Department of Defense
Legacy Resource Management Program

PROJECT 09-433

WORKSHOP REPORT: ASSESSING SPECIES VULNERABILITY TO CLIMATE CHANGE, APPLYING THE RMRS ASSESSMENT TOOL

Megan Friggens, Deborah M. Finch, Sharon Coe

August 2010

Partners

USDA Forest Service Rocky Mountain Research Station

Fort Huachuca and Barry M Goldwater Range

University of Arizona

Coronado National Forest

The Nature Conservancy

U.S. Fish and Wildlife Service

Sponsors

Department of Defense Legacy Program

USDA Forest Service Washington Office

US Fish and Wildlife Service

The Nature Conservancy

Invited Participants: Biologists, Tonto National Forest

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Summary:

On 8/30/2010, the RMRS conducted a workshop "Assessing Species Vulnerability to Climate Change: Using the Rocky Mountain Research Station (USFS) assessment tool to assist management goals in the face of climate change" at the Tucson Regional Office of Arizona Game & Fish Department, Conference Room (555 N Greasewood Rd, Tucson 85745). The purpose of this workshop was to present the findings of our recent work relating to Legacy Project #09-433 (MIPR#W31RYO90230121) which used a recently developed species vulnerability to climate change assessment tool to identify relative vulnerability, areas of specific vulnerabilities and potential management actions for threatened, endangered and at-risk species on the Ft. Huachuca and Barry M. Goldwater Ranges in southern Arizona. The stated objective of the workshop was to introduce the RMRS species vulnerability to climate change assessment and present results of our recent work using this tool to assess species inhabiting Fort Huachuca, the Barry Goldwater military range and Coronado National Forest in a setting that allows for a clear demonstration of product content and use.

The workshop consisted of a series of presentations followed by a demonstration of the assessment tool where workshop participants used the tool to score a species. In addition, copies of the final reports were available for preview by DoD personnel. Deborah Finch, program manager of the RMRS began with an introduction of the Legacy project and review of climate change issues and the role of species assessments in resource management. Megan Friggens introduced the RMRS tool and demonstrated its use in a case study of the Middle Rio Grande Bosque in NM. In addition, Megan provided a specific review and discussion of the results of the species assessments for Ft. Huachuca and Barry M. Goldwater ranges, including a preliminary review of potential management actions in light of identified species vulnerabilities. Sharon Coe demonstrated the application of the RMRS assessment tool on Coronado Forest lands including efforts to integrate vulnerability scores with spatially explicit data regarding species range. Following a brief break, Megan Friggens led an interactive demonstration where participants were presented with a brief biohistory for a hypothetical species, a review of future climate trends for the region and a copy of the Questionnaire. Using these documents, the groups as a collective choose among the questionnaire's responses and used these selections to calculate a vulnerability score for the hypothetical species. During the demonstration, participants were able to clarify the aims of questions and discuss the implication and utility of vulnerability scores. Larry Jones, of the Coronado National Forest, followed the demonstration with a presentation on climate change and Coronado lizard species, with the aim to solicit collaborative efforts for lizard research. The meeting was closed with a question and answer period where DoD and RMRS personnel were able to discuss one on one specific questions regarding the RMRS species assessments, project results and final products.

Agenda

Assessing Species Vulnerability to Climate Change: Using the Rocky Mountain Research Station (USFS) assessment tool to assist management goals in the face of climate change

Date: 8/30/2010

Location: Tucson Regional Office of Arizona Game & Fish Department, Conference Room
555 N Greasewood Rd, Tucson 85745
(front desk: 520-628-5376)

Time: 9:30 am – 12:30 pm

Objective: To introduce the RMRS species vulnerability to climate change assessment and present results of our recent work using this tool to assess species inhabiting Fort Huachuca, the Barry Goldwater military range and Coronado National Forest in a setting that allows for a clear demonstration of product content and use.

Target Audience: Staff and scientists of the Department of Defense and Coronado National Forest

Schedule:

9:30 am	**Introduction. Climate change & species/Assessments**	*Deborah Finch*
10:00 am	**RMRS vulnerability Tool: Development and Design**	*Megan Friggens*
10:10 am	**DoD project: Background, Process, Products/Results**	*Megan Friggens*
10:30 am	**Coronado project: Using the RMRS tool on USFS lands**	*Sharon Coe*
10:50 am	**Break**	
11:00 am	**Interactive Demonstration of the RMRS tool**	*Megan Friggens*
12:00 pm	**Climate change-Lizard extinction hypothesis**	*Larry Jones*
12:20 pm	**Q&A period/Wrap-up**	
12:30 pm	**Lunch**	

Participants

Name	Position	Affilation	Email
Rick Gerhart	Program Manager	Coronado National Forest Supervisor's Office	[redacted]
Larry Jones	Assistant Wildlife Program Manager	Coronado National Forest Supervisor's Office	[redacted]
Josh Taiz	District Biologist	Santa Catalina Ranger District, Coronado National Forest	[redacted]
Debbie Sebesta	District Biologist	Nogales Ranger District, Coronado National Forest	[redacted]
Linda Peery	Wildlife Biologist	Coronado National Forest Supervisor's Office	[redacted]
Glenn Klingler	District Biologist	Douglas Ranger District	[redacted]
Glenn Frederick	District Wildlife Biologist	Sierra Vista Ranger District, Coronado National Forest	[redacted]
Fred Wong	Forest Biologist	Tonto National Forest	[redacted]
Julia Camp	District Wildlife Biologist	Tonto National Forest, Pleasant Valley Ranger District	[redacted]
John E. Arnett Jr.	Wildlife Biologist	Luke Air Force Base, AZ	[redacted]
Sheridan Stone	Wildlife Biologist	Fort Huachuca, AZ	[redacted]
Ann M. Lynch	Research Entomologist	Rocky Mountain Research Station	[redacted]
Deborah Finch	Supervisory Research Wildlife Biologist	Rocky Mountain Research Station	[redacted]
Sharon Coe	Postdoctoral Wildlife Ecologist	Rocky Mountain Research Station	[redacted]
Megan Friggens	Research Ecologist	Rocky Mountain Research Station	[redacted]

Presenter Bios

DEBORAH M. FINCH

Deborah Finch received her Bachelor's Degree in Wildlife Management from Humboldt State University, Arcat, CA, her Master's in Zoology and Physiology from Arizona State University, Phoenix, and her Ph.D. in Zoology and Range Science from University of Wyoming, Laramie. Deborah has been a research wildlife biologist employed by the Rocky Mountain Research Station (RMRS) since 1978. Her research interests include assessing climate change impacts and vulnerability; ecosystem restoration using prescribed fire, fuel removal, thinning, and grazing adjustments; riparian and grassland ecology and health; avian reproductive ecology and habitat relationships; invasive and exotic plants; community ecology; threatened, endangered and sensitive species; and technology transfer. During her career, she has worked on various research projects in Colorado, Wyoming, Arizona, Oklahoma, Texas, Oregon, New Mexico, California, and Mexico. From 1993 to 2007, she led a Grassland and Riparian Ecosystem Research Unit, and from 1994 to 2009, she additionally led an interdisciplinary unit for Middle Rio Grande Ecosystem Management Research. Deborah served as Acting National Wildlife Program Leader for Forest Service Research and Development in 2007; as Acting Program Manager for two RMRS ecosystem programs in 2008-09, and as Acting Assistant Director for Forest Service Pacific Southwest Research Station in 2009-10.

MEGAN M. FRIGGENS

Megan Friggens is a Research Ecologist within the USFS Rocky Mountain Research Station where she has spent the last year working on the development and application of a species vulnerability to climate change too. Megan's past and present research involves disturbance (fire, drought, land conversion, climate change, pathogens and parasites) impacts on wildlife species and wildlife disease ecology. Megan has a B.S and M.S. in Biology from the University of New Mexico and a Ph.D. in Forest Science at Northern Arizona University's School of Forestry.

SHARON J. COE

Sharon Coe is a Postdoctoral Wildlife Ecologist under joint appointment with the USFS Rocky Mountain Research Station and the University of Arizona School of Natural Resources. In this position she has been working on assessments of species vulnerability to climate change in the Southwest. Sharon Coe holds both a Ph.D. and a M.Sc. degree in Biology from the University of California at Riverside where her research focused on avian ecology in the Sierra Nevada and Mojave Desert. Dr. Coe has worked on a variety of projects in the Southwest through positions as a Graduate Student Researcher for the U.C.L.A. Center for Embedded Network Sensing, the U. C. Riverside Center for Conservation Biology, and the U.S.G.S. Western Ecological Research Center. She also worked as environmental consultant conducting surveys for a variety of vertebrates throughout southern California. She holds a B.A. in Biology and Environmental Studies from the University of California at Santa Cruz.

LARRY JONES

Larry has spent over 8 years with Coronado National Forest first as a biologist for the Safford RD and then for the Supervisor's Office in Tucson, Arizona. Currently, Larry is in charge of a long-term monitoring project of Marijilda Canyon, near Safford, where he plans to test a climate change hypothesis and recently became co-chair of SW Partners in Amphibian and Reptile Conservation (SW PARC). Prior to his SW appointment, Larry spent 18 years as a Biologist with Pacific Northwest Research Station (Olympia Forestry Sciences Lab) where he studied amphibians, Northern Flying Squirrel, American Marten, birds, and a host of other critters. Larry has more than 60 scientific and popular publications, including three books. Larry holds both a B.S. and M.S. in Biology with an emphasis in Zoology from California State University, Long Beach.

KAREN E. BAGNE (not present)

Karen Bagne is a contract wildlife biologist who has worked in various aspects of wildlife and land management for the US government since 1990. She was awarded her PhD in Biology by the University of California, Riverside in 2005. She is currently assisting RMRS in research focused on assisting land managers protect biodiversity under current climate change projections. Completed research projects have addressed fire management issues related to wildlife populations in California and New Mexico.

Demonstration Materials

I. CLIMATE CHANGE SCENARIO FOR AREA OF INTEREST

II. SPECIES INFORMATION

III. SCORECARD

IV. RMRS TOOL

I. CLIMATE CHANGE SCENARIO: THE HUACHUCA MOUNTAINS AND FORT HUACHUCA

Climate changes:

- Annual increase in temperature 2.2°C (4°F) by 2050
    - Changes to flood regimes (earlier more intense floods)
    - Extended fire season
    - Greater evaporation
- Summer monsoon changes unknown
- More droughts & intense storms

Vegetation Changes:

- Sonoran Desert expands northward and eastward, and contracts in the southeast
- Grasses favored over shrubs
- Increases in invasive grasses
- Declines/shift in forest habitats likely (increased fire, insect outbreaks, etc)
- Decrease in riparian habitats

II. HYPOTHETICAL RIPARIAN BIRD SPECIES

HABITAT

Vegetation Association

- In the SW, this species breeds in riparian woodlands dominated by cottonwood and willow. Also occurs in salt cedar and mesquite at higher elevations. Overwinters in a wide variety of habitats southern Mexico.
- This species is known to avoid fragmented.

Specialized habitat requirements:

- Nests in trees, but also observed in Goodding's willow and Russian olive.

Indications for Habitat Quality

- Little information available for SW

Movement patterns

- Long distance migrant that requires stopover habitats.

PHYSIOLOGY

- The Huachuca area represents Southern extent of breeding range which may indicate upper temperature threshold
- Mass mortality events recorded for this species due to cold fronts and migration.
- Inactive in the hottest parts of the day.
- No specialized behaviors for dealing with resource variation
- Has moderate metabolism (endotherm)

PHENOLOGY

- Migration based on photoperiod.
- Nesting is likely tied to food and, in particular, peaks in insect prey. Nesting may be timed to Cicada emergence.
- Multiple nesting attempts.

BIOTIC INTERACTIONS

- Specialist on bees and wasps, though also eats wide variety of other insects.
- In Arizona, 40% of diet was cicadas.
- Eats fruit during migration and on wintering grounds.
- Does not exist in symbiotic relationship
- Nest mite infestations not uncommon, but not associated with widespread mortality
- No information regarding West Nile Virus, Salmonellosis
- No major predator or competitor species noted in literature

III. SCORECARD

Mark box that corresponds to appropriate option: a, b, or c. Each "a" counts as 1, each "b" as 0 and each "c" as -1. For Uncertainty, mark "b" for questions with adequate information and "a" where response is uncertain. Use these values to calculate scores by hand using worksheets 1 and 2 (See Copy of RMRS Tool). Shaded cells indicate that this cell is not valid for a given question. Check marks are placed for questions which will not be reviewed during this demonstration.					
CATEGORY	**Vulnerability**			**Uncertainty**	
HABITAT	**A (1)**	**B (0)**	**C (-1)**	**A (yes)**	**B (no)**
1. Is the area or location of the general associated vegetation type used for breeding activities by this species expected to change?					
2. Is the area or location of the general associated vegetation type used for non-breeding activities by this species expected to change?					
3. Are specific habitat components required for breeding expected to change within associated vegetation type?					
4. Are specific habitat components required for survival expected to change within associated vegetation type?		✓			✓
5. Within habitats occupied, are features of the habitat associated with better reproductive success or survival expected to change?		✓		✓	
6. What is the potential for this species to disperse?			✓		✓
7. Does this species require additional habitats during migration that are separated from breeding and non-breeding habitats?					
PHYSIOLOGY					
1. Are limiting physiological conditions expected to change?					
2. Is sex ratio determined by temperature?		✓			✓
3. Are disturbance events that affect survival or reproduction expected to change?					
4. Are temperature or precipitation regimes affecting activity periods expected to change?					
5. Does this species have strategies to cope with variation in resources across multiple years?	✓				✓
6. What is this species metabolic rate?		✓			✓

PHYSIOLOGY	**A (1)**	**B (0)**	**C (-1)**	**A (yes)**	**B (no)**
1. Does this species use temperature or moisture cues to initiate activities related to fecundity or survival?					
2. Are activities related to species' fecundity or survival tied to discrete resource peaks that are expected to change?					
3. What is the separation in time or space between cues that initiate activities and discrete events that provide critical resources?					
4. Does this species have more than one reproductive event per year?			✓		✓
BIOTIC INTERACTIONS					
1. Are important food resources for this species expected to change?					
2. Are important predator populations expected to change?		✓			✓
3. Are populations of symbiotic species expected to change?		✓			✓
4. Is prevalence of diseases known to cause widespread mortality or reproductive failure in this species expected to change?					
5. Are populations of important competing species expected to change?		✓		✓	

IV. SPECIES' VULNERABILITY TO CLIMATE CHANGE: SCORING TOOL V.2.0

Rocky Mountain Research Station
Albuquerque, New Mexico

Habitat

H1. Area and distribution: breeding. Is the area or location of the associated vegetation type used for breeding activities by this species expected to change? Specific habitat elements and food resources are considered in other questions.
  a. Area used for breeding habitat expected to decline or shift from current location (SCORE = 1)
  b. Area used for breeding habitat expected to stay the same and in approximately the same location (SCORE = 0)
  c. Area used for breeding habitat expected to increase and include the current location (SCORE = -1)

H2. Area and distribution: non-breeding. Is the area or location of the associated vegetation type used for non-breeding activities by this species expected to change?
  a. Area used for non-breeding habitat expected to decline or shift from current location (SCORE = 1)
  b. Area used for non-breeding habitat expected to stay the same in approximately the same location (SCORE = 0)
  c. Area used for non-breeding habitat expected to increase and include the current location (SCORE = -1)

H3. Habitat components: breeding. Are specific habitat components required for breeding expected to change within the associated vegetation type?
  a. Required breeding habitat components expected to decrease (SCORE = 1)
  b. Required breeding habitat components unlikely to change OR habitat components required for breeding unknown (SCORE = 0)
  c. Required breeding habitat components expected to increase (SCORE = -1)

H4. Habitat components: non-breeding. Are other specific habitat components required for survival during non-breeding periods expected to change within the associated vegetation type?
  a. Required non-breeding habitat components expected to decrease (SCORE = 1)
  b. Required non-breeding habitat components unlikely to change OR habitat components required for breeding unknown (SCORE = 0)
  c. Required non-breeding habitat components expected to increase (SCORE = -1)

H5. Habitat quality. Within habitats occupied, are features of the habitat associated with better reproductive success or survival expected to change?
  a. Projected changes are likely to negatively affect habitat features associated with improved reproductive success or survival. (SCORE = 1)
  b. Projected changes are unlikely to affect habitat features associated with improved reproductive success or survival.(SCORE = 0)
  c. Projected changes are likely to positively affect habitat features associated with improved reproductive success or survival.(SCORE = -1)

H6. Ability to colonize new areas. What is the potential for this species to disperse?
  a. Low ability to disperse (SCORE = 1)
  b. Mobile, but dispersal is sex-biased (only one sex disperses) (SCORE = 0)
  c. Very mobile, both sexes disperse (SCORE = -1)

H7. Migratory or transitional habitats. Does this species require additional habitats during migration that are separated from breeding and non-breeding habitats?
  a. Additional habitats required that are separated from breeding and non-breeding habitats (e.g. most migratory species) (SCORE = 1)
  b. No additional habitats required that are separated from breeding and non-breeding habitats (e.g. most resident species and short-distance migrants) (SCORE = 0)

Physiology

PS1. Physiological thresholds. Are limiting physiological conditions expected to change?

a. Projected changes in temperature and moisture are likely to exceed upper physiological thresholds (e.g. amphibians in dry climates, species with narrow thermal range) (SCORE = 1)
b. Projected changes in temperature or moisture will primarily remain within physiological thresholds OR species is inactive during limiting conditions (e.g. species with moderate thermal range, aestivators that avoid hot/dry conditions) (SCORE = 0)
c. Projected changes in temperature or moisture will decrease current incidents where lower thresholds are exceeded (e.g. species active in cold climates, amphibians in wet climates) (SCORE = -1)

PS2. Sex ratio. Is sex ratio determined by temperature?

a. Yes. (SCORE = 1)
b. No. (SCORE = 0)

PS3. Exposure to weather-related disturbance. Are disturbance events (e.g. severe storms, fires, floods) that affect survival or reproduction expected to change?

a. Projected changes in disturbance events will likely decrease survival or reproduction (SCORE = 1)
b. Survival and reproduction are not strongly affected by disturbance events OR disturbance events are not expected to change (SCORE = 0)
c. Projected changes in disturbance events will likely increase survival or reproduction (SCORE = -1)

PS4. Limitations to daily activity period. Are projected temperature or precipitation regimes that influence activity period of species expected to change?

a. Duration of daily active periods likely to be reduced (e.g. heliotherms in hot climates, terrestrial amphibians in drier climates) (SCORE = 1)
b. Duration of daily active periods unchanged or not limited by climate (species in habitats buffered from extremes, nocturnal species, primarily aquatic amphibians) (SCORE = 0)
c. Duration of daily active periods likely to increase (e.g. heliotherms in cool climates, terrestrial amphibians in wetter climates) (SCORE = -1)

PS5. Survival during resource fluctuation. Does this species have flexible strategies to cope with variation in resources across multiple years?

a. Species has no flexible strategies to cope with variable resources across multiple years (SCORE = 1)
b. Species has flexible strategies to cope with variable resources across multiple years (e.g. alternative life forms, irruptive, explosive breeding, cooperative breeding) (SCORE = -1)

PS6. Energy requirements. What is this species metabolic rate?

a. Very high metabolic rates (e.g. shrews, hummingbirds) (SCORE = 1)
b. Moderate (e.g. most endotherms) (SCORE = 0)
c. Low (i.e. ectotherms) (SCORE = -1)

Phenology

PH1. Mismatch potential: Cues. Does this species use temperature or moisture cues to initiate activities related to fecundity or survival (e.g. hibernation, migration, breeding)?

a. Species primarily uses temperature or moisture cues to initiate activities (e.g. some hibernators, aestivators, rainfall breeders) (SCORE = 1)
b. Species does not primarily use temperature or moisture cues OR no cues to predict or initiate activities (e.g. photoperiod or circadian rhythms, resource levels) (SCORE = 0)

PH2. Mismatch potential: Event timing. Are activities related to species' fecundity or survival tied to discrete resource peaks (e.g. food, breeding sites) that are expected to change?

a. Species' fitness is tied to discrete resource peaks that are expected to change (SCORE = 1)
b. Species' fitness is tied to discrete resource peaks that are NOT expected to change (SCORE = 0)
c. No temporal variation in resources or breeds year round (SCORE = -1)

PH3. Mismatch potential: Proximity. What is the separation in time or space between cues that initiate activities related to survival or fecundity and discrete events that provide critical resources?

a. Critical resource occurs far in advance or in distant locations from cues or initiation of activity (SCORE = 1)
b. Critical resource does NOT occur far in advance or in distant locations from cues or initiation of activity (SCORE =0)
c. Species initiates activities directly from critical resource availability (e.g. opportunistic breeders) (SCORE = -1)

PH4. Resilience to timing mismatch. Does this species have more than one opportunity to time reproduction to important events?

a. Species reproduces once per year or less. (SCORE = 1)
b. Species reproduces more than once per year (SCORE = -1)

Biotic Interactions

I1. Food resources. Are important food resources for this species expected to change?
   a. Primary food source(s) are expected to be negatively impacted by projected changes (SCORE = 1)
   b. Species consumes variety of prey/forage species OR primary food resource(s) not expected to be impacted by projected changes (SCORE =0)
   c. Primary food resource(s) expected to be positively impacted by projected changes (SCORE = -1)

I2. Predators. Are important predator populations for this species expected to change?
   a. Primary predator(s) are expected to be positively impacted by projected changes (SCORE = 1)
   b. Preyed upon by a suite of predators OR the primary predator is not expected to be impacted by projected changes (SCORE = 0)
   c. Species has no predators (SCORE = 0)
   d. Primary predator(s) expected to be negatively impacted by projected changes (SCORE = -1)

I3. Symbionts. Are populations of symbiotic species expected to change?
   a. Symbiotic species populations expected to be negatively impacted by projected changes (SCORE = 1)
   b. Symbiotic species populations not expected to be impacted by projected changes (SCORE = 0)
   c. No symbionts (SCORE =0)
   d. Symbiotic species populations expected to be positively impacted by projected changes (SCORE = -1)

I4. Disease. Is prevalence of diseases known to cause widespread mortality or reproductive failure in this species expected to change?
   a. Disease prevalence is expected increase with projected changes (SCORE = 1)
   b. No known effects of expected changes on disease prevalence (SCORE = 0)
   c. Disease prevalence is expected to decrease with projected changes (SCORE = -1)

I5. Competitors. Are populations of important competing species expected to change?
   a. Major competitor species are expected to be positively impacted by projected changes (SCORE = 1)
   b. Species has a variety of competitive relationships OR no expected impacts of projected changes in major competitor species (SCORE = 0)
   c. Competing species are expected to be negatively impacted by projected changes (SCORE = -1)

COMPUTING SCORES

I. Hand Calculations

A. Vulnerability

Positive values indicate vulnerability to climate change and negative scores indicate resilience. Factors are adjusted for max score per factor = 5 or -5 to aid comparison among factors. Overall scores are computed from all predictive criteria (i.e. the 25 questions) regardless of factor and adjusted for maximum score of 20 or a minimum score of -20. Use caution in interpreting total score as any one factor may be limiting a species survival. Calculate scores as shown or enter raw totals of positive and negative values into the unfilled cells of the table below. Include the minus sign with negative totals and update fields ("F9") after adding or changing values.

