Horizon
A Guide to Climate Change Vulnerability Assessment


Strategies for Managing the Effects of Climate Change on Wildlife and Ecosystems


Voluntary Guidance for States to Incorporate Climate Change into State Wildlife Action Plans & Other Management Plans


THE CENTER FOR CLIMATE STRATEGIES
Center for Climate Strategies Adaptation Guidebook
Comprehensive Climate Action


DRAFT
U.S. Fish & Wildlife Service
Rising to the Challenge
Strategic Plan for Responding to Accelerating Climate Change

Submitted by AFWA Climate Change Subcommittee Think Tank
A Recommended Approach for State Agencies to Incorporate Climate Change Considerations in Fish and Wildlife Conservation

The Pacific Northwest Vulnerability Assessment of Species & Habitats to Climate Change

University of Washington
University of Idaho
Idaho Dept of Fish and Game
Washington Dept of Fish and Wildlife
Oregon Dept of Fish and Wildlife
Montana Fish Wildlife and Parks
US Geological Service
National Park Service
National Wildlife Federation
The Nature Conservancy

http://climatevulnerability.org

Coarse-filter

Vulnerability Indices

- Qualitative categorization
- Substantial uncertainty
- Relatively quick
- Multiple species

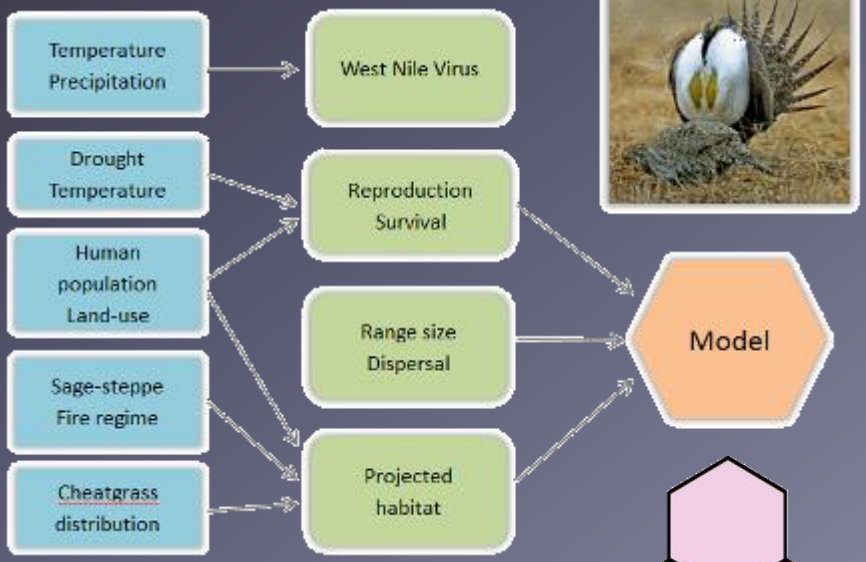
Vs.

Fine-filter

Species Distribution Modeling

- Quantitative, often spatially-explicit
- Substantial uncertainty
- Time consuming ($$)
- Single species

Fine-filter Example: *Population Modeling*

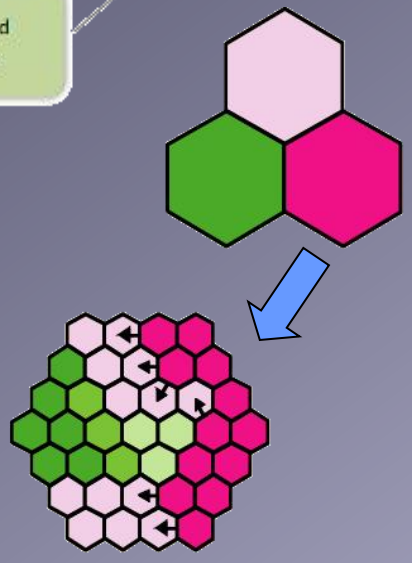


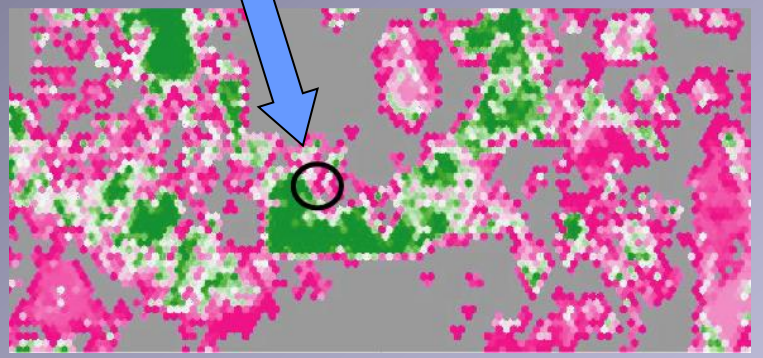
Greater Sage-grouse

Habitat quality

best

worst





- Simulate potential impacts of climate change on populations
- ~12 species

(Chad Wilsey)

Coarse-filter Example


Photo Credit: H. Ulmschneider (BLM) and R. Dixon (IDFG)

HOME | BROWSE SPECIES | BROWSE SYSTEMS | YOUR PROFILE

Search site...