Habitat = Positive total [5/7] + Negative total [5/6] = ___

Physiology = Positive total [5/6] + Negative total [1] = ___

Phenology = Positive total [5/4] + Negative total [5/3] = ___

Biotic Interactions = Positive total [1] + Negative total [1] = ___

Total Score = Positive total [20/22] + Negative total [20] = ___

Higher scores indicate greater vulnerability

WORKSHEET 1. VULNERABILITY SCORE WORKSHEET						
	Enter total positive	Enter total negative	Enter # "none"	Positive score adjusted	Negative score adjusted	**SCORE**
Habitat			X	0.00	0.00	**0.00**
Physiology				0.00	0.00	**0.00**
Phenology			X	0.00	0.00	**0.00**
Interactions			X	0.00	0.00	**0.00**
Overall total	0	0	0	0.00	0.00	**0.00**

B. Uncertainty

Assuming climate change projections are correct, what was the amount of information available for each question for assigning scores? Chose one of the following:

a. Adequate information available to assign score for this species. SCORE = 0
b. Information is not adequate to confidently assign score OR conflicting predictions or responses make scoring difficult. SCORE = 1

Factor Uncertainty = Sum a+b and divide by total number of questions in each category.

Total Uncertainty = Sum a+b across all categories and divide by 22.

Higher percentages indicate greater uncertainty.

WORKSHEET 2. UNCERTAINTY SCORE WORKSHEET			
	Sum Score	/	Percent Uncertainty
Habitat	3	7	0%
Physiology	2	6	0%
Phenology	1	4	0%
Interactions	2	5	0%
TOTAL		2.9	0%

PRESENTATIONS

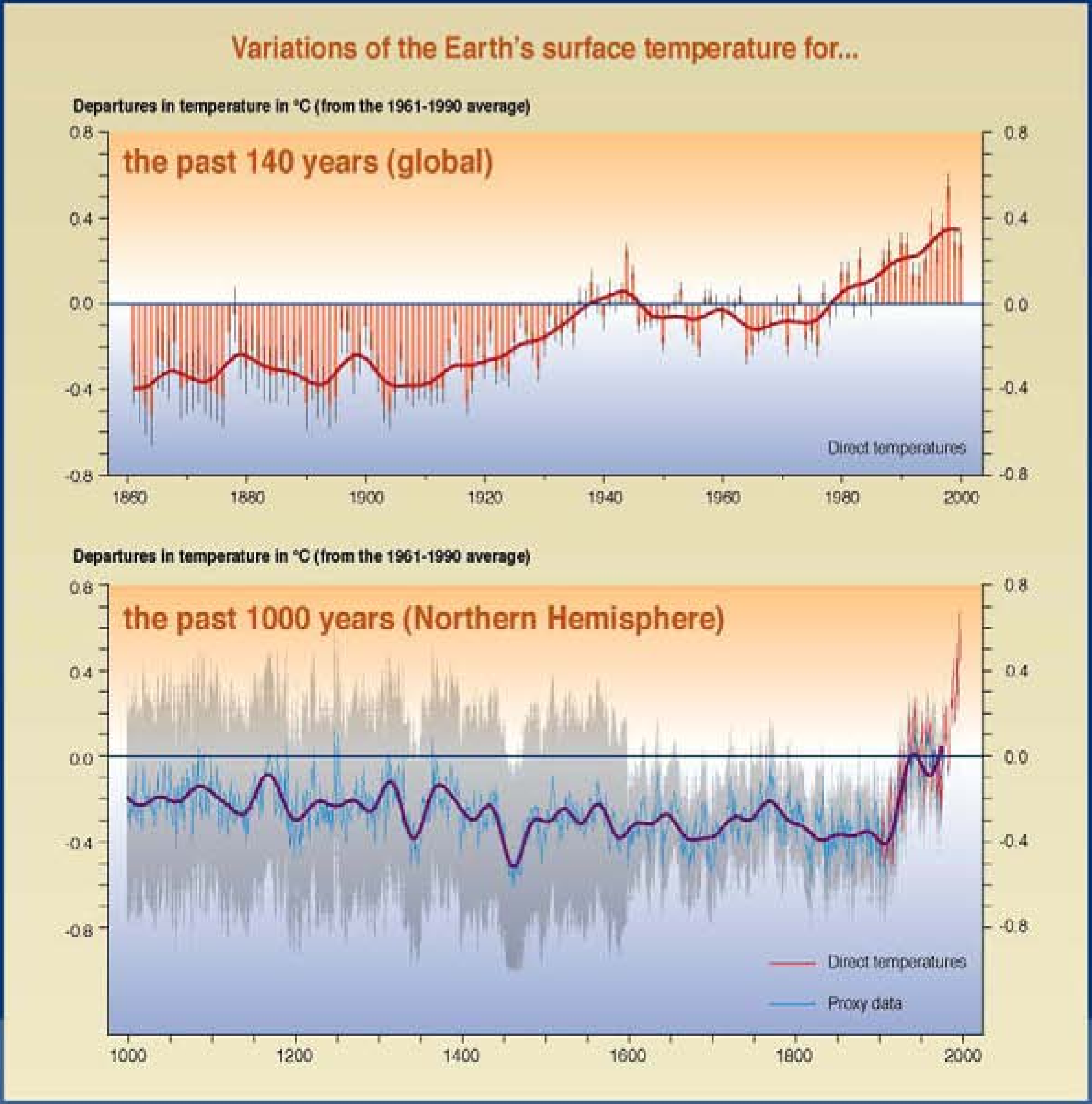


Climate Change and Species Vulnerability

Deborah Finch
US Forest Service, Rocky Mountain Research Station, Albuquerque, NM

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

RMRS ROCKY MOUNTAIN RESEARCH STATION

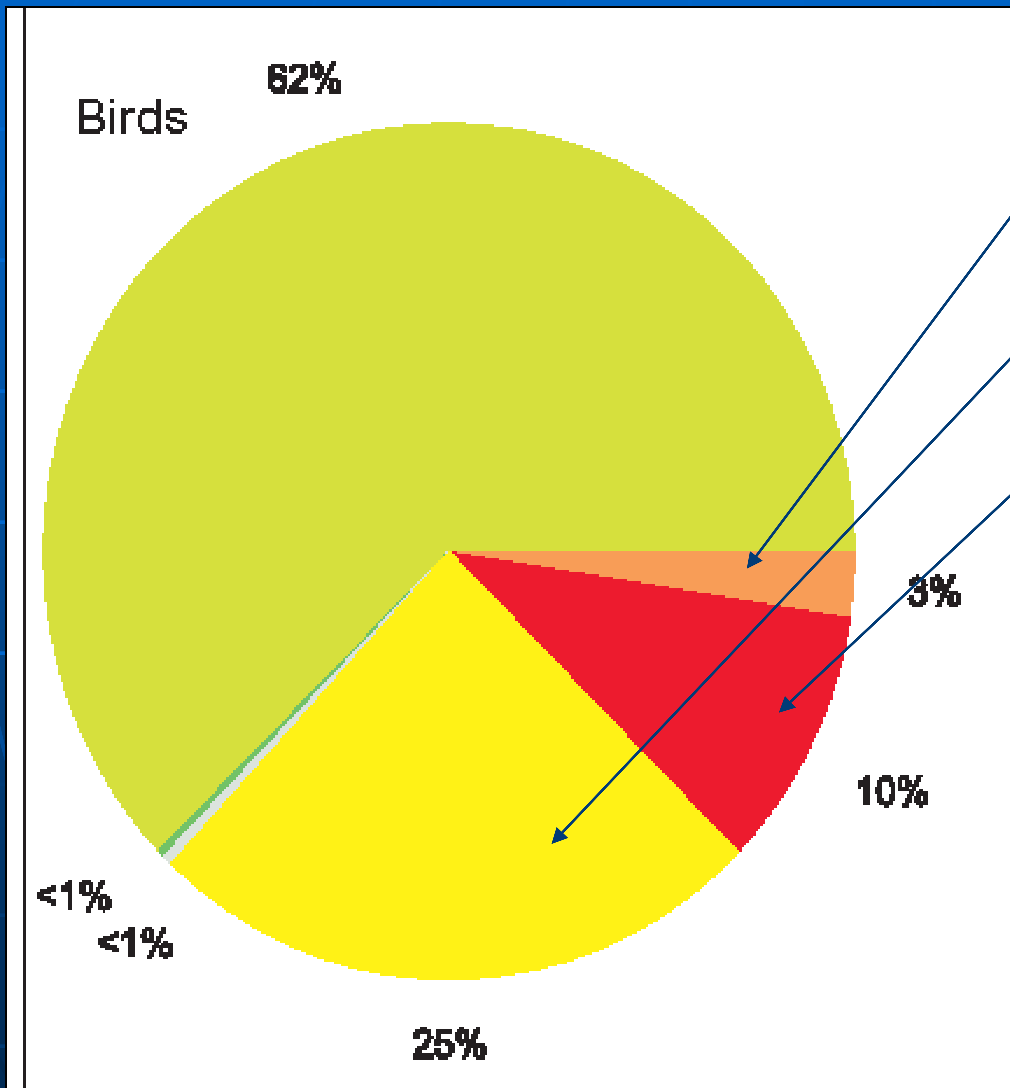


SYR - FIGURE 2-3

What do we know about wildlife?

- How does climate change threaten wildlife?
- How will different species respond to climate change?
- Are species already responding?
- How will habitats be impacted?
- Where will impacts be greatest?

IUCN



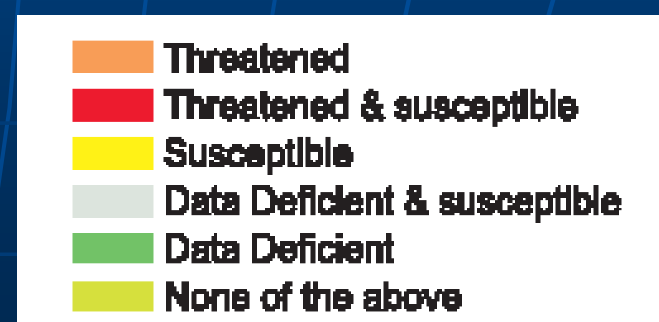
Threatened

CC susceptible

Threatened & CC susceptible

Total Birds =

38% (~ 3 x's more)



Foden et al. 2008. *IUCN*.

Direct vs. Indirect Effects

Direct effects

of temperature, ppt. & carbon dioxide on birds (dehydration, egg-warming …)

Indirect Effects:

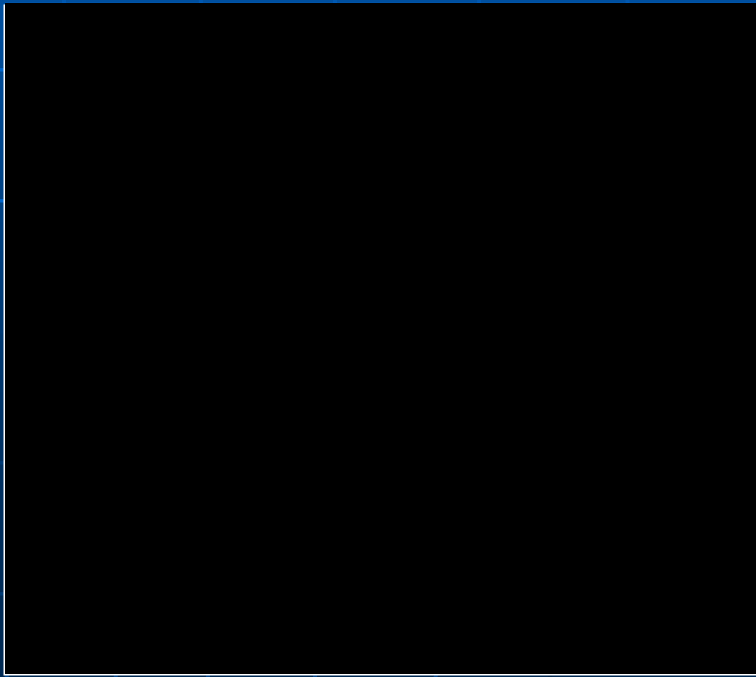
- Habitat loss and shifts in habitat distributions
- Responses by invasive species
- Changes in fire frequency
- Diseases
- Changes in phenology
- Disruption of food webs
- Decoupling of cues and responses

Migration times are shifting

Birds are migrating earlier in the spring.

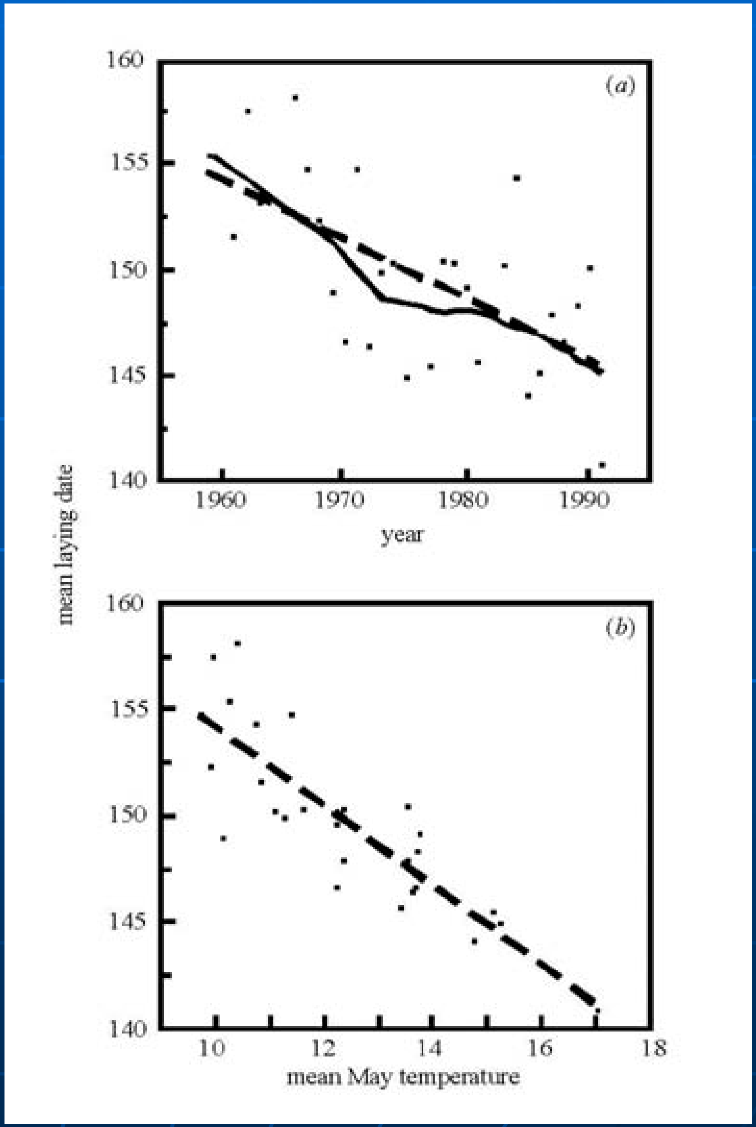
A study of 63 years of data for 96 species of bird migrants in Canada showed that 27 species have altered their arrival dates significantly, with most arriving earlier, in conjunction with warming spring temperatures.

Birds also seem to be delaying fall departure: in a study of 13 N. Amer. passerines, 6 species were found to delay their departure dates in relation to warming.



Some birds in Europe are even failing to migrate at all.

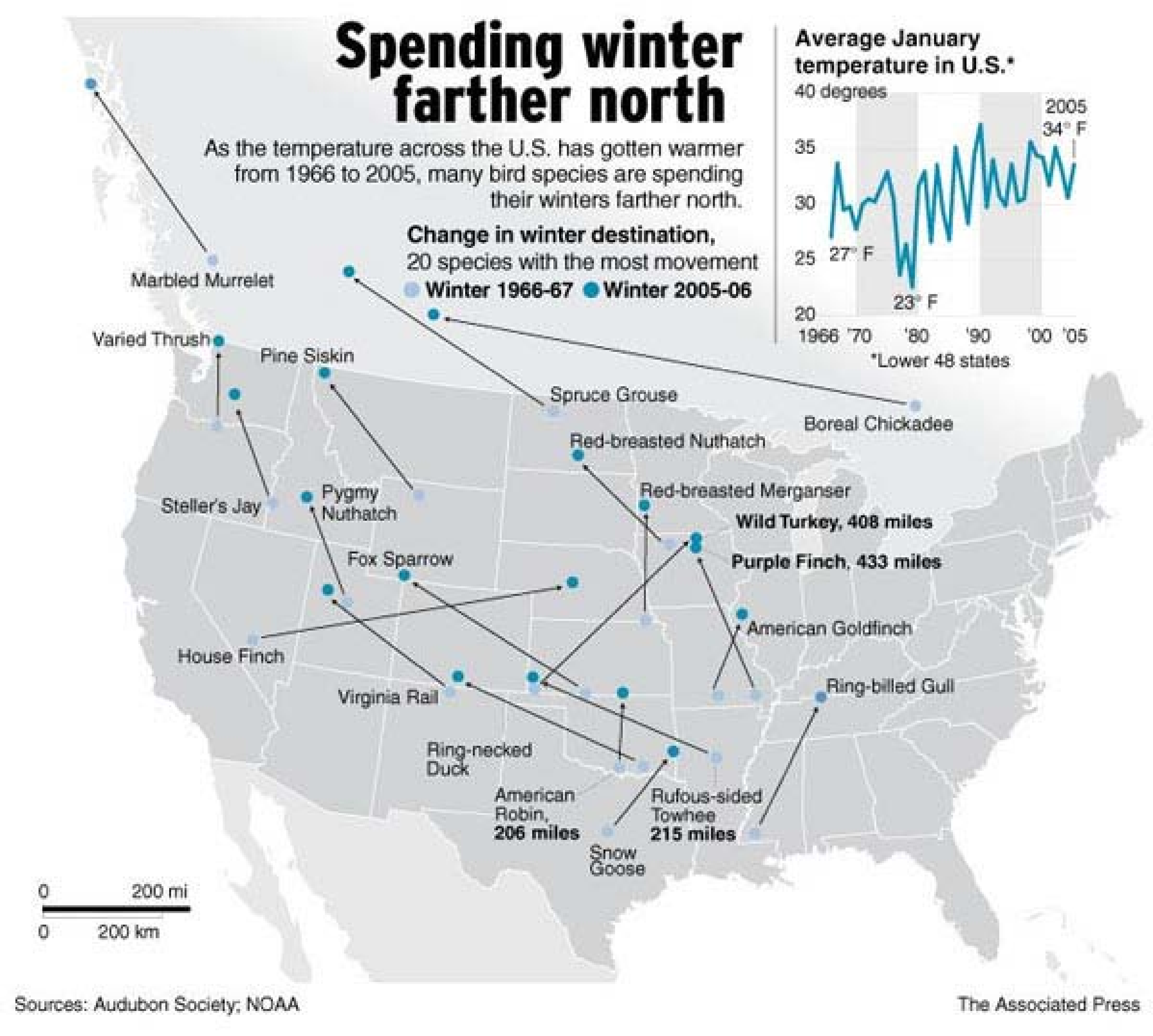
Reproductive Timing



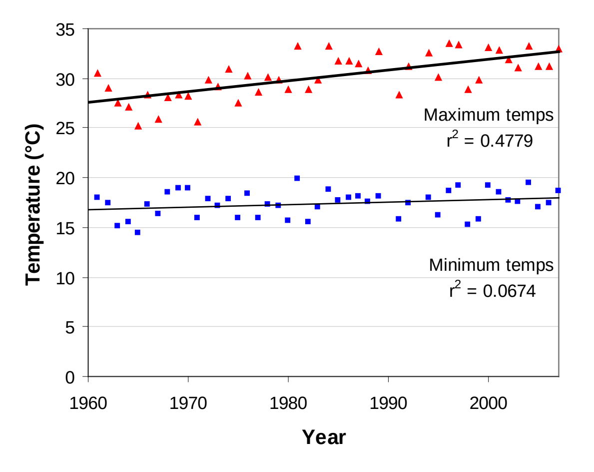
Temperature cues and climate change can lead to earlier lay dates. North American tree swallows nest up to 9 days earlier than 30 years ago, corresponding to an increase in average spring temperatures.

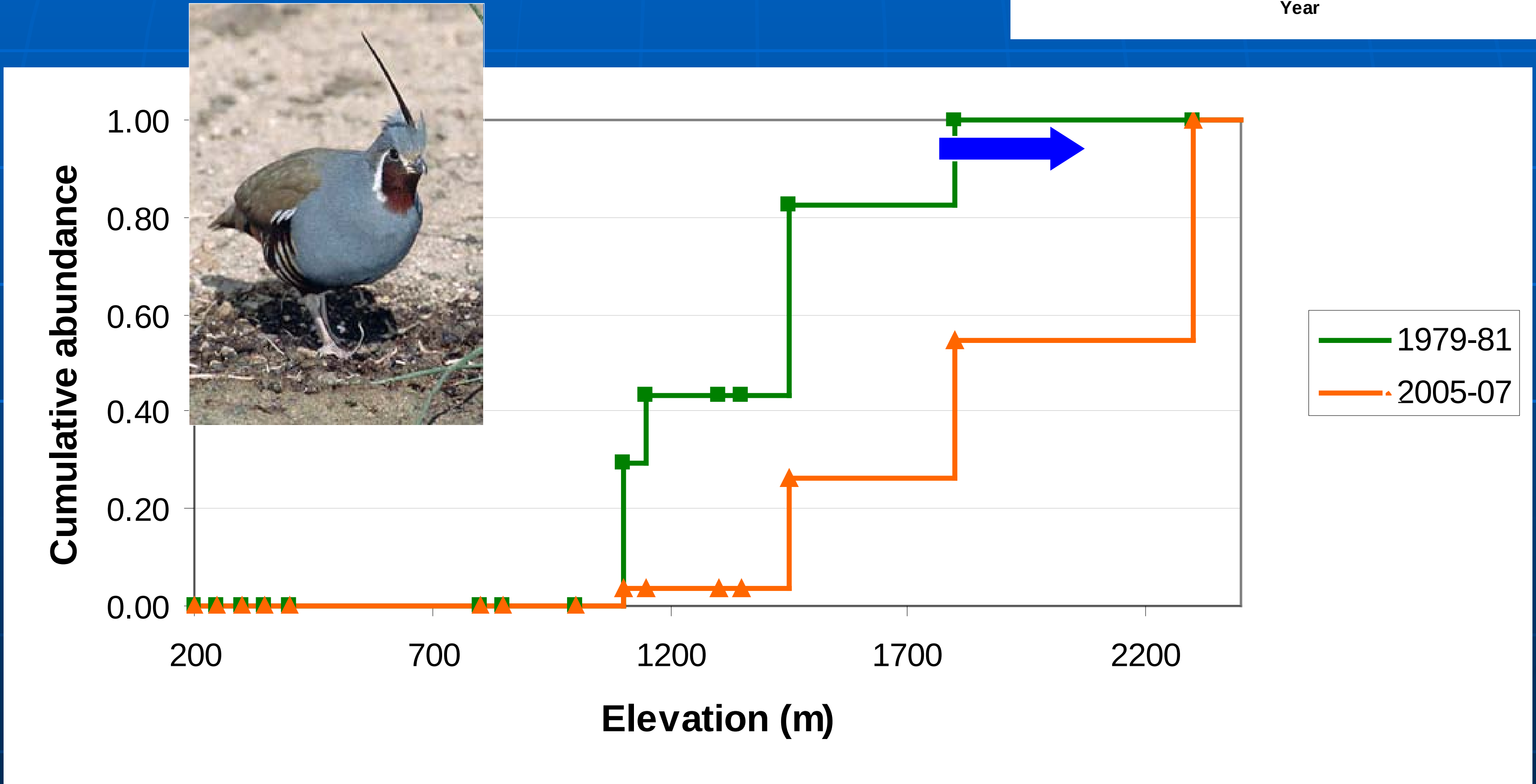
Benefit or potential mismatch?

Dunn and Winkler 1999. *Proc. Royal Soc. Lond.* 266


Spending winter farther north
As the temperature across the U.S. has gotten warmer from 1966 to 2005, many bird species are spending their winters farther north.
Change in winter destination,
20 species with the most movement
Winter 1966-67
Winter 2005-06
Average January temperature in U.S.*
40 degrees
35
30
25
20
2005
34° F
27° F
23° F
1966
'70
'80
'90
'00
'05
*Lower 48 states
Marbled Murrelet
Varied Thrush
Pine Siskin
Spruce Grouse
Boreal Chickadee
Red-breasted Nuthatch
Red-breasted Merganser
Wild Turkey, 408 miles
Purple Finch, 433 miles
Steller's Jay
Pygmy Nuthatch
Fox Sparrow
American Goldfinch
House Finch
Virginia Rail
Ring-billed Gull
Ring-necked Duck
American Robin, 206 miles
Rufous-sided Towhee 215 miles
Snow Goose
0
200 mi
0
200 km
Sources: Audubon Society; NOAA
The Associated Press

Shifts in elevational distributions: Mountain Quail

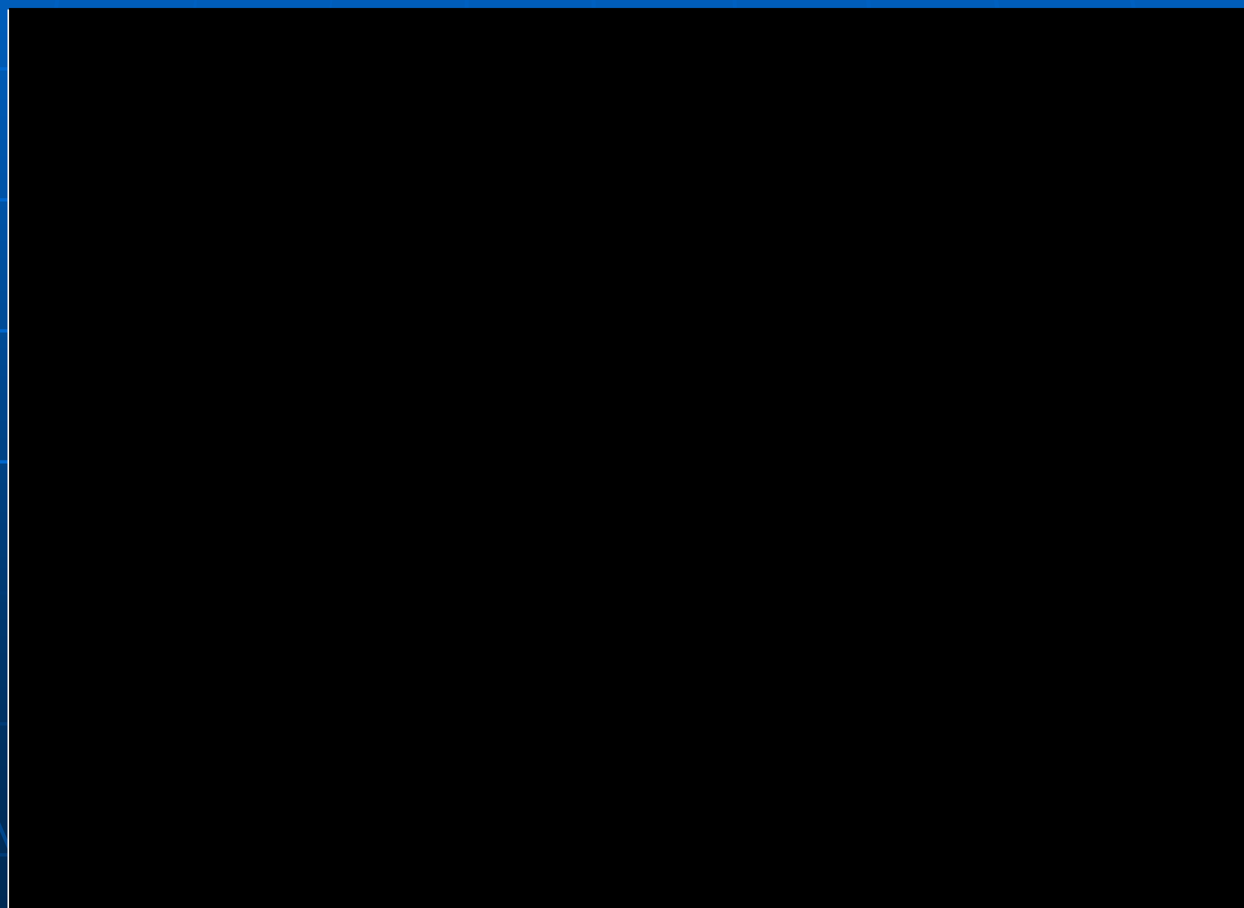




Hargrove and Rotenberry 2009, UC Riverside

Ecological communities are disrupted

Global warming can change entire ecological communities. Food and nesting materials may no longer be there. Wildlife may face new prey, parasites, competitors, and predators to which they are not adapted.



Steps and Strategies

- Model species demographic responses
- Plan for changes in critical habitats
- Identify vulnerable species
- Make mitigation / assisted adaptation plans
- Climate change partnerships
- Increase habitat resilience
- Control invasive species
- Manage outside historical range of variation
- Monitor and analyze existing data


CLIMATE CHANGE 2007
SYNTHESIS REPORT
mental Panel on Climate Change
The Birdwatcher's Guide to Global Warming
Wildlife Responses to Climate Change
NORTH AMERICAN CASE STUDIES
Edited by Stephen H. Schneider and Terry L. Root
ADVANCES IN ECOLOGICAL RESEARCH
35
BIRDS AND CLIMATE CHANGE
EDITED BY
A. MØLLER, W. FIEDLER AND P. BERTHOLD
Birds and Climate Change
Ecological Disruption in Motion
A Briefing for Policymakers and Concerned Citizens on Audubon's Analyses of North American Bird Movements in the Face of Global Warming
Audubon
February, 2009

USDA FS Roadmap

USDA FS Response to Climate Change

Agency Capacity
1. Employee education.
2. Designate climate change coordinators.
3. Develop program guidance and training.

Partnerships and Education
4. Integrate science and management .
5. Develop partnerships and alliances.

Adaptation
6. Assess the vulnerability.
7. Set priorities.
8. Monitor change.

Mitigation and Sustainable Consumption
9. Assess and Manage carbon.
10. Reduce environmental footprint.

Scanning the Conservation Horizon

A Guide to Climate Change Vulnerability Assessment

http://www.nwf.org/Global-Warming.aspx

1910

NATIONAL WILDLIFE FEDERATION

Developing a tool to predict species' vulnerability to climate change

Predicting Vulnerability

- Are current management strategies going to be successful?
- Are current target habitats and species appropriate?
- Will costs and scale of conservation in the future be prohibitive?
- Can we anticipate effects and act to prevent future losses?

Using vulnerability in Management: Actions

- Identify how and why species may be vulnerable from species accounts
- Indicate intervention points where management may be most effective
- Integrate with spatial data to identify target locations for management

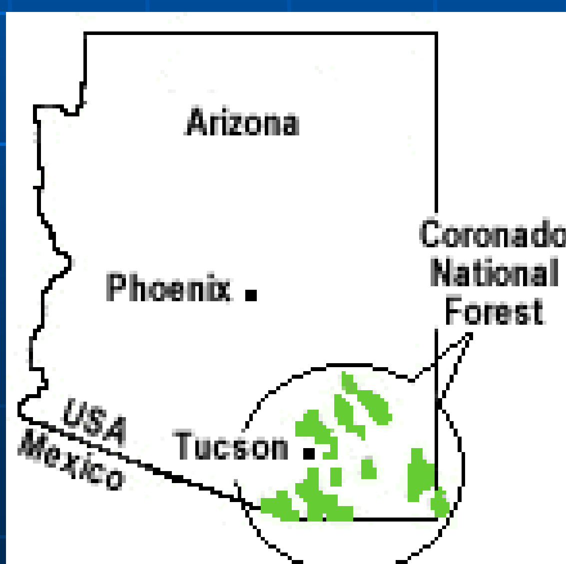
Tools to Assess and Assist Vulnerable Species at Risk from Climate Change

(USFS Research and Development Grant)

SKY ISLANDS
CORONADO
NATIONAL FOREST

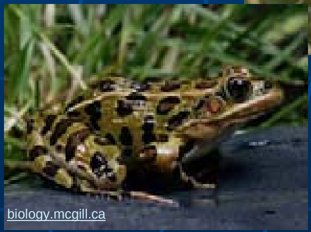
Desert pupfish

Cactus ferruginous pygmy owl



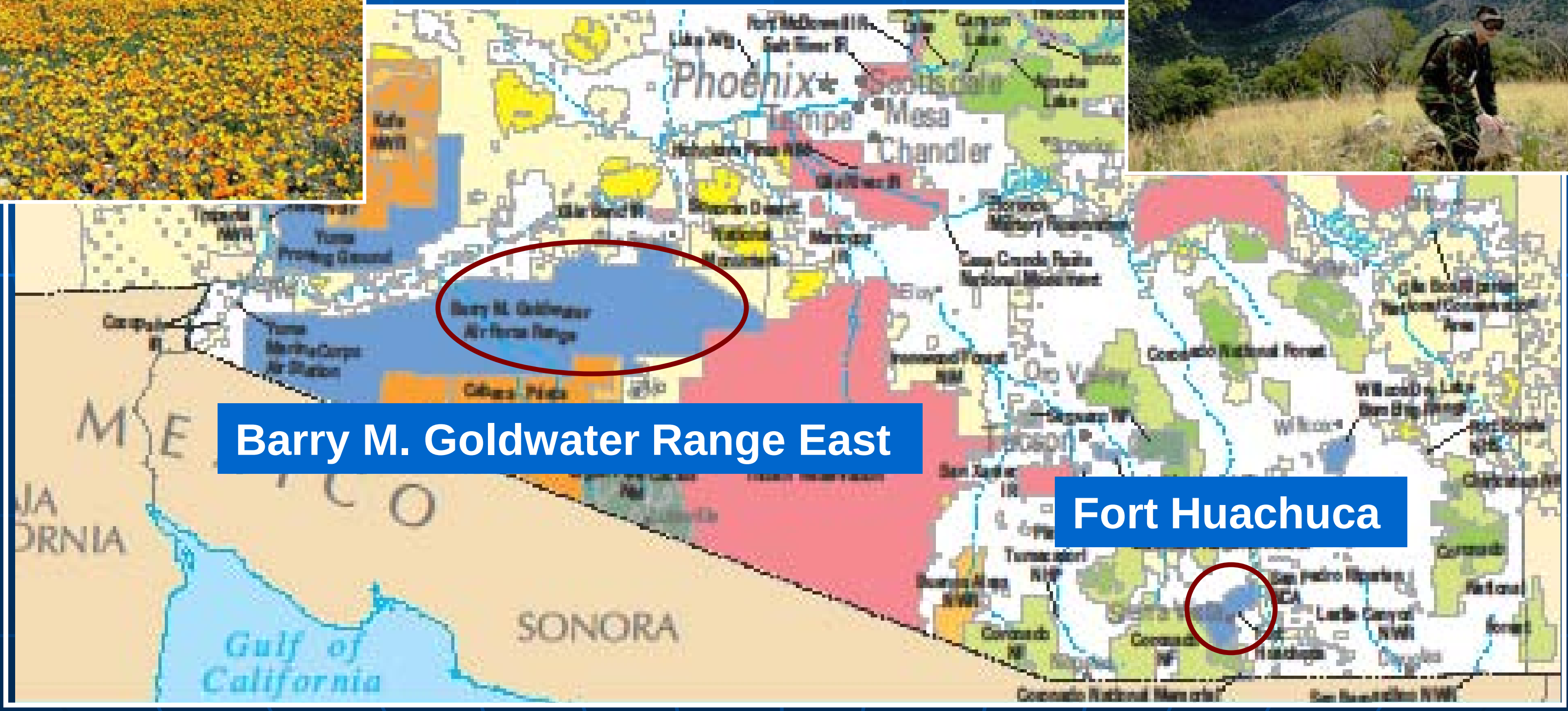
Middle Rio Grande Bosque Initiative

Assessments of species vulnerability to climate change for all vertebrate species



Vulnerable species on DoD lands

Arizona Borderlands



Predicting species' vulnerability and taking anticipatory action

Lesser Long-nosed Bat


Huachuca Water Umbel


Desert Tortoise

Mexican Spotted Owl

White-eared Hummingbird

Thanks

- USDA Forest Service, Washington Office, and Coronado National Forest
- Department of Defense
- U.S. Fish and Wildlife Service
- University of Arizona
- Arizona State Polytechnic
- The Nature Conservancy

Assessing Species Vulnerability to Climate Change

Megan M Friggens, Deborah Finch, Karen Bagne, and Sharon Coe

Tucson Arizona

August 30th, 2010

RMRS
ROCKY MOUNTAIN RESEARCH STATION

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

Our partners

Forest Service U.S. Department of Agriculture

Region 3 & WO

Department of Defense Legacy Program

U.S. Fish & Wildlife Service Department of the Interior

The Nature Conservancy
Protecting nature. Preserving life.™

The University of Arizona®

ASU Arizona State University

forest GUILD

RMRS Species Vulnerability Assessment Tool

Our goal:

Using the concept of threat assessments (e.g. IUCN, Partners in Flight), develop a system to identify which species appear to be most susceptible to climate change

Tool Development

I. Identified how climate affects a species' survival and reproduction

- Change in availability of free-standing water for pond breeders
- Increasing temperatures may alter energetic expenditures and activity periods
- Changes to species interactions

II. Identified species traits relating to these effects to act as indicators for how species may respond to climate change

- Reliance on water sources
- Ectothermic versus endothermic
- Habitat specialists

Tool Development

III. Selected a suite of traits

1. Minimize redundancy
2. Quantifiable effect on population

IV. Additional considerations

1. Make system applicable to different regions and multiple taxonomic groups
2. Recognize that more information will be available for some species than for others

Assessment is a questionnaire (22 questions)

1. Each question relates to a trait or criterion that is an important predictor of species response to climate variations
   - User selects from multiple-choice responses
   - Points associated with each response
2. Higher score --> Greater vulnerability
3. 2 types of scores:
   A. Overall vulnerability (20)
   B. Categorical score (5)
      - Habitat, Physiology, Phenology, Biotic interactions
4. Assessment is place based
   - AOI, forest, management unit, etc.
5. Uncertainty is also scored

Assessing a species

Gather information on projected temperature, precipitation and vegetation for target area

↓

Gather information for species

↓

Score species on anticipated fitness consequences of environmental change

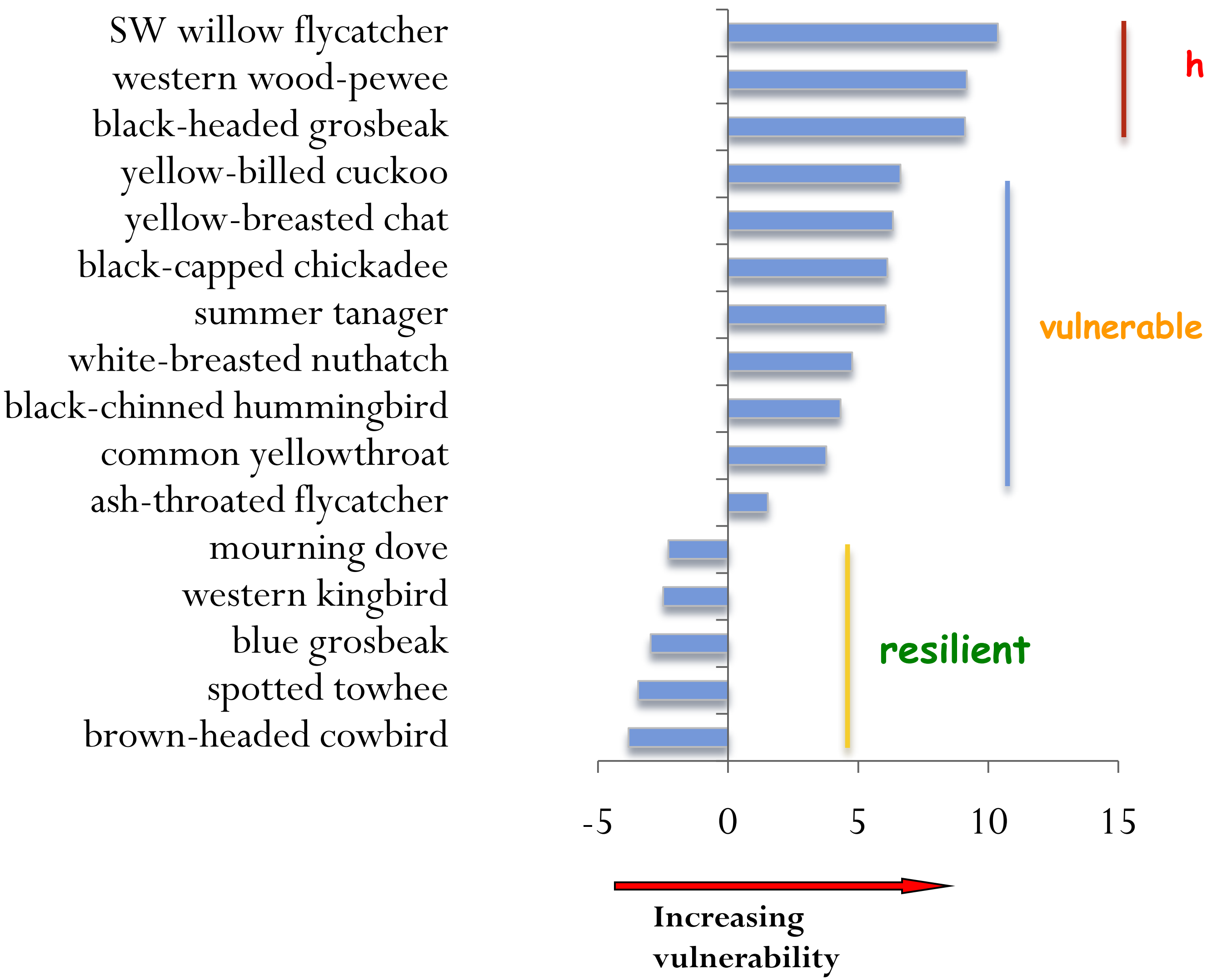
Climate Wizard, Vegetation projections, primary literature, etc.