Climate Change Sensitivity Database

Please create an account and login to view det
summary information.

Home Page

Welcome to the Climate Change Sensitiv

Climate changes poses a daunting challe
of Washington has partnered with key c
This assessment is designed to evaluate
Northwest to climate change.

This digital database summarizes the inf
concern throughout the Pacific Northwe
some of the most basic and most import
respond to climate change.

Please come take a look!

Recent Science Updates

Rapid Range Shifts of Species Assoc

Submitted by Michael Case on Tue, 2011-08-30

Science 19 August 2011: Vol. 333 no. 6045 p
I-Ching Chen, Jane K. Hill, Ralf Ohlemüller, D

Climate change wil
cover on many Nort

Brachylagus idahoensis -

View | Edit | Revisions

Common Name:

Pygmy Rabbit

Enter known common names, one name per line.

Is this Species completed: *

Yes

- Taxonomy
- Dispersal Ability
- Disturbance Regimes
- Generalist/Specialist
- Physiology
- Life History
- Sensitive Habitats
- Ecological Relationships
- Interacting non-climatic stressors
- Other Sensitivities
- Overall User Ranking
- Comment settings

Maximum annual dispersal distance:

- Please select an option below.
- >100 km
- 75-100 km
- 50-75 km
- 25-50km
- 5-25km
- <1km

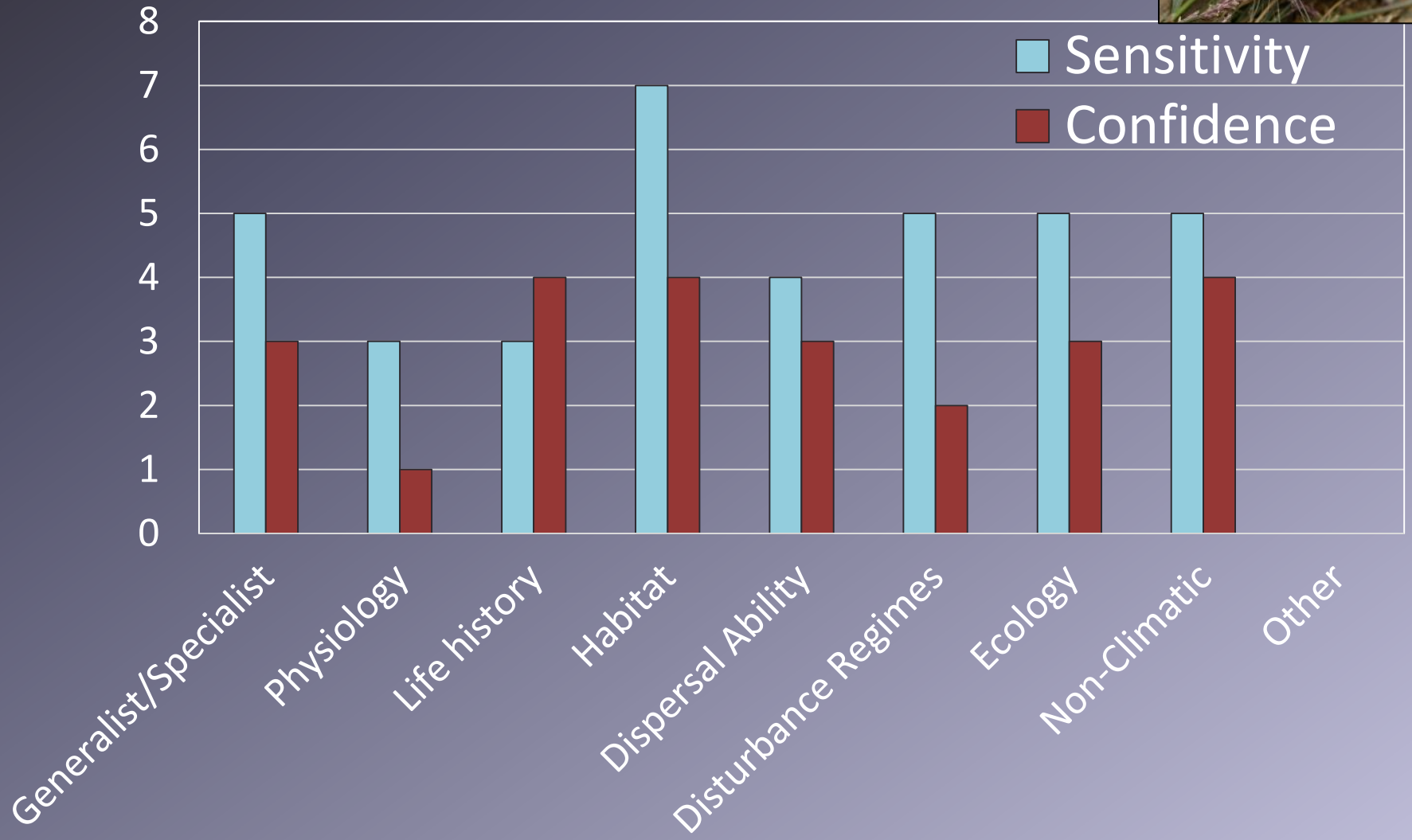
Confidence in maximum annual dispersal distance:

4 Medium-High

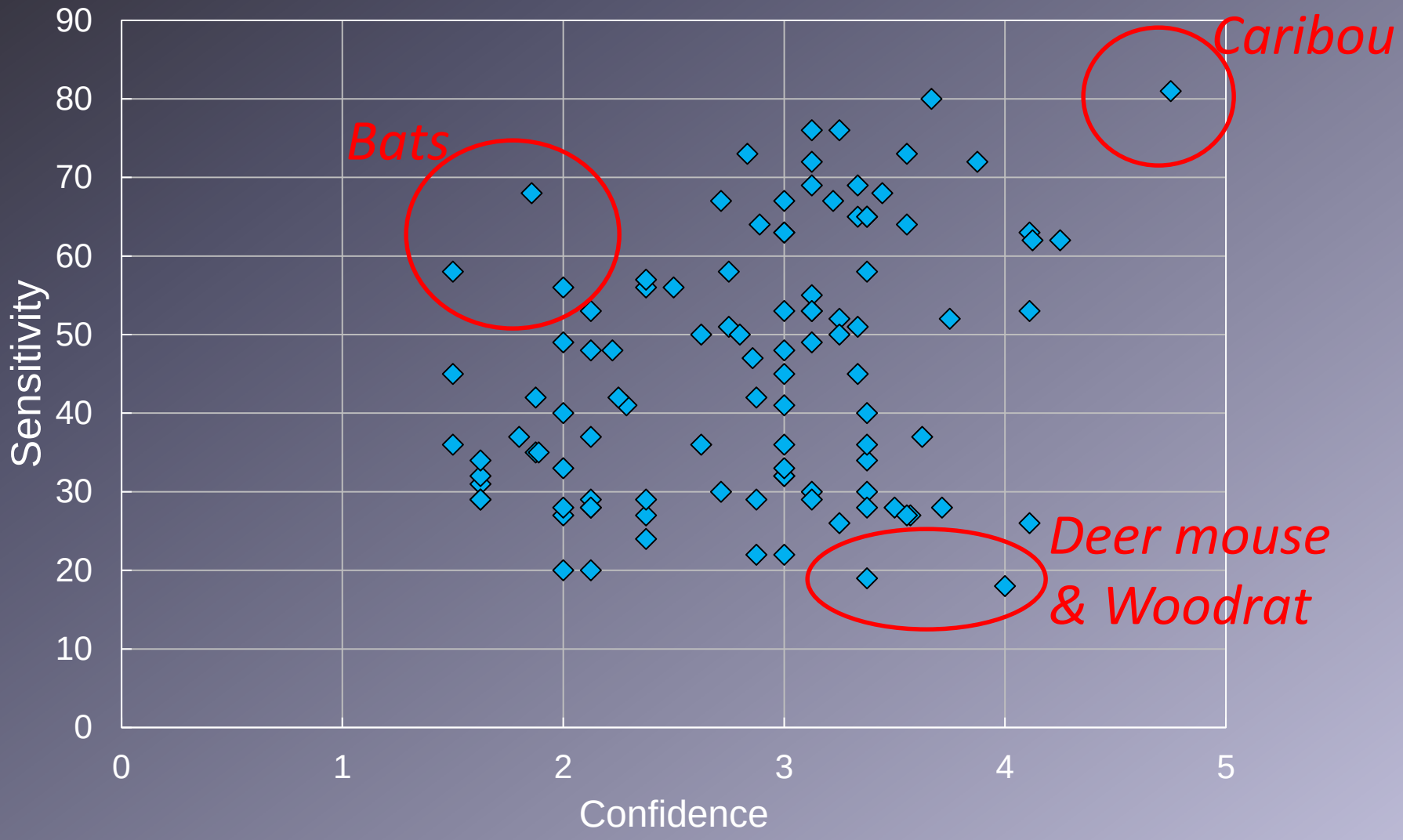
Please rate your confidence on the values selected.