Species accounts, primary literature, AnimalDiversity.com and other websources, etc.

Overall score to prioritize species
Categorical scores identify intervention points

Typical Scores for overall vulnerability

Bird scores for the Middle Rio Grande Bosque, NM

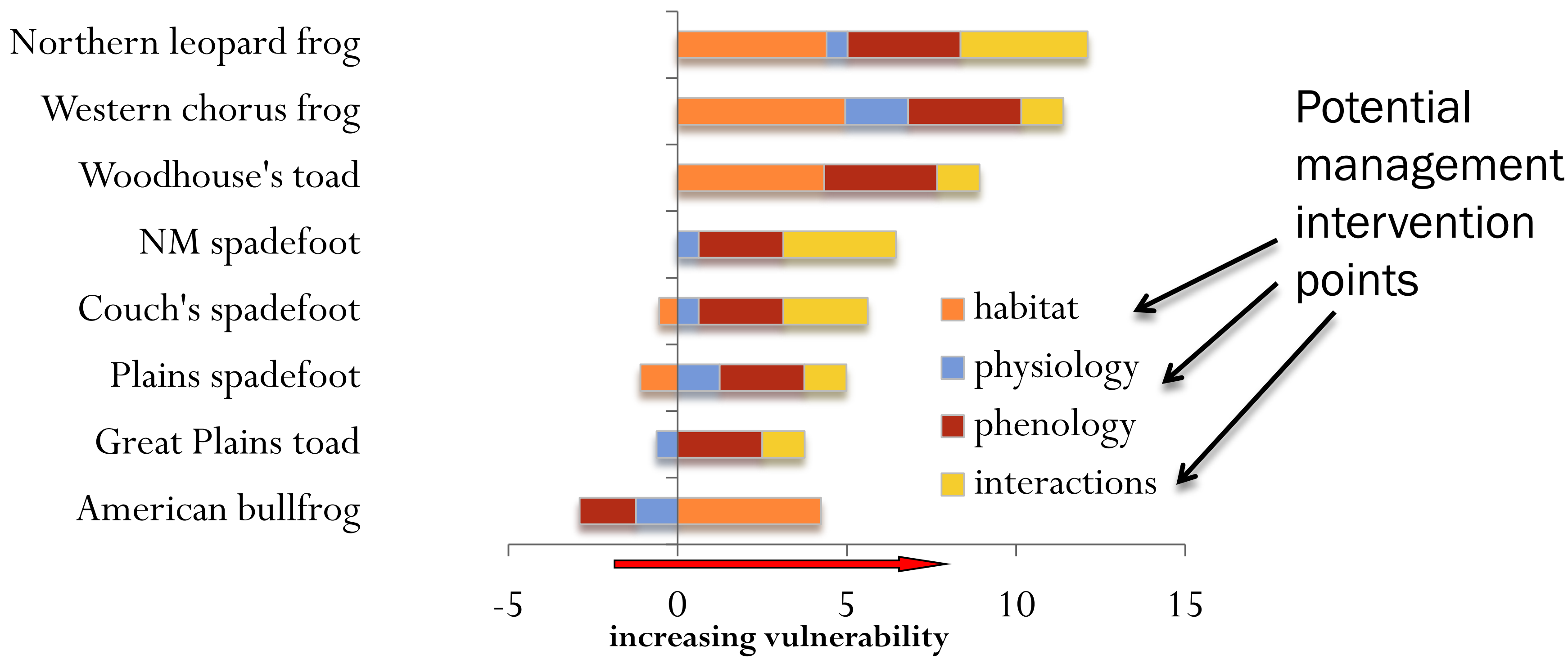


1. Identify species at risk

2. Identify relative vulnerability among a suite of species

Categorical Scores

Amphibians from the Middle Rio Grande



RMRS Assessment Tool: Application

Middle Rio Grande, NM

Barry Goldwater/Fort Huachuca, AZ

Coronado National Forest, AZ

Part II. AN ASSESSMENT OF VULNERABILITY OF THREATENED, ENDANGERED, AND AT-RISK SPECIES TO CLIMATE CHANGE ON TWO DOD INSTALLATIONS IN ARIZONA

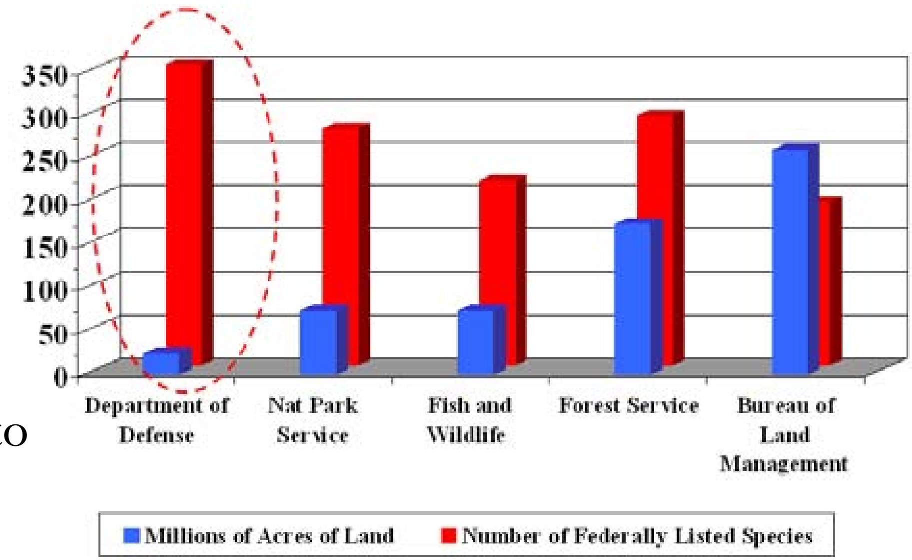
Karen Bagne and Deborah Finch

Background

1. Legacy Grant

2. Purpose:
   - Assess vulnerability of TER-S to climate change.
   - Identify management actions to reduce risk and prevent interruption to military mission

3. TER species at 2 sites:
   Fort Huachuca
   Barry M. Goldwater Range-East



http://www.usmc.mil/unit/mciwest/Pages/EnvironmentalStewardship.aspx

4. Products:
   - Climate assessments
   - Species accounts
   - Management & research implications
   - Species vulnerability tool for vertebrate & plant species

Fort Huachuca

>70,000 acres

Current climate:

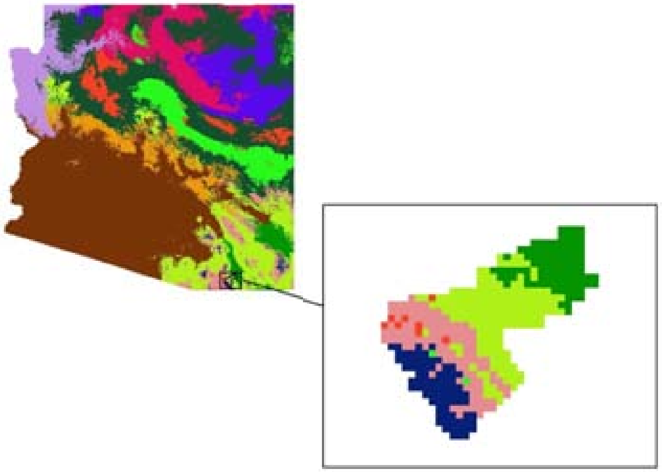
- Dry, warm summers, mild winters, summer monsoons
- Average 38cm rain/year
- Perennial and ephemeral streams

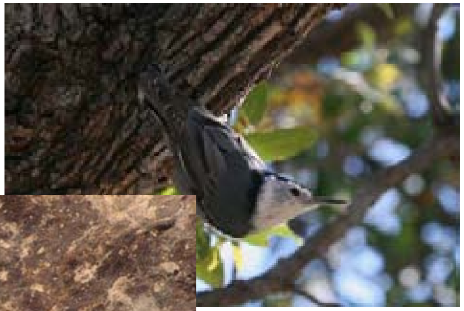
Vegetation:

- Chihuahuan desert scrublands and open scrub-grasslands transitioning to Madrean oak woodland and oak-pine woodlands
- Riparian forest

TER-S:

- 4 known listed vertebrates
- 1 known listed plant
- >12 known species at risk





Barry M Goldwater Range

>1.7 million acres (focused on eastern half)

Current climate:

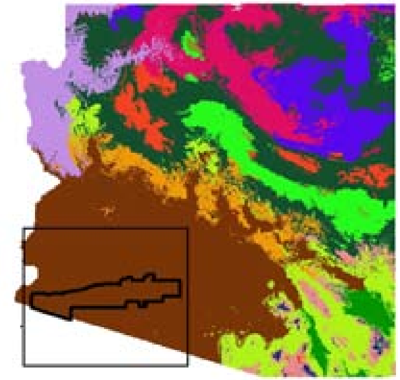
- Hot and dry, Summer monsoons
- Annual rainfall is ~18cm
- Limited water sources

Vegetation:

- Predominately Sonoran Desert scrub

TER-S:

- 2 known listed vertebrates
- No known listed plants
- > 8 species at risk



Courtesy of USFWS

General expectations for future climate conditions in Southern AZ

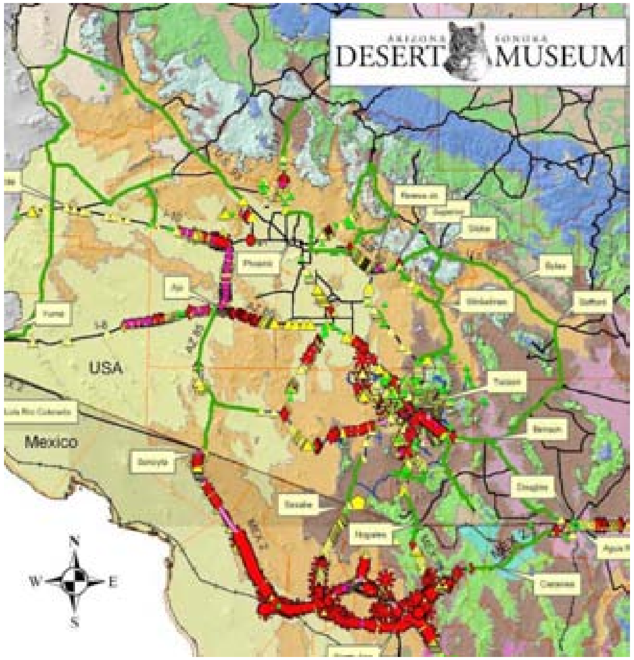
- Annual increase in temperature 2.2°C (4°F) by 2050
  - Change flood regimes
  - Extend fire season
  - Increase evaporation
- Summer monsoon changes unknown
- More droughts & intense storms

General expectations for future vegetation trends in Southern AZ

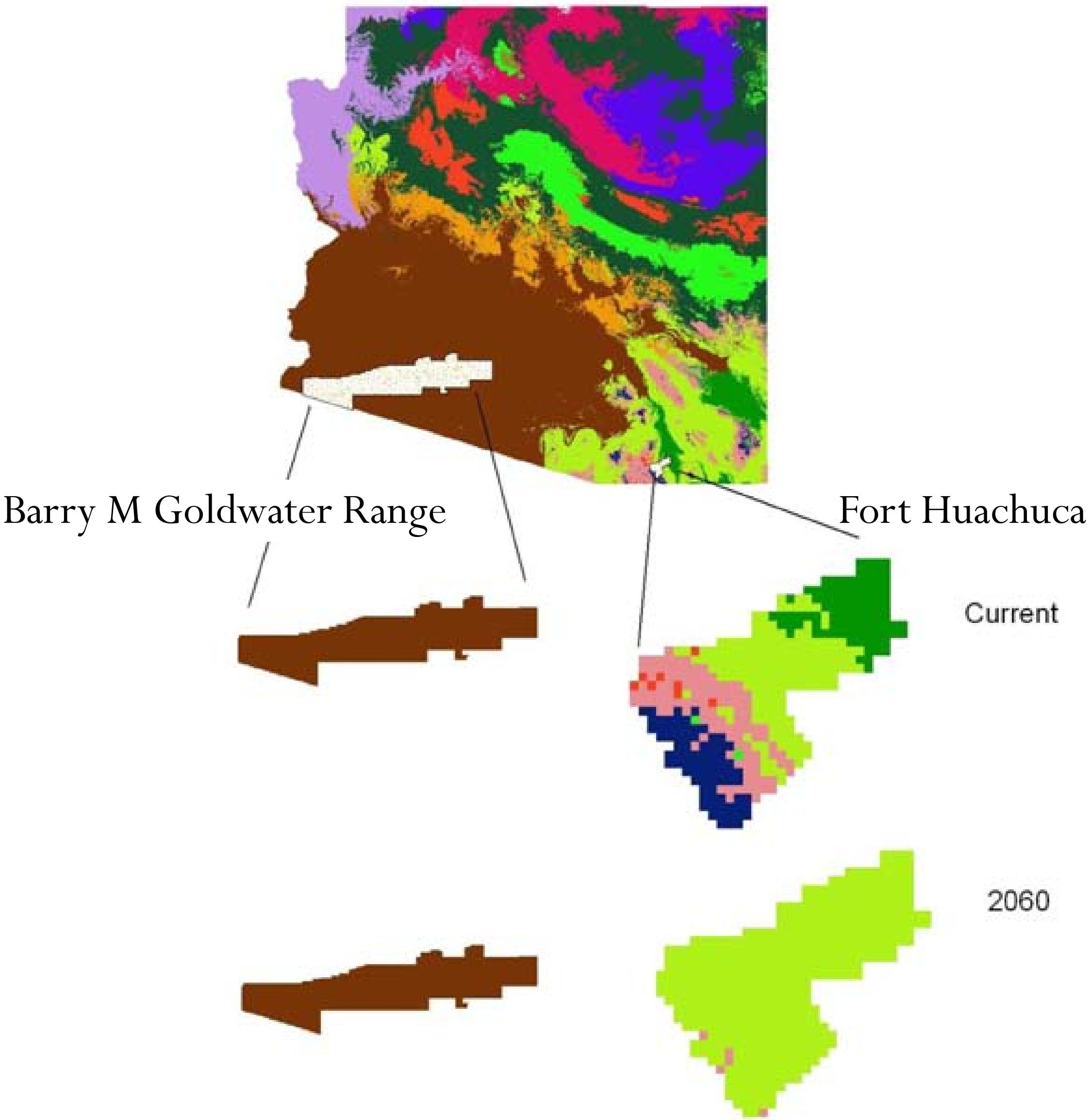
- Sonoran Desert expands northward and eastward, and contracts in the southeast
- Grasses favored over shrubs
- Increased invasive grass species
- Declines/shift in forest habitats likely

(increased fire, insect outbreaks, etc)

- Decrease in riparian habitats



Vegetation change (Rehfeldt et al., 2006)



Vertebrate Scores: Fort Huachuca

Species	Overall Score	Species (cont)	Overall Score
N. Mexican Gartersnake	10.8	Mexican Long-tongued bat	4.1
SW Willow Flycatcher	9.9	Elegant Trogon	4.1
Arizona Treefrog	8.0	Peregrine Falcon	3.5
AZ Ridge-nosed Rattlesnake	8.0	Lesser Long-nosed Bat	3.1
Chiricahua Leopard Frog	6.8	Bald Eagle	2.4
Arizona Shrew	6.4	Northern Goshawk	2.4
W. Yellow-billed Cuckoo	6.1	Cave Myotis	2.2
Buff-breasted Flycatcher	5.3	Desert Massasauga	2.2
Mexican Spotted Owl	5.3	Aplomado Falcon	1.2
Sonoran Tiger Salamander	5.0	Black-tailed Prairie Dog	-2.4
W. Barking Frog	5.0		

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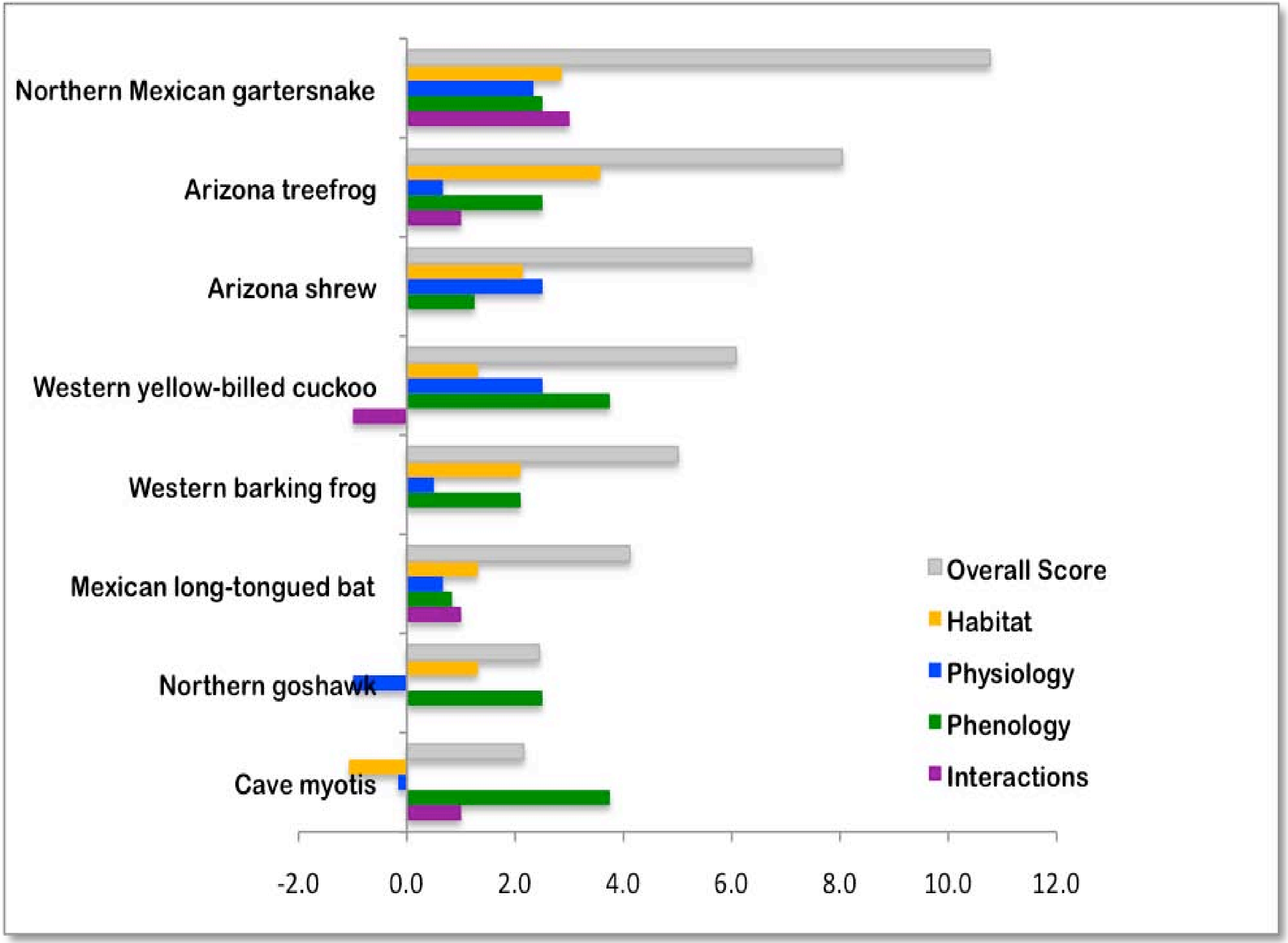
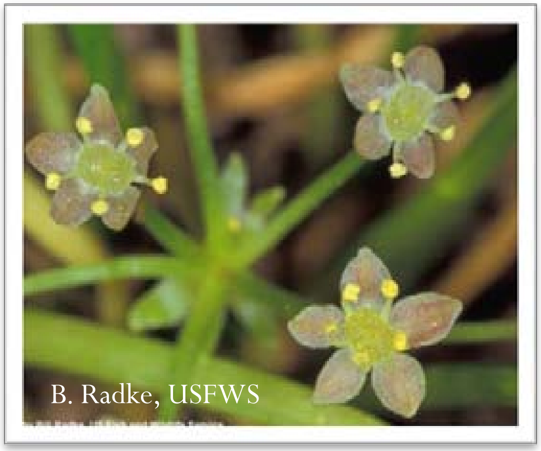
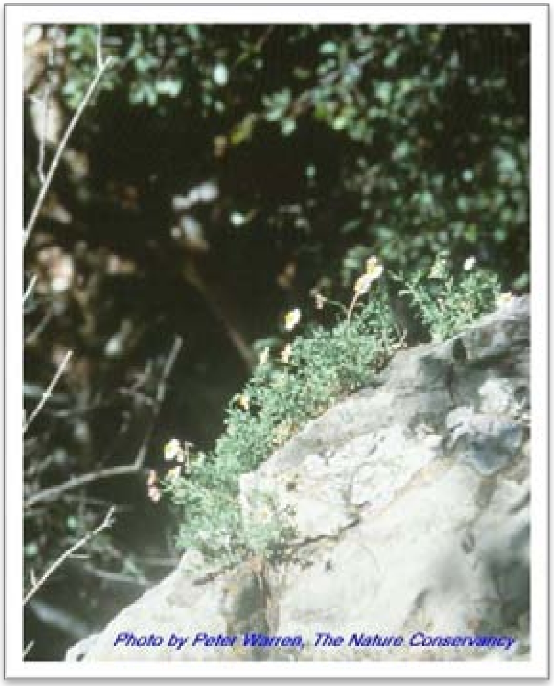
Factor Scores: Ft Huachuca