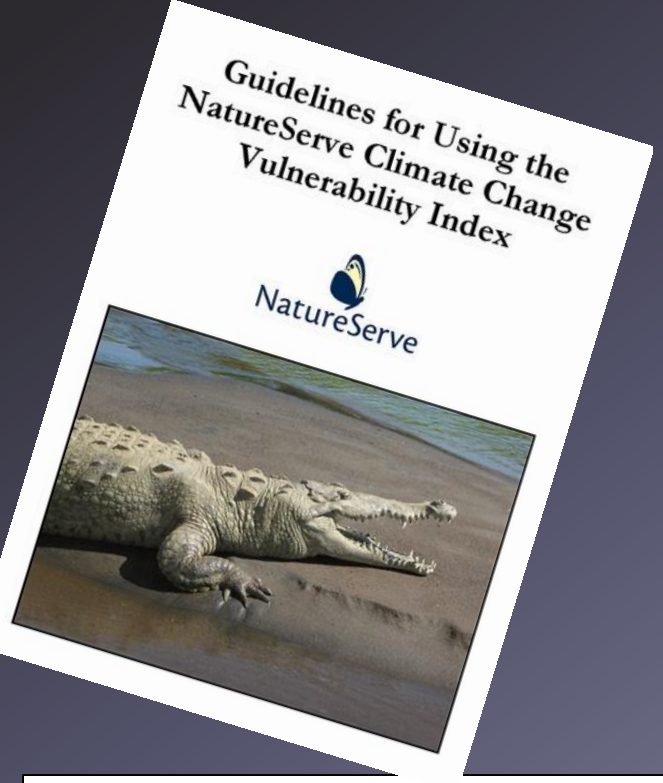
http://climatechangesensitivity.org

Northern Bog Lemming Sensitivity Index & Confidence

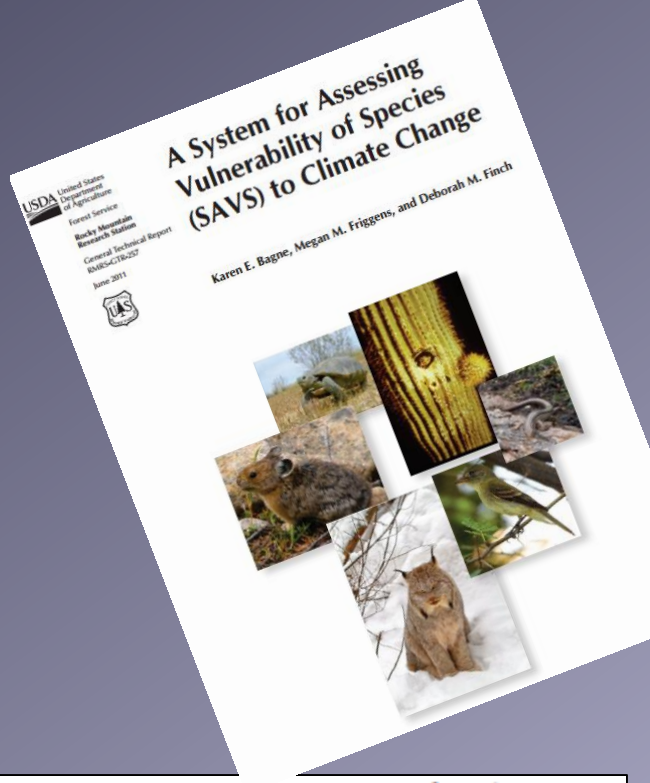


Idaho Mammals





Several Vulnerability Indices



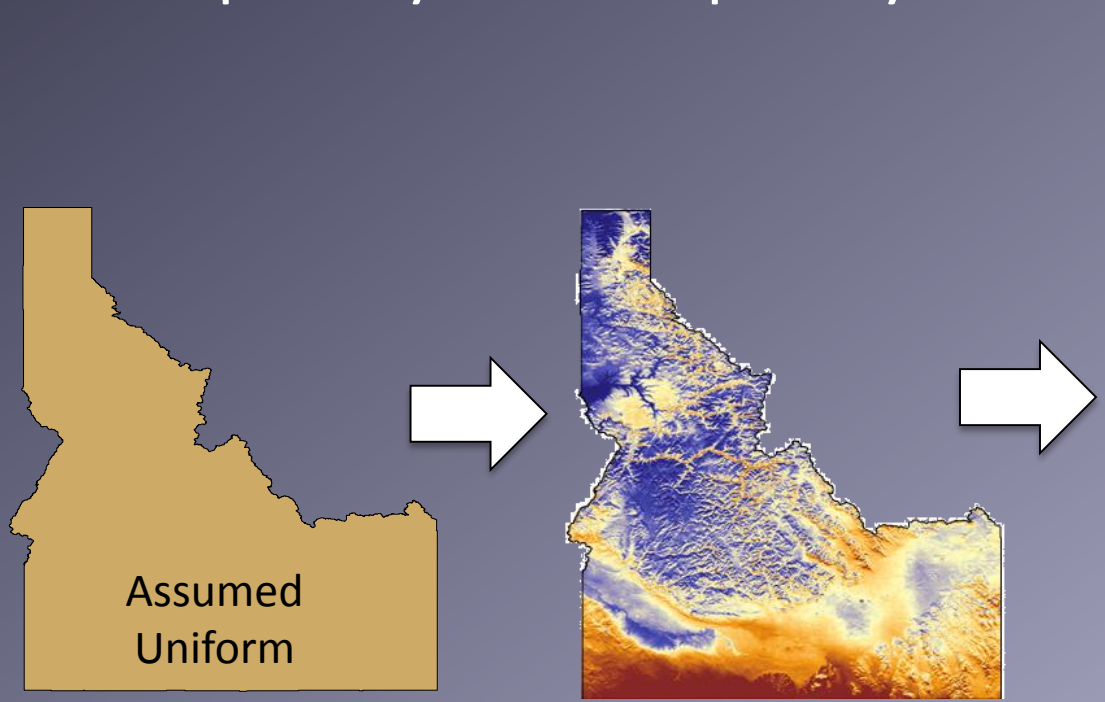
Assessment	Canadian lynx (*Lynx canadensis*)	Woodland caribou (*Rangifer tarandus caribou*)	Cliff chipmunk (*Tamias dorsalis*)	Lesser goldfinch (*Carduelis psaltria*)	Juniper titmouse (*Baeolophus ridgwayi*)	American three-toed woodpecker (*Picoides dorsalis*)
Climate Change Sensitivity Database	67—high	81—high	34—medium	22—low	39—medium	57—medium
NatureServe Climate Change Vulnerability Index	Moderately vulnerable	Highly vulnerable	Not vulnerable, increase likely	Not vulnerable, presumed stable	Not vulnerable, presumed stable	Highly vulnerable
U.S. Forest Service System for Assessing the Vulnerability of Species[a]	4.55	10.00	4.55	7.27	0.00	1.82

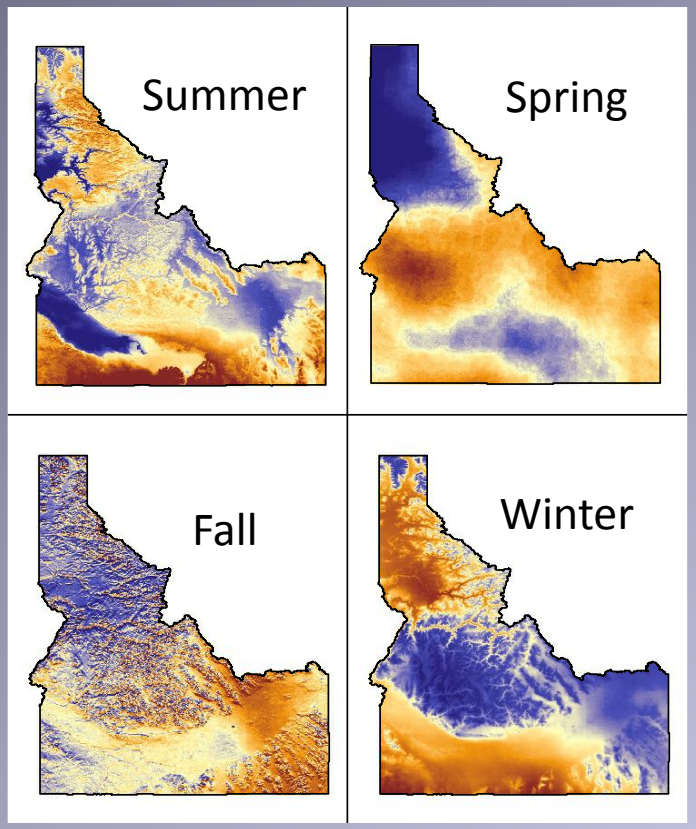
[a] Numerical scores for this assessment range on a scale from −20 (very high resilience) to 20 (very high vulnerability) with 0 indicating neither vulnerability, nor resilience.