Plant scores: Fort Huachuca

Species	Overall Score
Lemmon Fleabane	2.9
Huachuca Water Umbel	2.8





Vertebrate Scores: BMGR

Species	Overall Score	Species (cont)	Overall Score
Sonoran Pronghorn	8.2	Couch's Spadefoot	4.1
Desert Tortoise	7.0	Le Conte's Thrasher	2.4
Cactus Ferruginous Pygmy-Owl	5.3	Lesser Long-nosed Bat	2.2
Yuman Fringe-toed Lizard	5.2	Cave Myotis	2.2
Peregrine Falcon	4.4	Saddled Leaf-nosed Snake	1.5
Red-backed Whiptail	4.4	Gilded Flicker	0.8
Desert Bighorn	4.3	California Leaf-nosed Bat	0.5
Mexican Long-tongued Bat	4.1		

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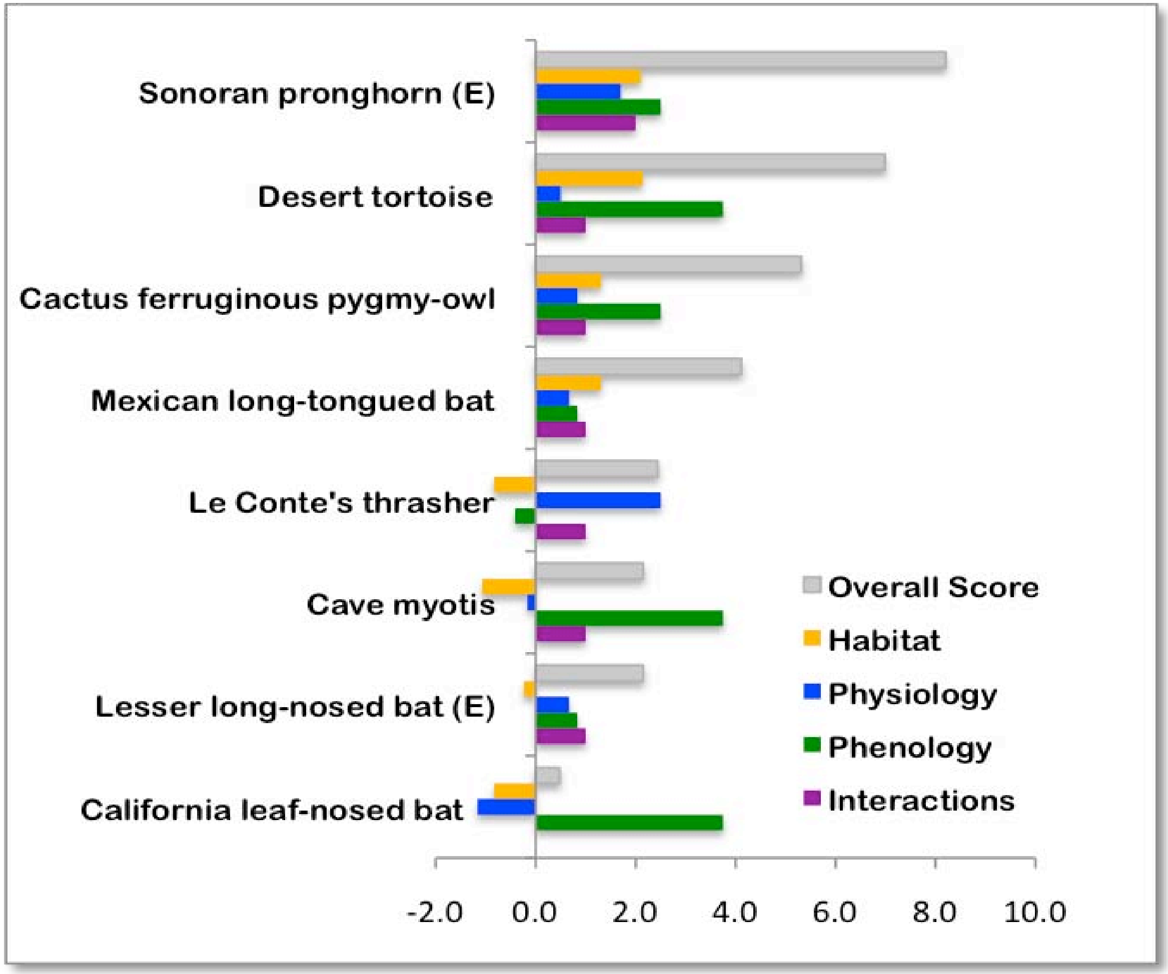
Factor Scores: BMGR



Plant scores: BMGR

Species	Overall Score
Acuña Cactus	2.8

Illustration by Bill Singleton

Common Vulnerabilities

Habitat Issues:

- Water dependent habitats
- Higher elevation habitats
- Limited dispersal
- Long-distance migration

Phenology issues:

- Use cues
- Shift in timing of key breeding resources
- Lower breeding success

Physiology Issues:

- Limited tolerance to high temperatures
- Mortality from disturbance events such as intense storms

Interaction issues:

- Increased disease transmission
- Reductions in food resource
- Much uncertainty

Management Implications: Habitat Vulnerability

- Manipulate factors such as fire or vegetation
- Enhance water catchment or stream flows
- Increase dispersal opportunities
- Relocation to more favorable areas or with better corridor access


Courtesy of US Army

Management Implications: Physiological Thresholds

- Target variation in local conditions
- Protect or direct management towards cooler or moister microsites
- Use corridors or relocation for species that cannot tolerate conditions


Courtesy of USGS

Management Implications: Timing Shifts

- Alter restriction dates that target species vulnerable to timing changes
- Expect lengthening of seasonal use
- Manage to increase duration of temporary waters

Opportunities

Species expansion:

- Local conditions may become more favorable for some species
- Populations may increase
- New species may arrive

Management:

- Increase ephemeral waters and reduce aquatic non-natives
- Effective invasive plant control

Applications

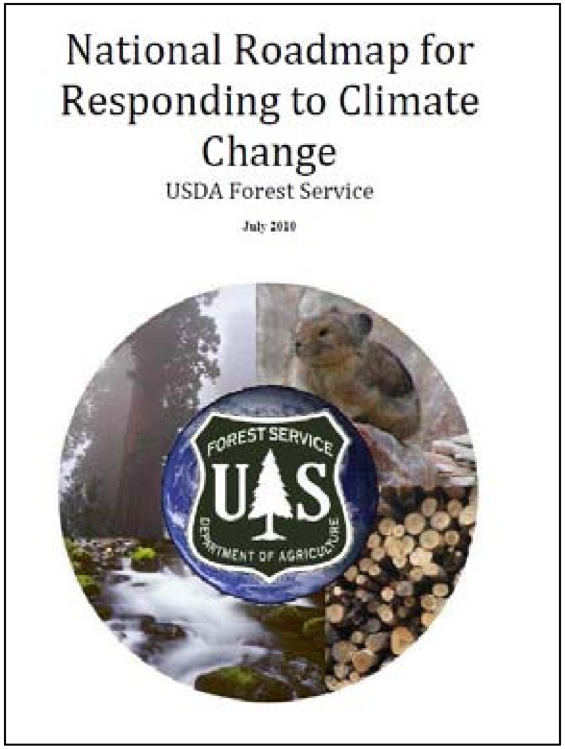
- Add to other threat assessments to identify vulnerable species
- Add expected climate change effects to management plans
- Category scores may suggest focus areas for management actions
- Identify whether legally protected species may need more intensive management
- Legal protection might be prevented by proactive management of vulnerable species
- Work with partners to manage species at a large scale
- Identify species that require more analysis or monitoring

Assessment of Wildlife Vulnerability to Climate Change on the Coronado National Forest

Sharon Coe
Rocky Mountain Research Station,
University of Arizona School of Natural Resources & the Environment

Deborah Finch, Megan Friggens
Rocky Mountain Research Station

Climate change and USFS



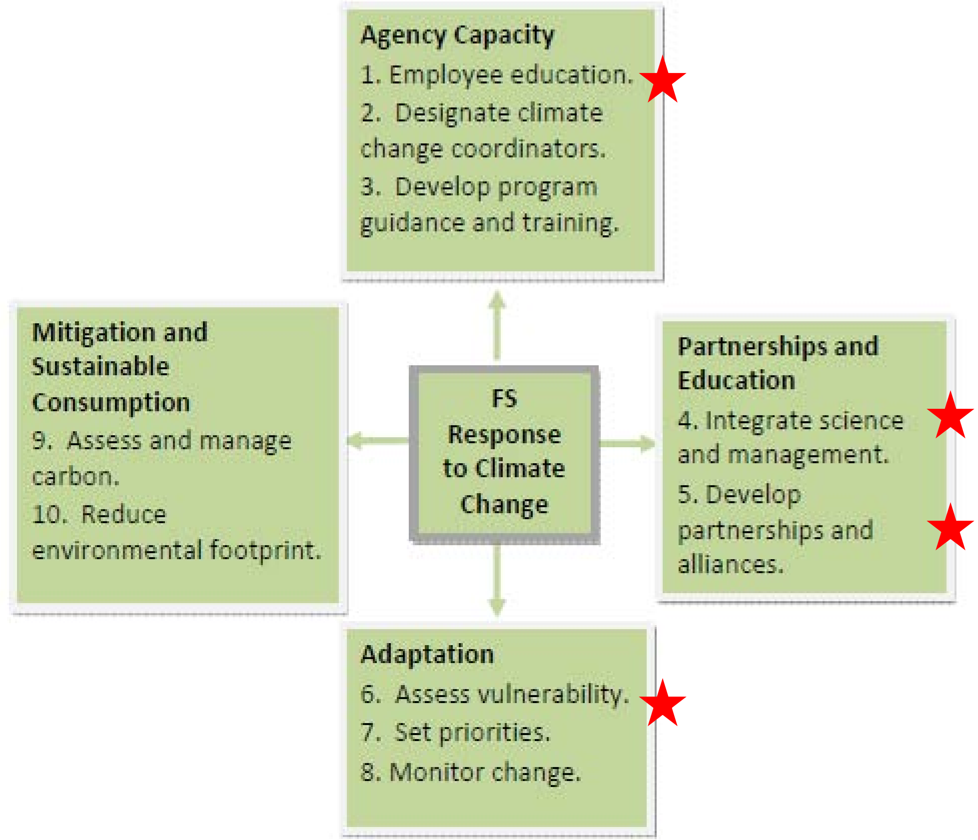


Figure 1. The Forest Service Performance Scorecard for accountability in responding to climate change considers ten elements in four dimensions.

http://www.usda.gov/documents/roadmap.pdf

Climate change and USFS, cont'd

The Forest Service Climate Change Performance Scorecard, 2010

To be completed annually by each National Forest. Regions, Stations, and national programs do not complete the scorecard; however, they must play an essential role in assisting the forests and grasslands.

Scorecard Element		Yes/no	Explain. If no, plan for getting to yes. If yes, describe accomplishments and outcomes.
Organizational Capacity – engage employees through training and integrate climate change into program of work			
★ 1. Employee education	Are all employees provided with training on climate change causes, impacts, role of forests and grasslands, and possible responses? Do employees understand the potential contribution of their own work to climate change response?		
2. Designated climate change coordinators	Is at least one employee assigned to coordinate and be a resource for climate change questions and issues? Is this employee provided with the institutional support to make his/her assignment successful?		
★ 3. Guidance, training, plans of work	Is adaptation, mitigation, and climate change education incorporated into staff program guidance, training, and plans of work?		
Partnerships, Engagement and Education – develop relationships and transfer knowledge			
★ 4. Integrate science and management	Does the unit actively participate in local or regional partnerships with the science community (FS R&D, university, other) to improve its ability to respond to change?		
★ 5. External partnerships	Has adaptation, mitigation, or climate change education been incorporated into existing partnerships? Have new strategic alliances been initiated to respond to climate change?		
Adaptation – assess impacts of climate change and manage change			
★ 6.Vulnerability assessment	Is information about the vulnerability of key resources, ecosystem elements, and human communities to the impacts of climate change being used in unit decisions? (Vulnerability assessment can be done at a regional scale and interpreted for the unit level.)		
7. Adaptation activities	Is an adaptation strategy in place that helps incorporate the vulnerability of resources and places into priority setting and land treatment actions?		
8. Monitoring	Is monitoring being conducted to track changing conditions of species, watershed condition, forest and grassland health, and other measures, and the effectiveness of treatment programs? (Monitoring programs can be conducted at a regional scale and above, and interpreted for the unit level.)		

http://www.fs.fed.us/climatechange/pdf/performance_scorecard_final.pdf

Vulnerability assessment of species on Coronado National Forest

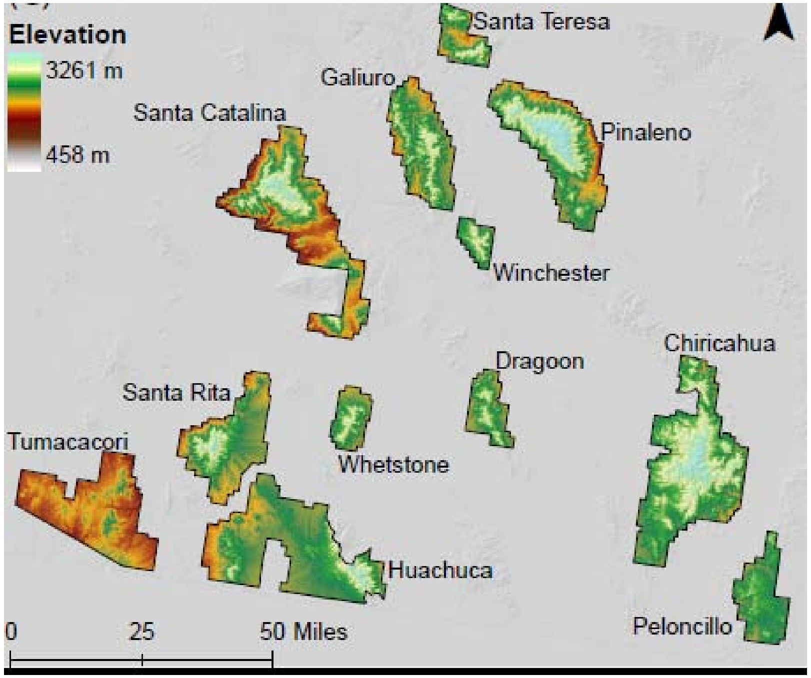
- Funding: Grant from USFS Research & Development (Washington Office) to address vulnerability of species to climate change

- Case study: Coronado NF

  --12 management areas (5 ranger districts)

  --elevation ~1000-2800m

  --high biological diversity

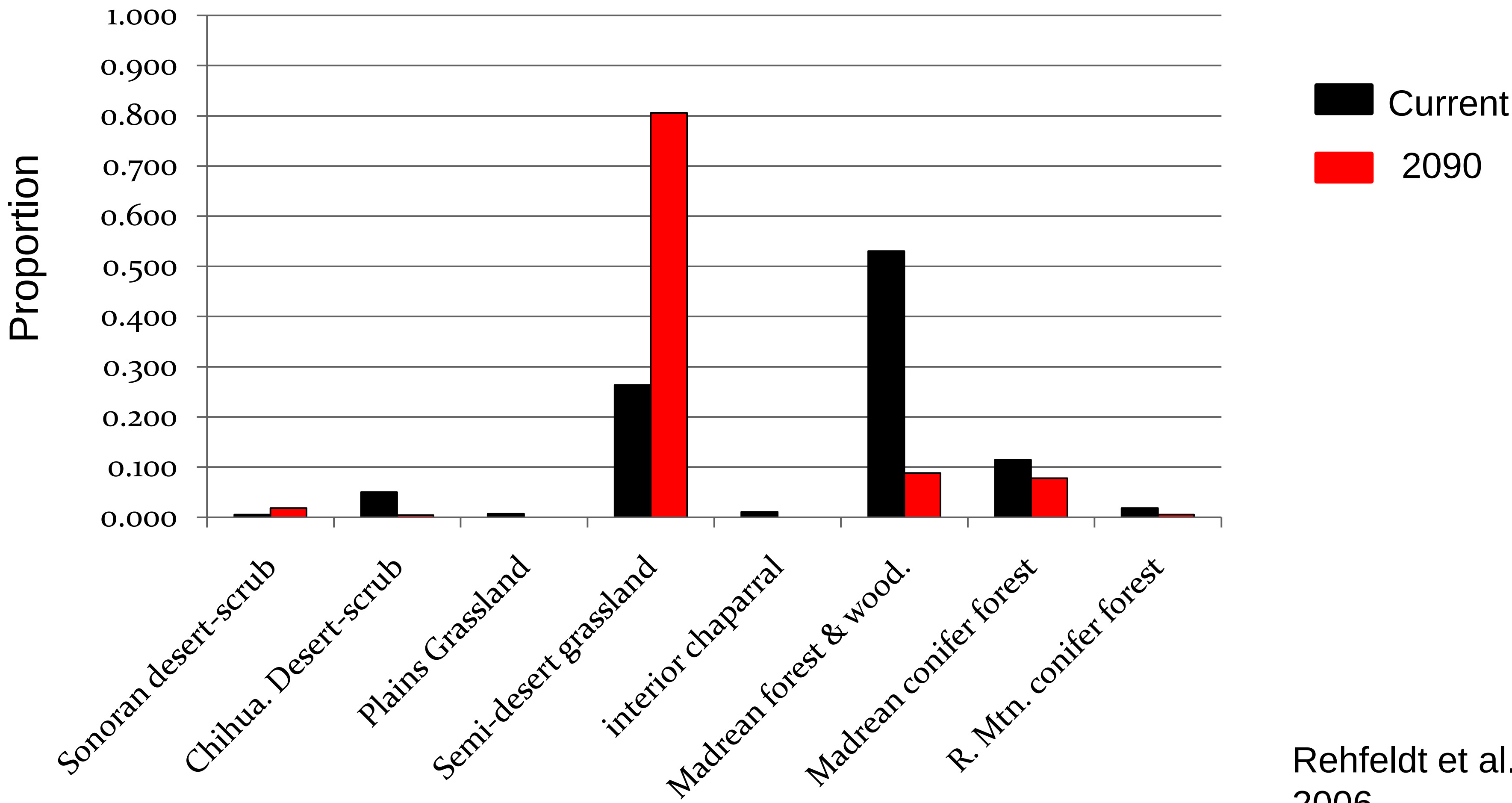


Vegetation communities on Coronado NF

Vegetation community	Percent of Coronado NF	Description
Madrean encinal woodland	**42%**	**A variety of oak species (*Quercus*), pines (Chihuahua, pinyon), juniper, Arizona cypress.**
Semi-desert grassland	**26%**	**A variety of grassland types**
Desert communities	9%	Sonoran and Chihuahuan desert.
Interior chaparral	9%	
Madrean pine/oak woodland	8%	Open or closed canopy of evergreen oaks such as Arizona white oak, alligator juniper, Chihuahua pine, other pines.
Ponderosa pine	3%	
Mixed conifer forest	2%	
Spruce/fir	<1%	
Riparian communities	<1%	Three types of riparian forest: Cottonwood Willow, Mixed Broadleaf Deciduous and Montane Willow.