(Lankford et al. 2014)

Potential Issues…

- Ignore full annual cycle & geographic variation
- May inaccurately represent vulnerability both spatially and temporally





(Small-Lorenz et al. 2013)

A New Framework for Spatio-temporal Climate Change Impact Assessment

- Species sensitivity in a spatial context
- Seasonal-specific climate exposure
- Assess different approaches for calculation of sensitivity

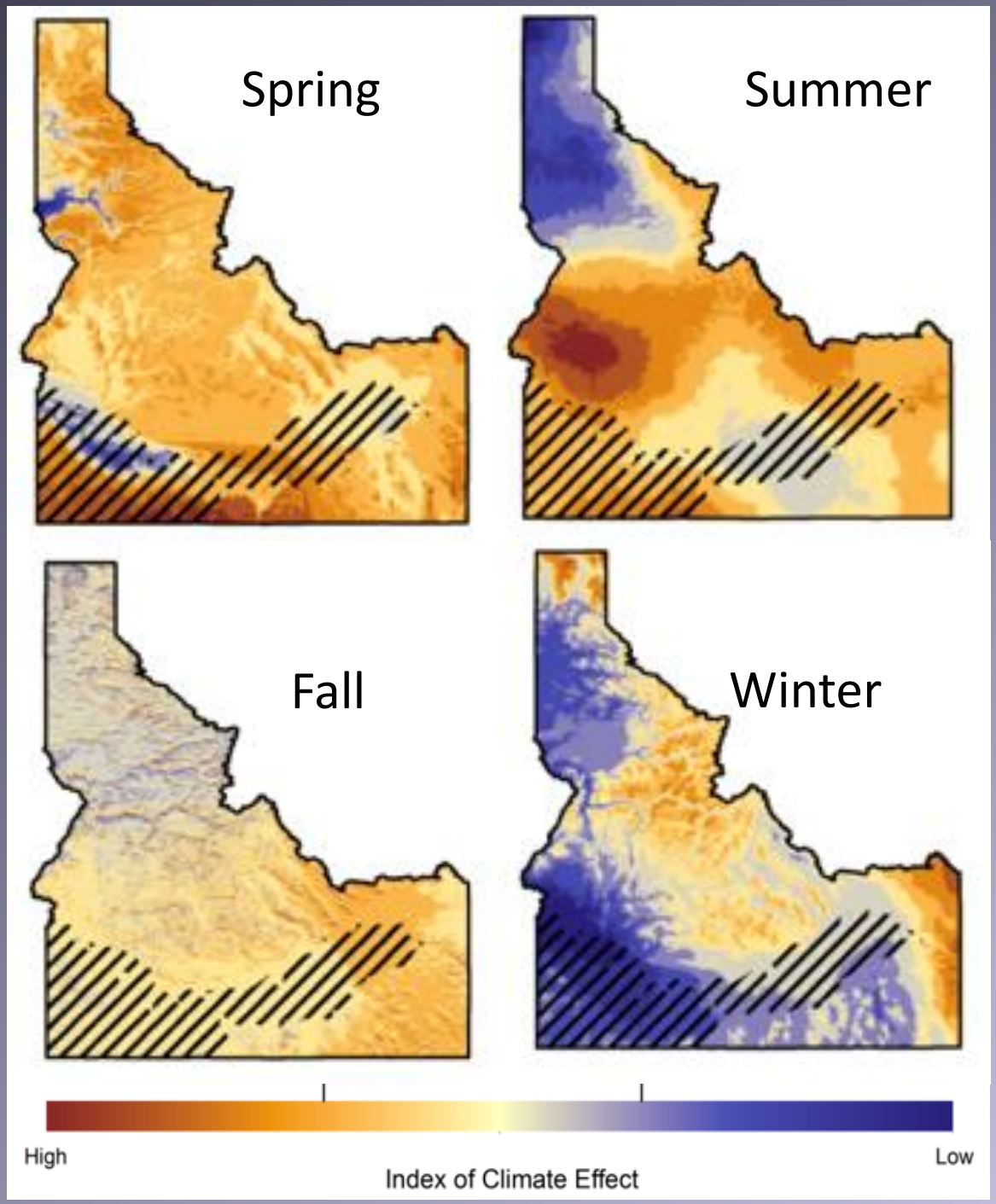
(Bingle et al. in press)

Exposure Factors

Exposure Factors	Statewide shift in exposure factor
Spring	
Mean spring temperature	Increase
Total spring precipitation	Increase, Decrease
Number of frost free days	Increase
Summer	
Mean summer temperature	Increase
Total summer precipitation	Decrease
Mean temperature warmest month	Increase
Autumn	
Mean autumn temperature	Increase
Total autumn precipitation	Increase
Winter	
Mean winter temperature	Increase
Total winter precipitation	Increase
Mean temperature coldest month	Increase
Snow water equivalent	Increase, Decrease

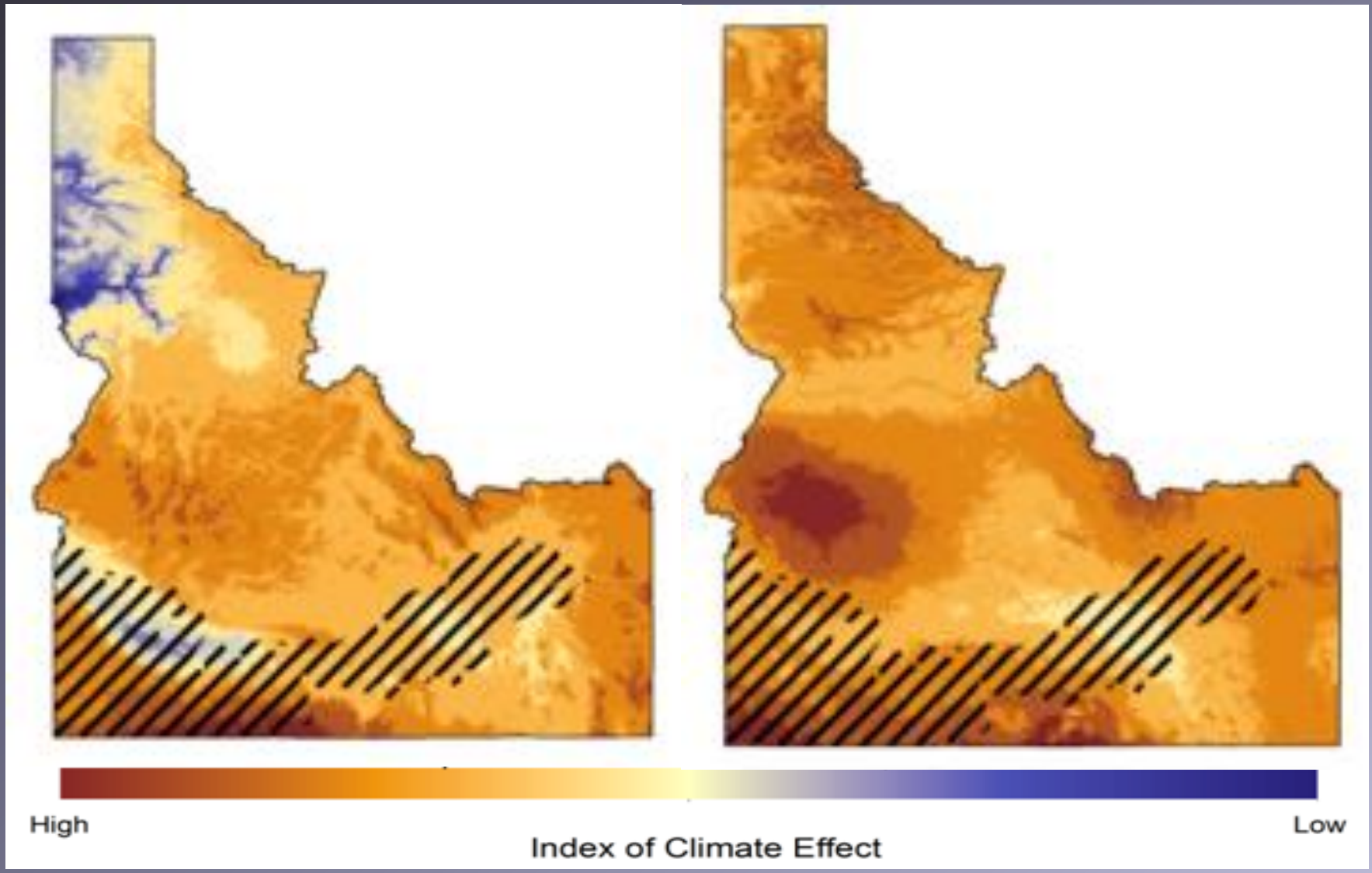
(Bingle et al. in press)

Spatial and Seasonal Variability



(Bingle et al. in press)

Annual Mean Vs. Seasonal Maximum



(Bingle et al. in press)

So What?