Source: CNF Draft Ecological Sustainability Report, 2009

Projected change in area having *suitable climate* for various veg. communities on CNF



Rehfeldt et al. 2006

Assessed 30 species identified by CNF as high priority

- Threatened or Endangered
- USFS sensitive
- Management Indicator Species

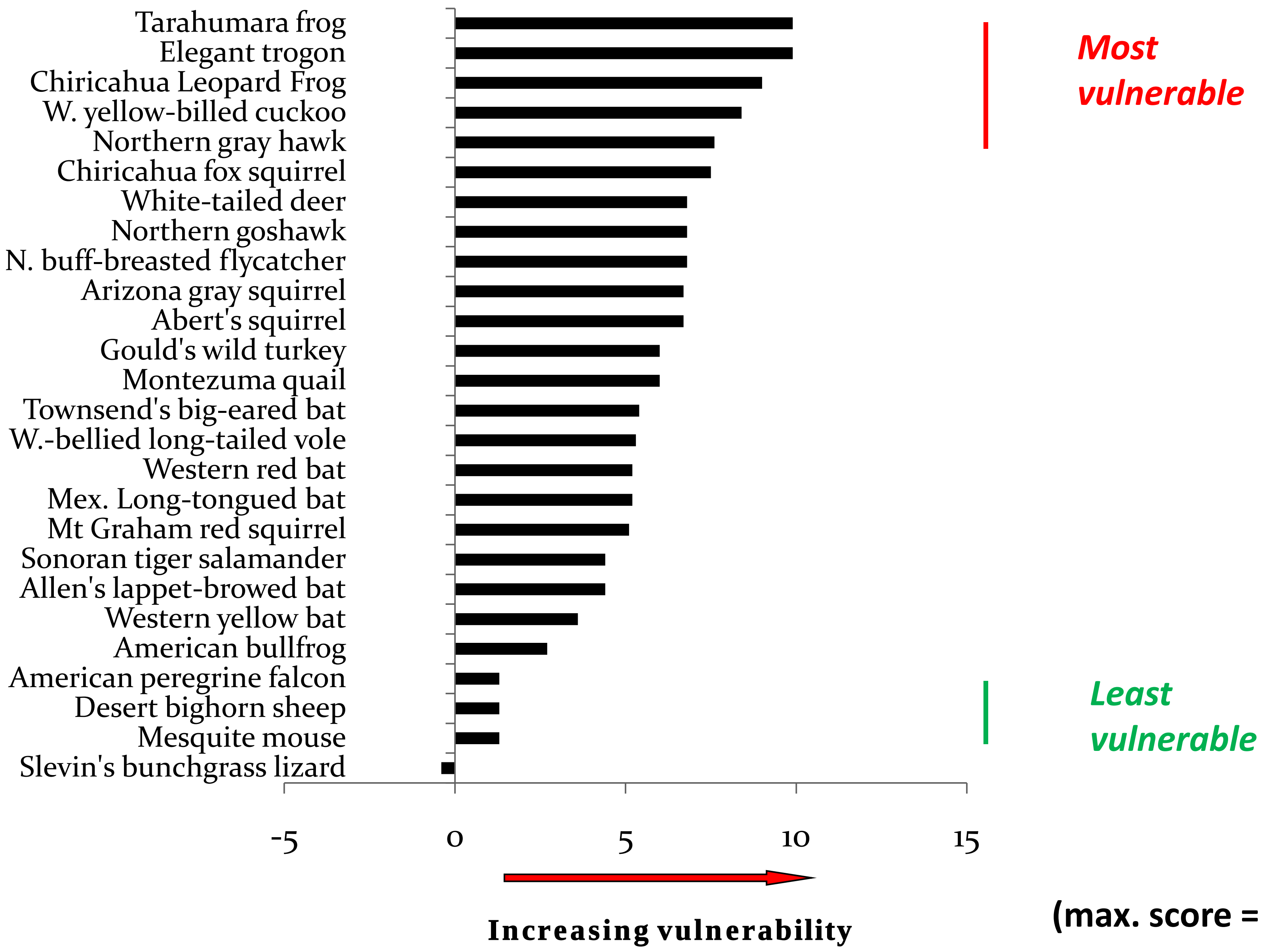
- occur across the 12 management units

Chiricahua leopard frog

13 mammals
8 birds
4 amphibians
5 reptiles (*4 in progress*)

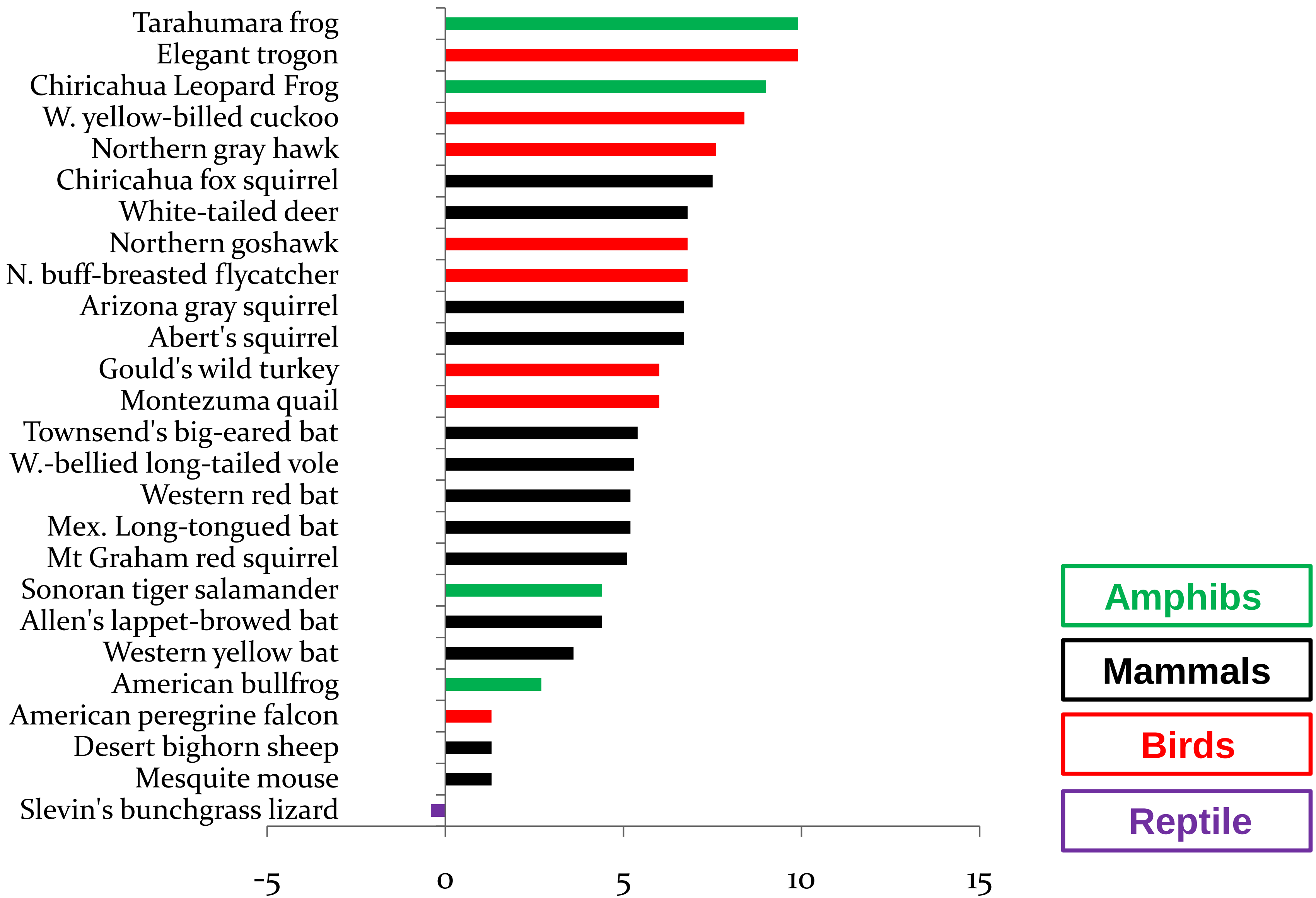
Mexican long-tongued bat

Overall vulnerability (26 spp.)

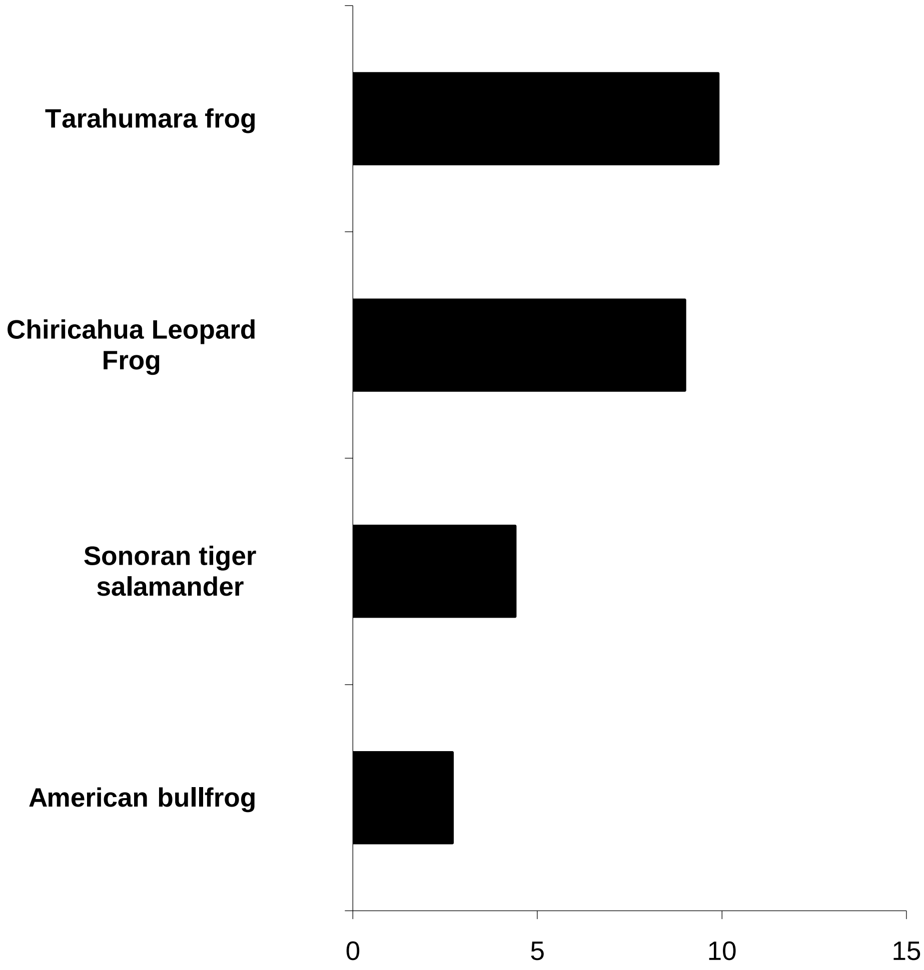


(max. score = 20)

Highest vulnerability not limited to a single taxon. group

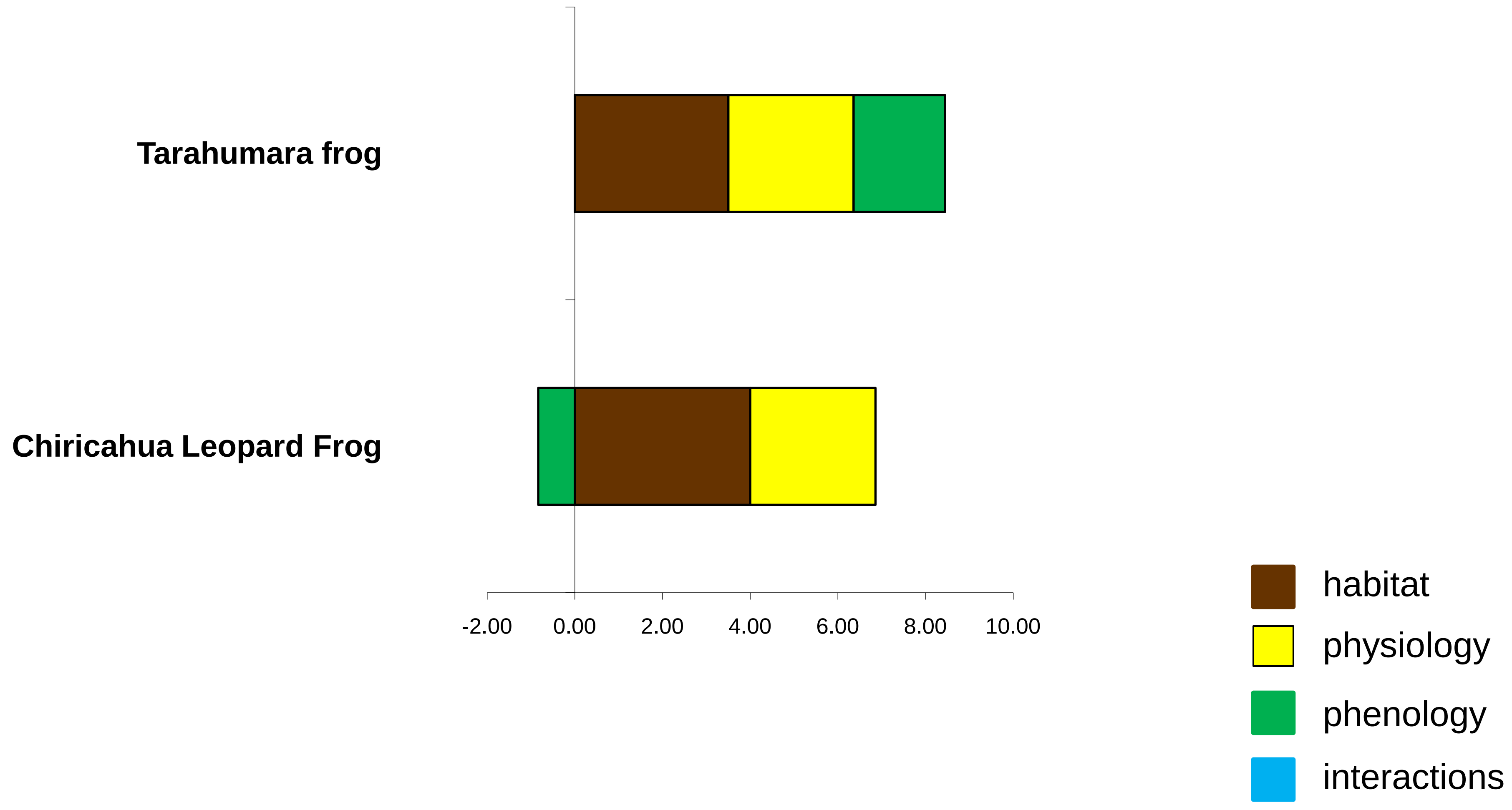


Two native frogs most vulnerable…

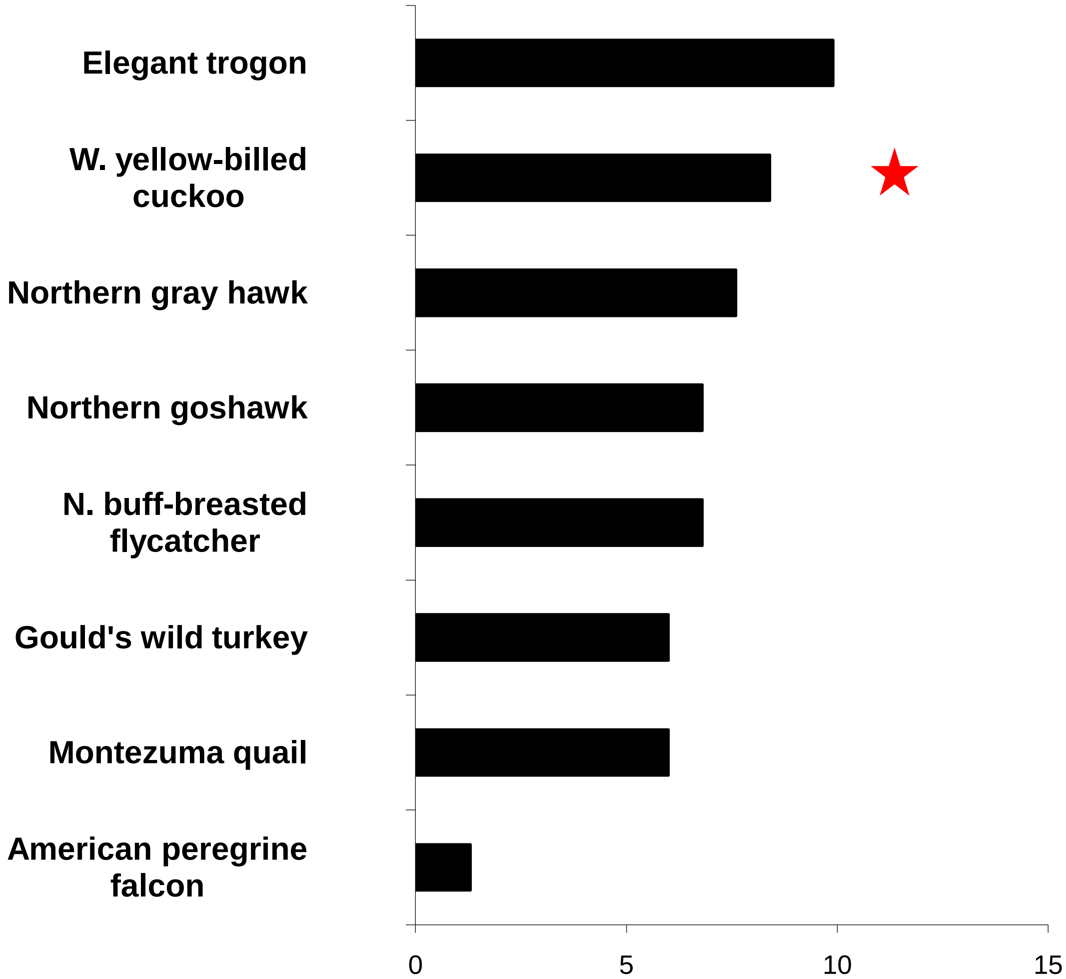


Tarahumara frog

…but difference in how each category contributes to each frog's vulnerability

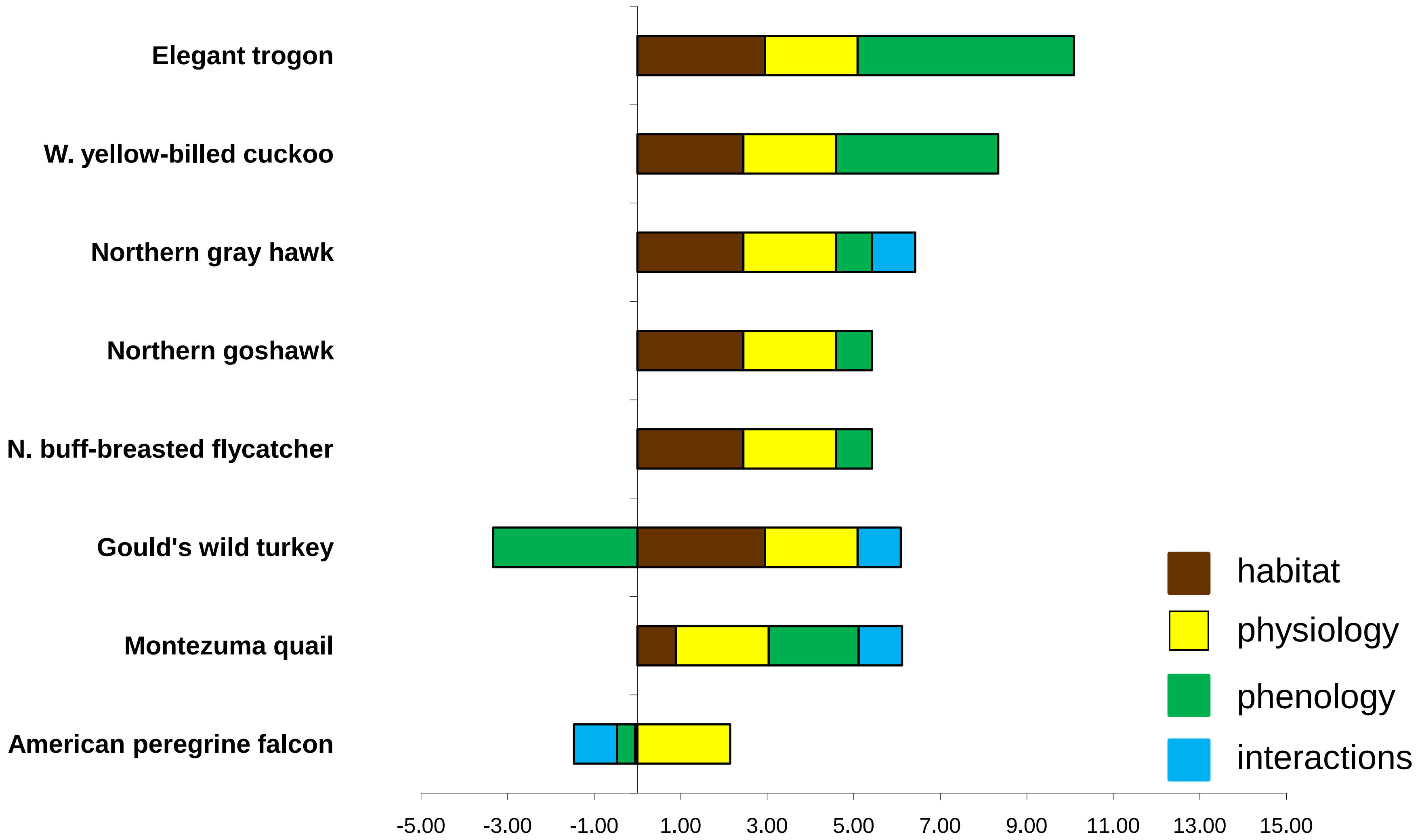


Some other bird species are nearly as vulnerable as a species tightly tied to riparian habitat for breeding