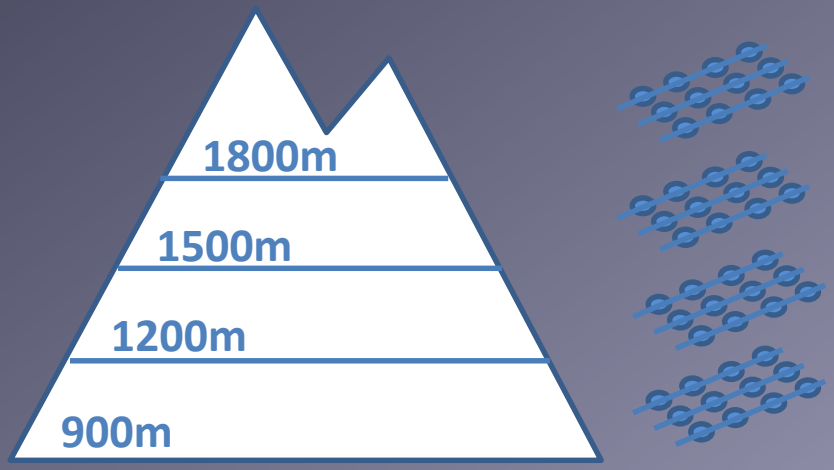
- Many assumptions in predicting impacts to wildlife
- Ignoring spatial and seasonal variability may be dangerous
- Relying on existing data is necessary, but also dangerous

Wildlife Research Needs

- Significant lack of natural history info (coarse-filter)
- Empirical data are scarce (fine-filter)
- Consequences at population levels and community composition are unclear
- Species adaptive capacity is unknown

Monitoring

Expect changes in distribution and behavior of wildlife over both space and time.

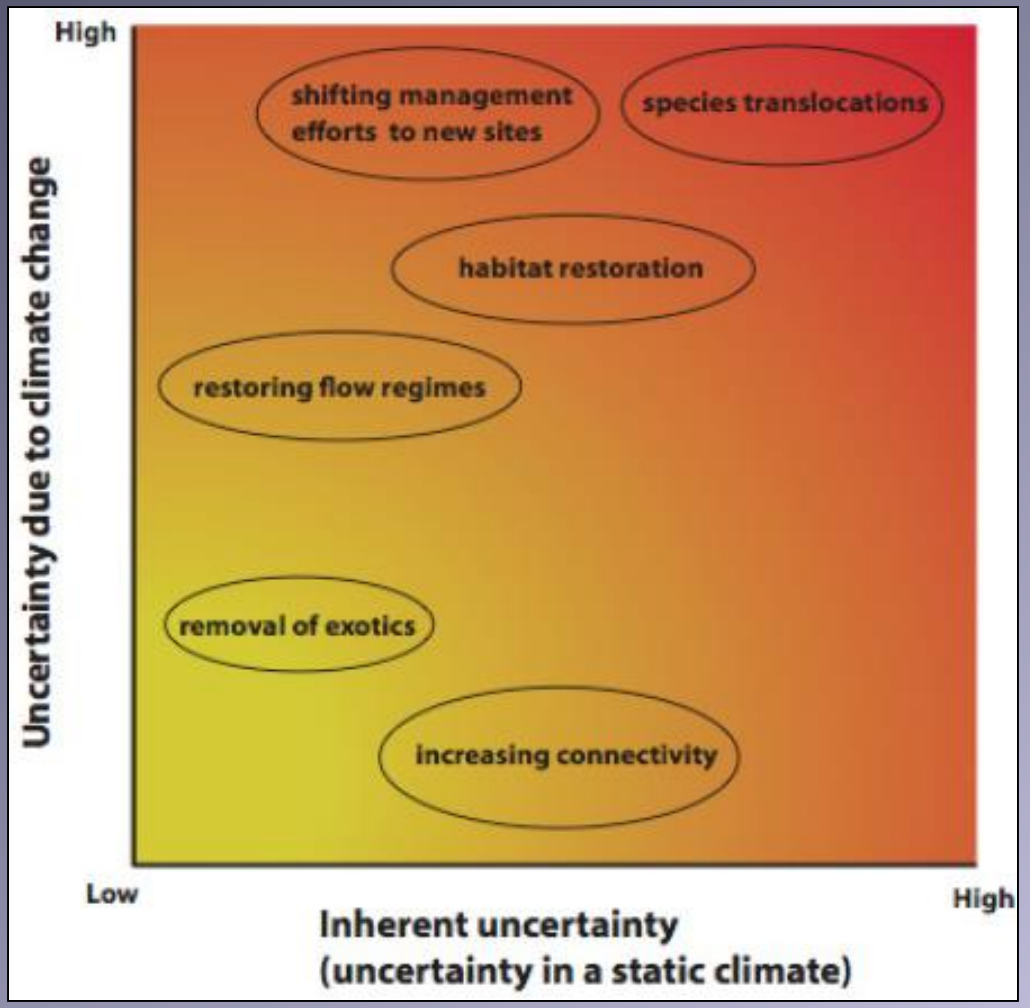


- Extent of sampling?
- Stratification?
- Detectability / Timing?
- Cost?

Modified from Conroy et al. 2011

Climate Research Needs

- Mismatches in scale
- Spatial and temporal variability
- Different models produce different results
- Management outcomes unknown



It is not the strongest
of the species
that survives,
nor the most intelligent.
It is the one that is the most
adaptable to change.