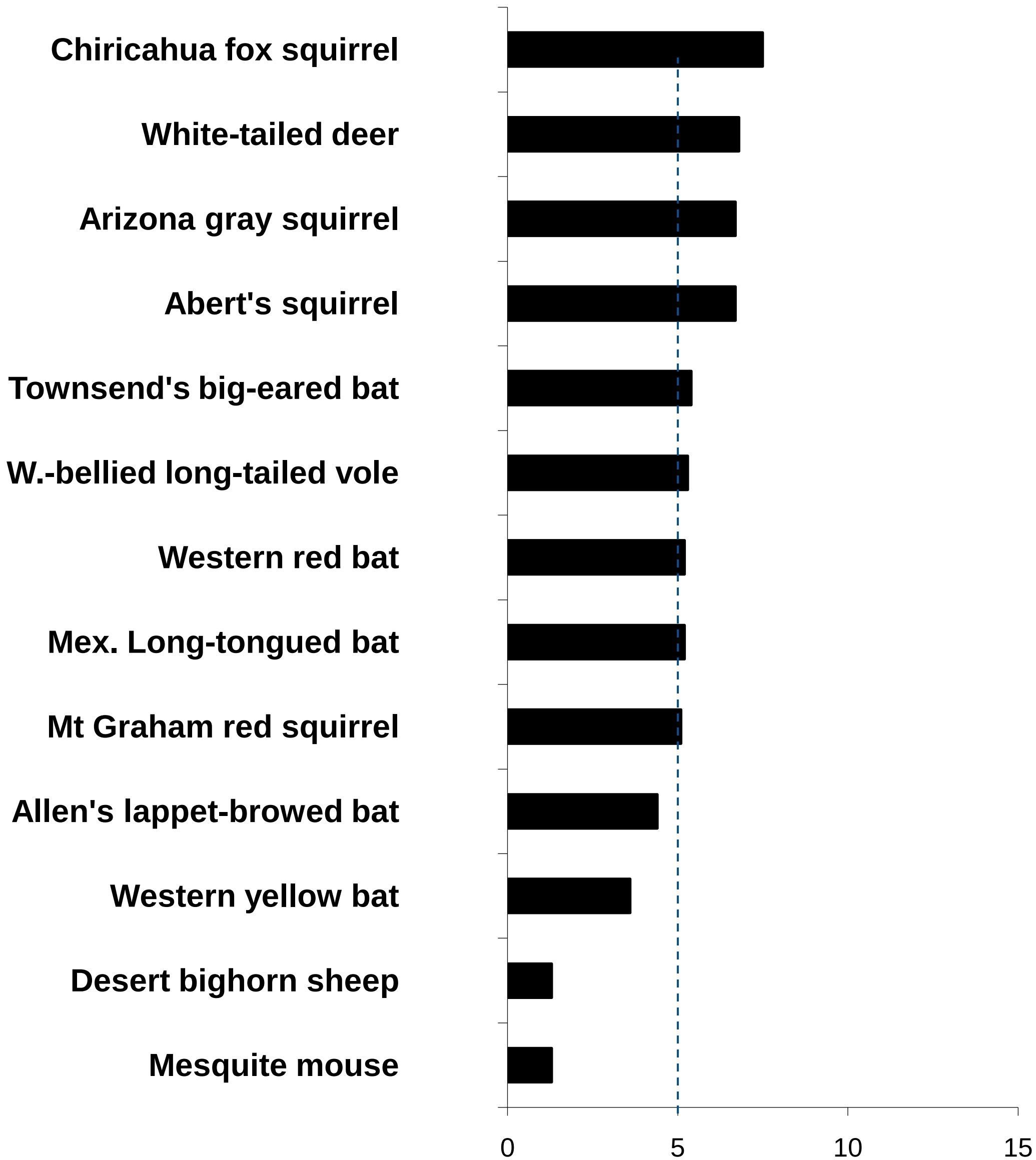


Western yellow-billed cuckoo

In birds, note differences in phenology category

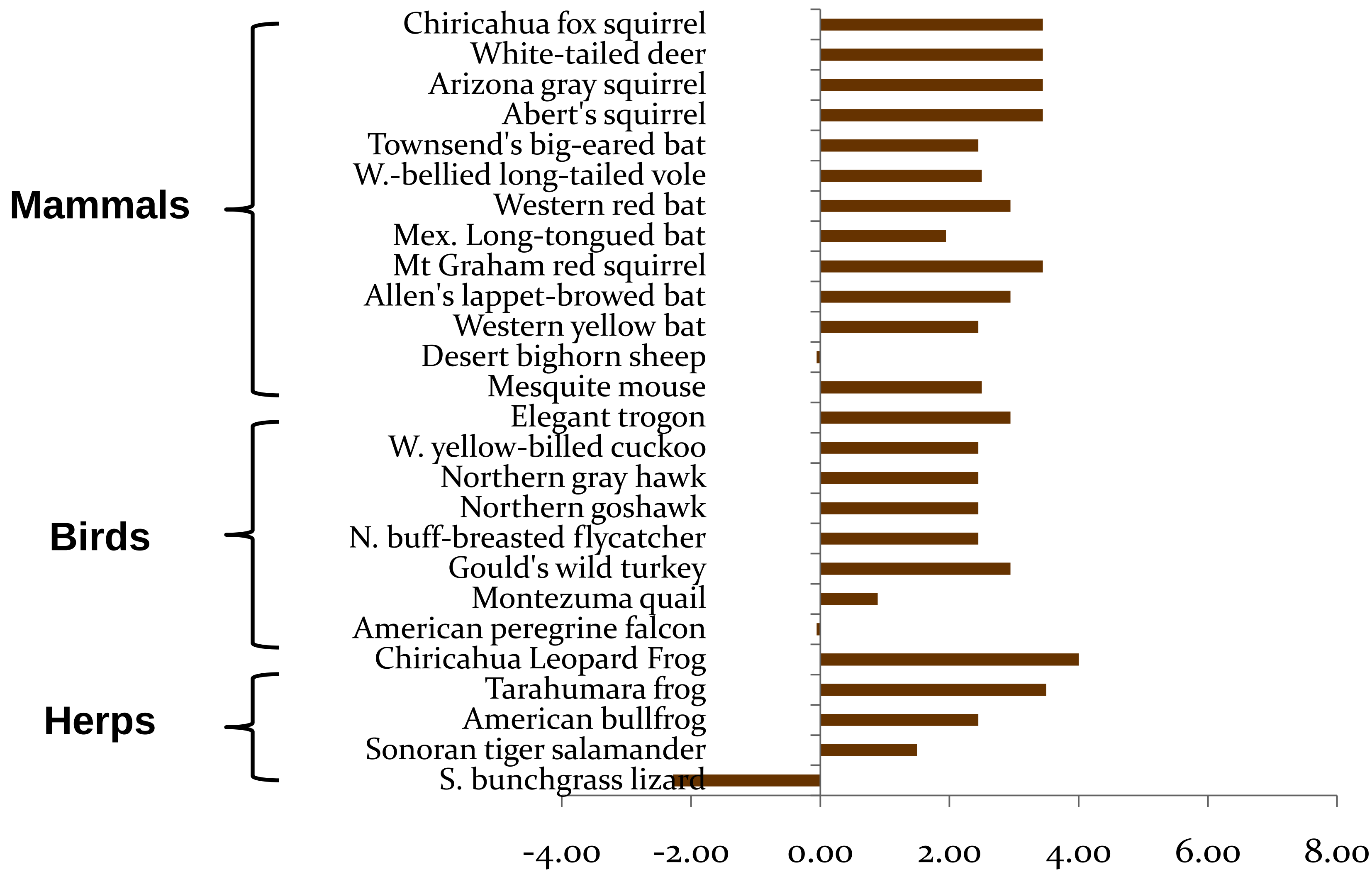


Some squirrels are slightly more vulnerable than some bats



Chiricahua fox squirrel

All taxonomic groups scored high in habitat category, and most species did as well



What to keep in mind when considering assessment results…

1. Vulnerability to climate change is just one factor affecting species' persistence…decisions should not be made in a "climate change vacuum"
2. Uncertainty exists, in projections, and due to limitations on data on species
3. Best management will be flexible/adaptive, range of options for both short-term and long-term

Considering Species Vulnerability in a Spatial Context: Coronado National Forest

Jennifer Davison[1], Sharon Coe[2], Deborah Finch[2], Erika Rowland[1], Megan Friggens[2] and Lisa Graumlich[1]

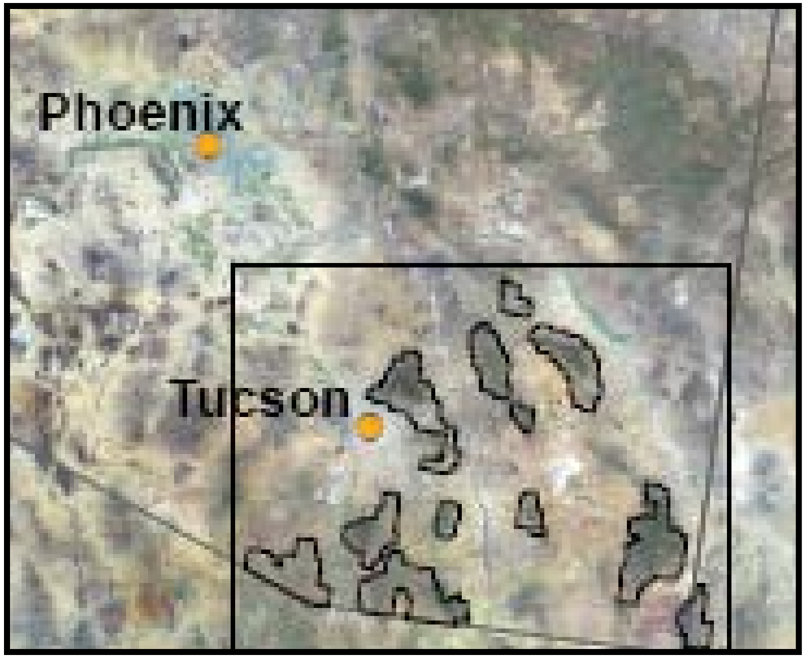
[1]University of Arizona;
[2]USDA-Forest Service Rocky Mountain Research Station

Objective

- Examine the spatial patterns of species vulnerability on the Coronado NF

vulnerability scores

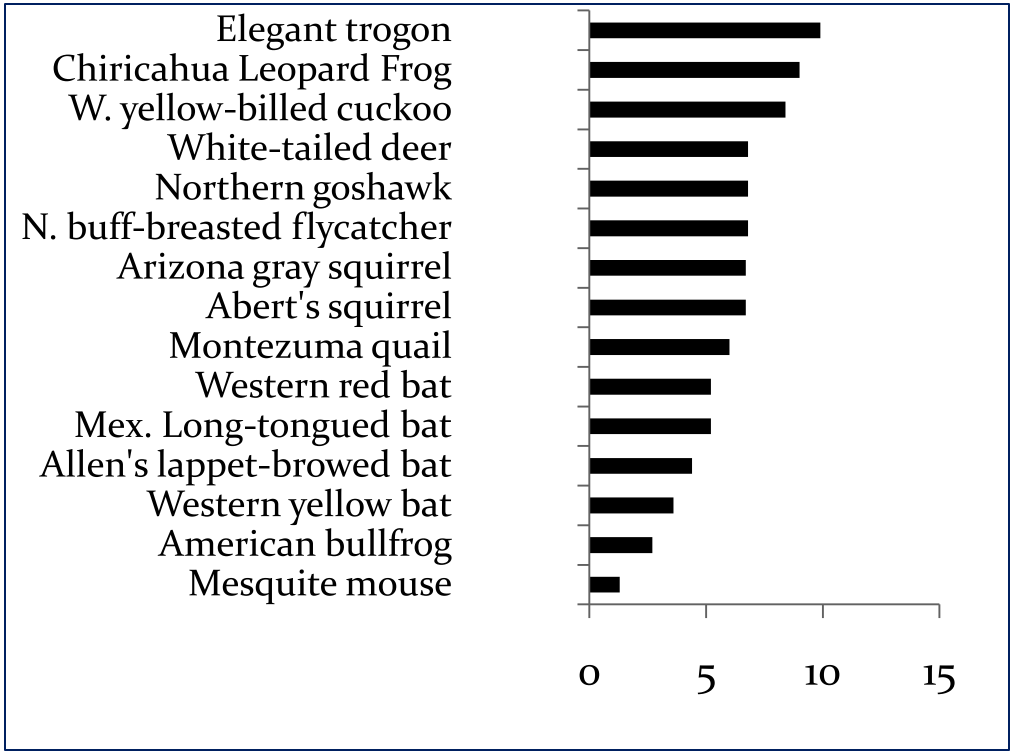
✚



Methods

Used vulnerability scores from a sub-set of 15 spp.

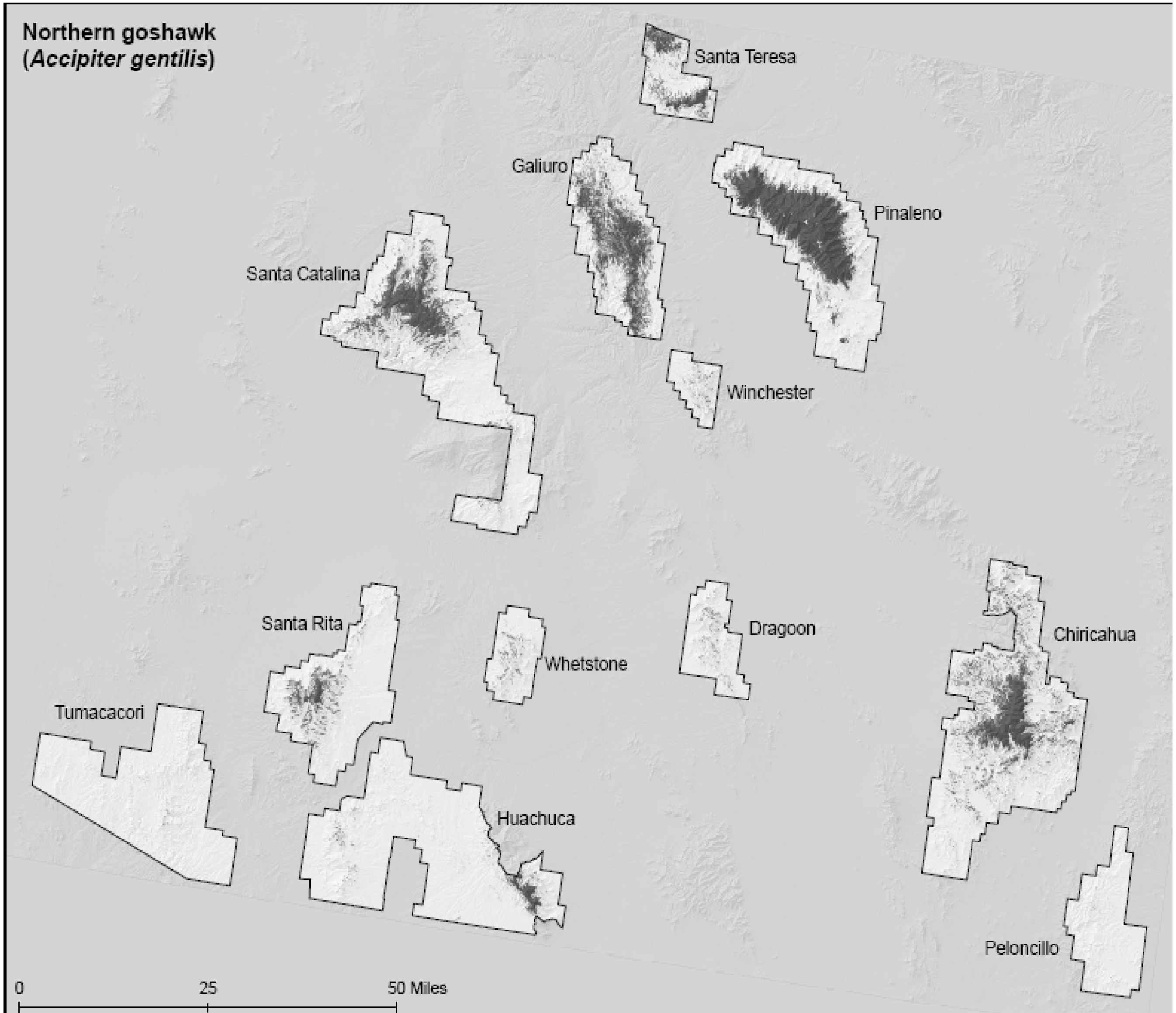
--8 mammals, 5 birds, 2 amphibians



Methods, cont'd

1. Used species' habitat models from SW Regional GAP Analysis Program (SWReGAP) to map species' potential distribution on CNF
   - ReGAP identifies potential habitat
   - Had to consider potential distribution because extent of many spp. on CNF not well known

Species habitat model: example



Methods, cont'd

2. For each species, applied vulnerability score to its habitat model

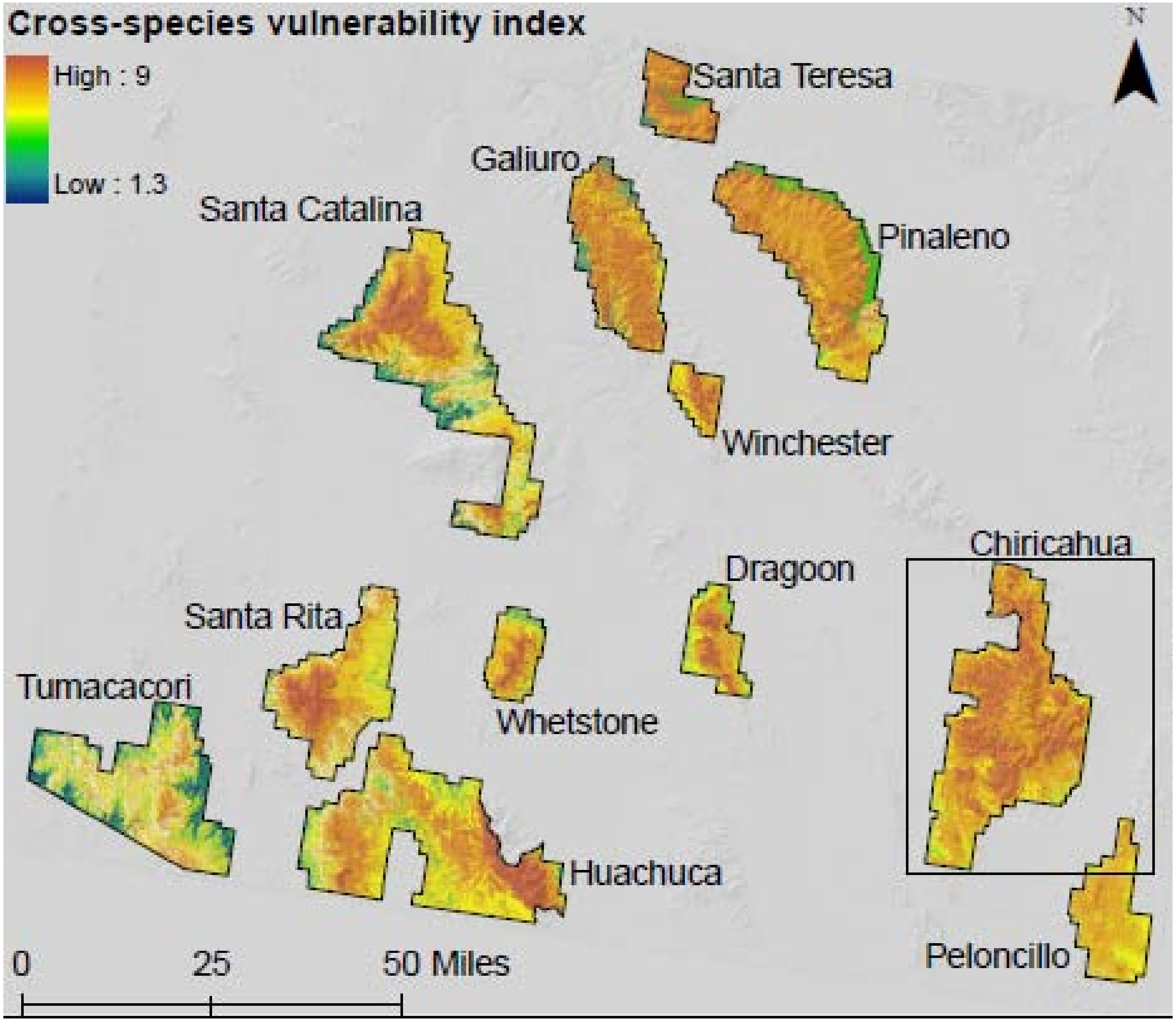
3. Created a "cross-species vulnerability index" (CSVI)

- For each 30-m pixel, summed the vulnerability scores for all species with potential habitat in the pixel, then divided by number of species

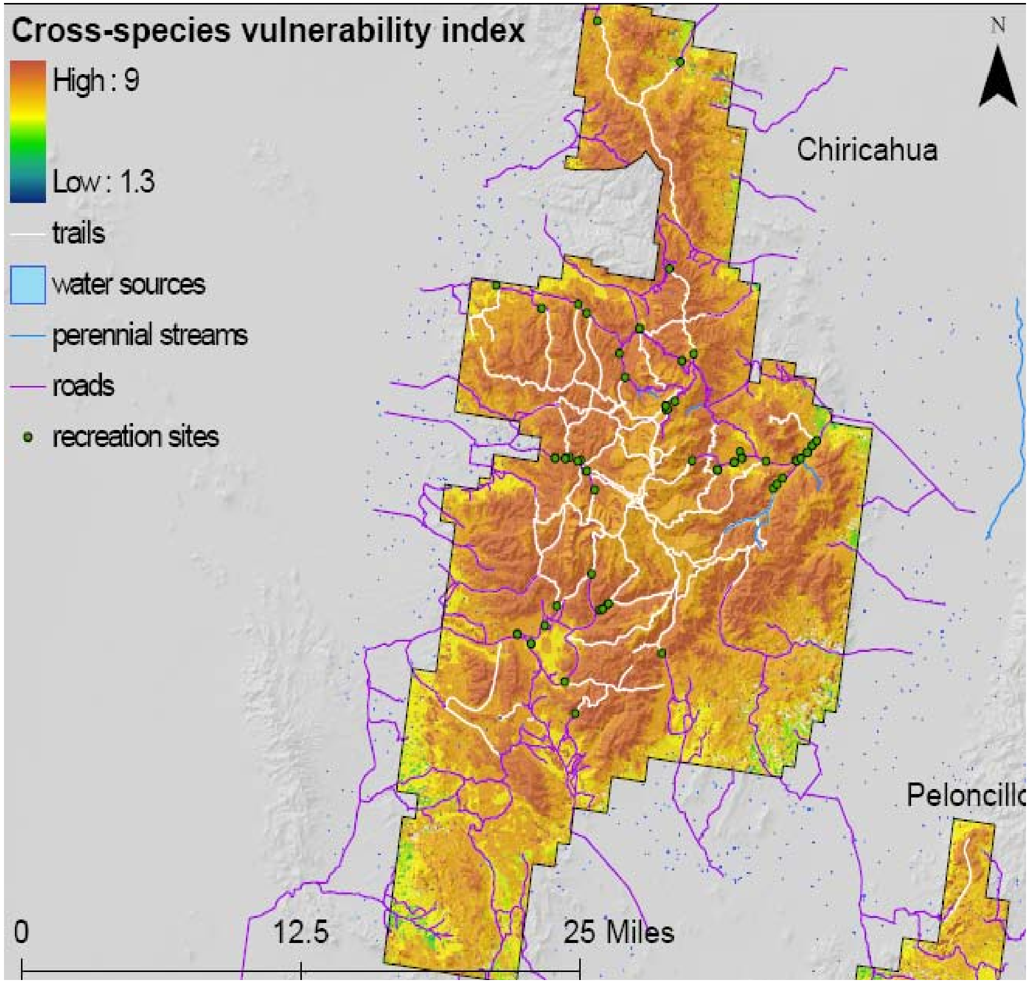
--e.g., if Pixel X has potential habitat for 4 species, and each species has a vulnerability score of 10, then CSVI = (4 x 10) ÷ 4 = 10

Average species vulnerability (CSVI)

Orange= high CSVI



Average species vulnerability (CSVI)



CSVI tended to be higher:

- in middle to high elevations
- areas with greater overall vegetation cover and riparian vegetation cover

Considerations of the vulnerability index (CSVI):

- Calculating additional indices may be helpful to management
  - e.g., index using just T&E spp., single taxonomic group, etc.)

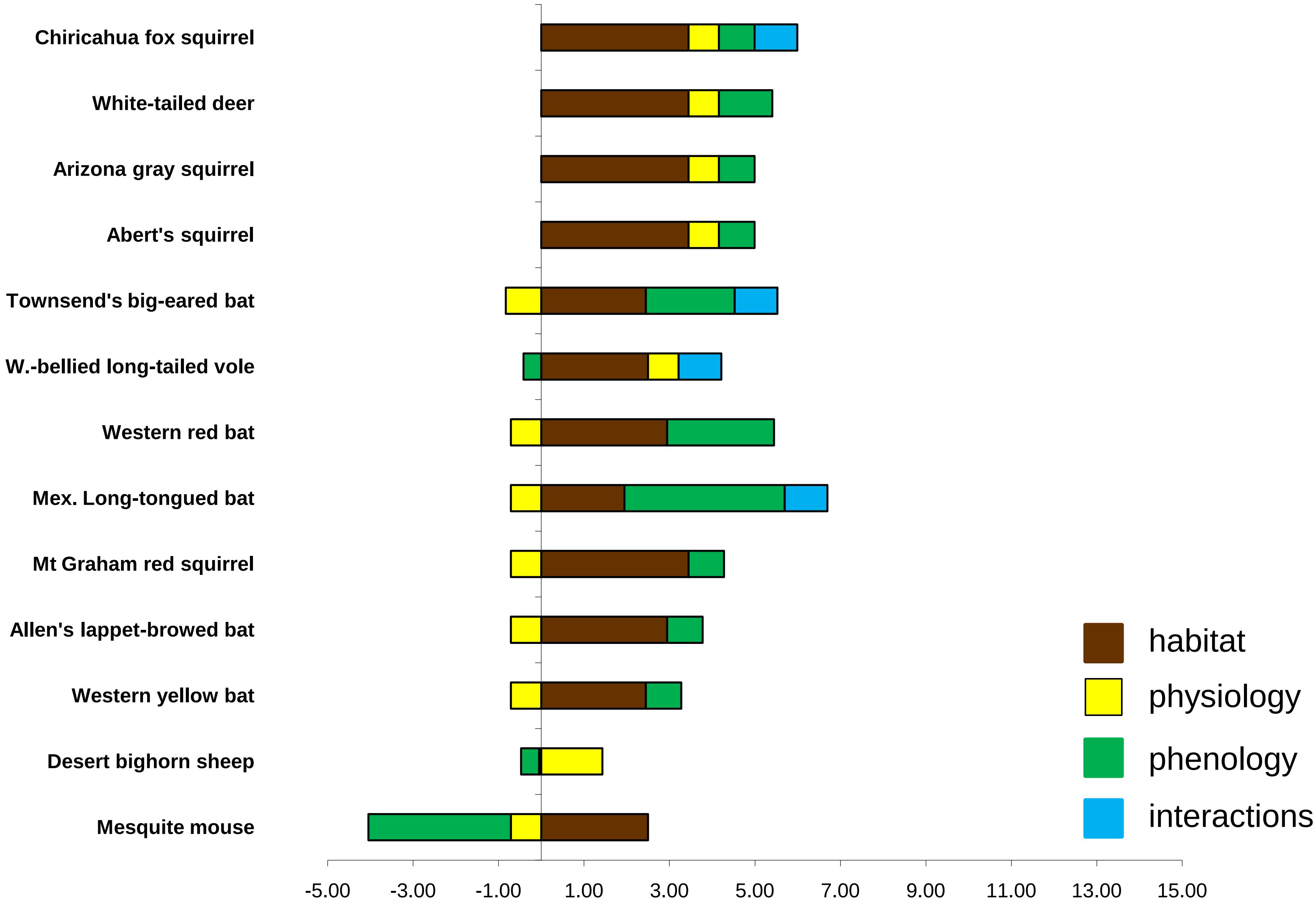
    --i.e., each index would be plotted as a new map
- Process would benefit from more information on known species locations, not just potential habitat

Conclusions

- Setting vulnerability scores for multiple species in a geographic context helps visualize where on the ground there are high average levels of vulnerability
- The 15 spp. analyzed here show a pattern of greater vulnerability at higher, more isolated landscapes
- Cross-species vulnerability indices can be integrated with other spatial data and other species information to aid in evaluating the impact of potential management decisions

Overall, next steps…

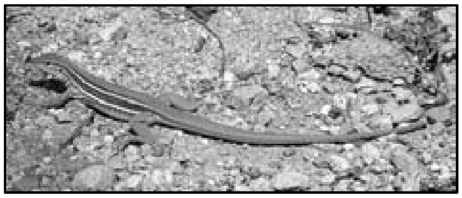
- Final report on species assessments and spatial analysis by University of Arizona completed within next ~2-3 months
- We expect to submit report for publication as a USFS General Technical Report



Chiricahua fox squirrel
White-tailed deer
Arizona gray squirrel
Abert's squirrel
Townsend's big-eared bat
W.-bellied long-tailed vole
Western red bat
Mex. Long-tongued bat
Mt Graham red squirrel
Allen's lappet-browed bat
Western yellow bat
Desert bighorn sheep
Mesquite mouse
-5.00
-3.00
-1.00
1.00
3.00
5.00
7.00
9.00
11.00
13.00
15.00
habitat
physiology
phenology
interactions

Testing a Climate Change/Lizard Extinction Hypothesis with Long-term Monitoring in the Most Species-rich Venue of the United States

Lawrence L. C. Jones
Coronado National Forest
Tucson, Arizona



The Sinervo et al., 2010 Climate Change-Lizard Extinction Hypothesis

- Based on real data in México
- Predicts 20% global extinction of lizards by 2080
- Predicts 40% local extinctions by 2080
- Based on spring window of activity, as it relates to reproductive output, body temperatures, rates of evolution, and such

Why test the hypothesis on Coronado NF in SE AZ?

- Highest diversity of lizards in the U.S.
- Apparent high densities (makes for large sample sizes) in some areas
- Canary in a coal mine for analyses of other species (Forest Service Sensitive, Threatened and Endangered)
- Historic and existing data

The Wright and Lowe 1968 Weed Species Hypothesis

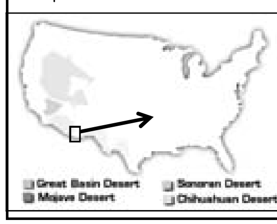
- Parthenogenetic whiptails occupy weed-favoring habitat ("disclimax, marginal, ecotone, transient, extreme, and perpetually disturbed")
- Hence, they are "weed species"
- In weed-habitat, hybrid vigor is expected (e.g., outcompete gonochoristic species)

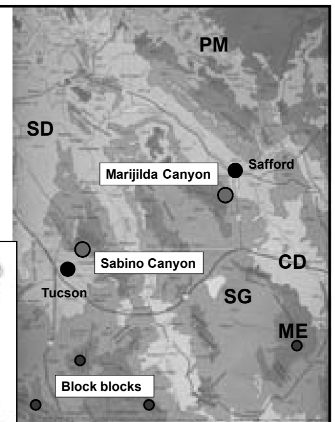
Why test the hypothesis on Coronado NF in SE AZ?

- Coronado NF is a semi-epicenter of parthenogenetic whiptails and parental stocks
- The convergence of ecoregions is a good testing ground for weed habitats
- This hypothesis is an important component of any analyses addressing climate change extinction models in this area.

Ecoregion convergence zones:

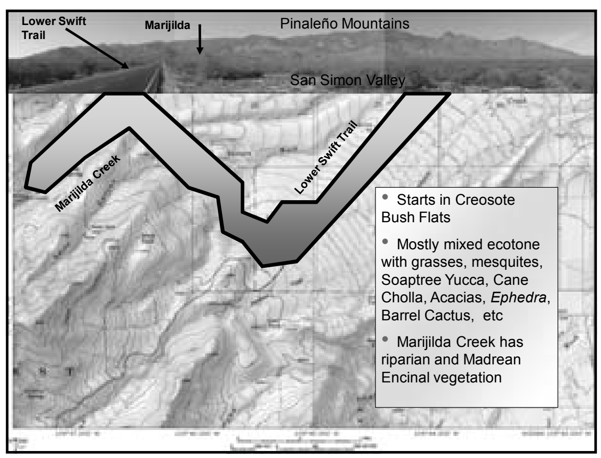
- Sonoran Desert
- Ch huahuan Desert
- Semi-desert Grasslands
- Madrean Encinal Woodland
- Petran (Mogollon) Montane
- R parian





Brown and Lowe 1980

Marijilda Canyon and Lower Swift Trail



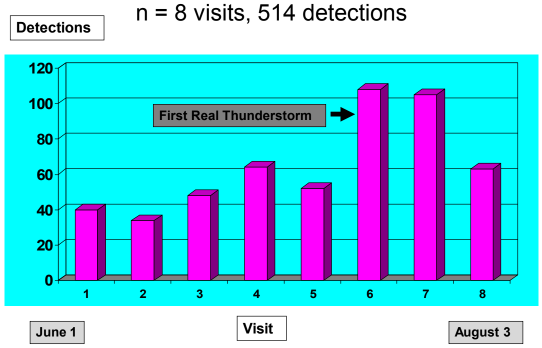
Marijilda Lizard Surveys: Basal Road Transect

- 4 mi boulder-lined dirt road (FR 57)
- 3 mph (CL4WD)
- Tally lizards by 0.1 mi segment
- 1960's Nickerson & Mays
- 2003 weekly visits
- 2004- 2009 opportunistic
- 2010 re-initiate surveys monthly
- ¿2011- 2080?

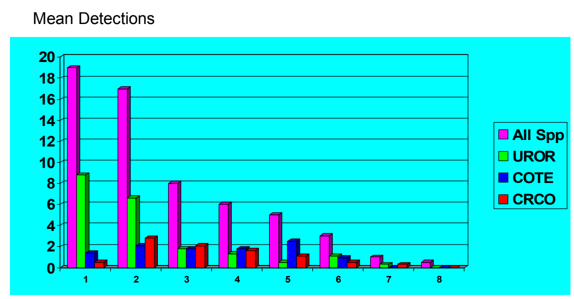
2003 Marijilda Road Lizard Surveys

Common Name	Scientific Name	Number	Percent
Ornate Tree Lizard	*Urosaurus ornatus*	163	32
Greater Earless Lizard	*Cophosaurus texana*	93	18
Eastern Collared Lizard	*Crotaphytus collaris*	77	15
Desert Spiny Lizard	*Sceloporus magister*	58	11
Common Side-blotched Lizard	*Uta stansburiana*	37	7
Tiger Whiptail	*Aspidoscelis tigris*	26	5
Clark's Spiny Lizard	*Sceloporus clarki*	18	4
Unknown lizard	*Lagartijas mysteriosas*	18	4
Striped and/or spotted whiptail	*A. uniparens/flagellicauda*	10	2
Zebra-tailed Lizard	*Callisaurus draconoides*	9	2
Round-tailed Horned Lizard	*Phrynosoma modestum*	2	<1
Sonoran Whipsnake	*Masticophis bilineatus*	2	<1
Gopher Snake	*Pituophis catenifer*	1	<1
TOTAL	9 lizard species, 2 snake species "confirmed"	514	*ca.* 100

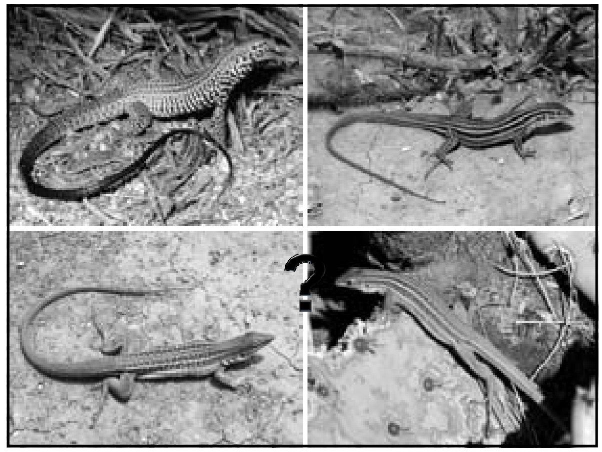
2003 Marijilda Lizard Surveys
n = 8 visits, 514 detections



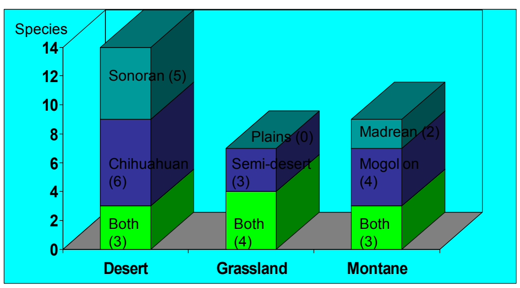
2003 Marijilda Lizard Distribution by 0.5 mi Segment for Total and Three Most Common Species



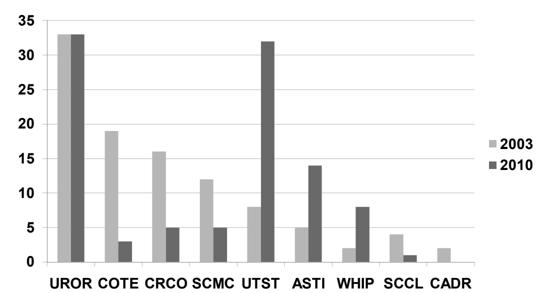
Common Name	Scientific Name	Comments
Gila Spotted Whiptail	*Aspidoscel s flagell cauda*	+/- *A. sonorae* genetics issue
Tiger Whiptail	*A. tigris*	
Desert Grassland Whiptail	*A. uniparens*	
Zebra tailed Lizard	*Callisaurus draconoides*	
Western Banded Gecko	*Coleonyx variegatus*	
Greater Earless Lizard	*Cophosaurus texana*	
Eastern Collared Lizard	*Crotaphytus collaris*	
Long nosed Leopard Lizard	*Gambe ia wislizenii*	
Gila Monster	*Heloderma suspectum*	
Texas Horned Lizard	*Phrynosoma cornutum*	Only detected on lower Swift Trail
Greater Short horned Lizard	*P. hernandesi*	
Round tailed Horned Lizard	*P. modestum*	
Regal Horned Lizard	*P. solare*	
Great Plains Skink	*Plestiodon obsoletus*	
Twin spotted Spiny Lizard	*Sceloporus bimaculosus*	Needs genetics for *S. mag ster* complex issue
Desert Spiny Lizard	*S. magister*	Needs genetics for *S. mag ster* complex issue
Clark's Spiny Lizard	*S. clarki*	
Yarrow's Spiny Lizard	*S. jarrovii*	
Ornate Tree Lizard	*Urosaurus ornatus*	
Common Side blotched Lizard	*Uta stansbur ana*	
TOTAL	20 species	



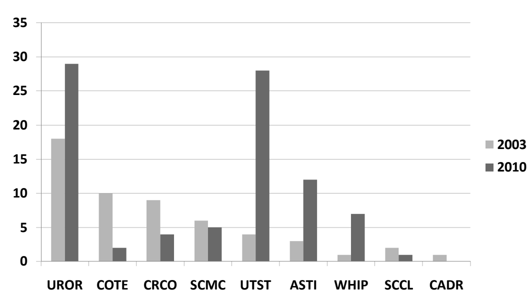
Biogeographic Contributions to Lizard Community Structure in the Marijilda/Lower Swift Trail Area

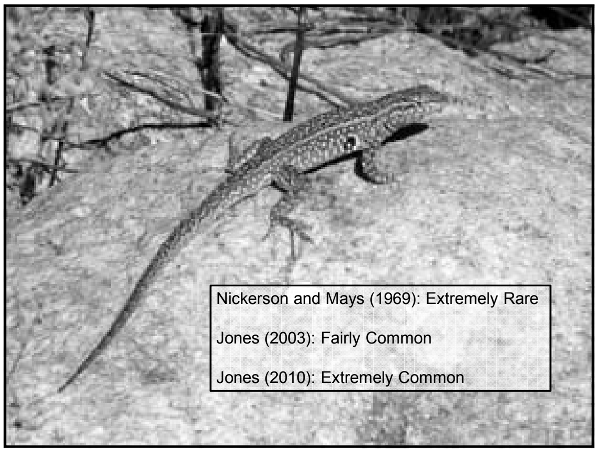


Observed Changes in Lizard Relative Abundance for Common Species, between 2003 (8 visits) and 2010 (3 visits), Marijilda Road (FR 57) Transect



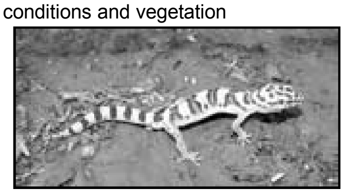
Observed Changes in Mean Numbers of Lizards Tallied in 2003 and 2010, Marijilda Road (FR 57) Transect

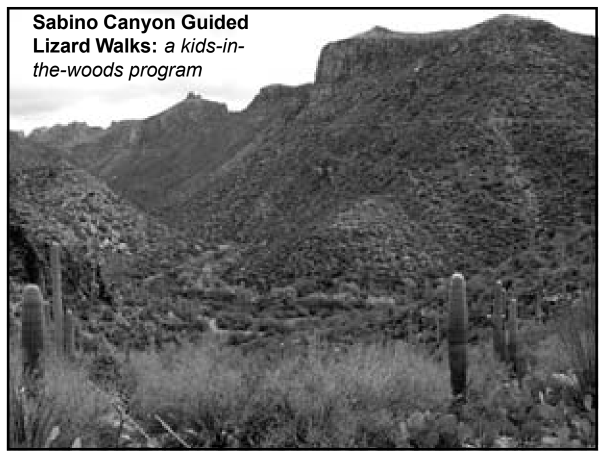




Components of a Long-term Monitoring Plan

- **Road Transect, Marijilda Road (FR 57)**
- **Walking transects or plots for *Aspidoscelis***
- Extra effort required for *Phrynosoma*, *Coleonyx*, *Heloderma, Elgaria, Plestiodon*
- Other replicates nearby (desert flats/montane)
- *Aspidoscelis* and *Sceloporus magister* complex genetics
- Monitor environmental conditions and vegetation
- A monitoring network?





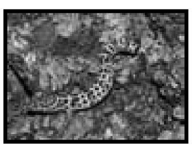
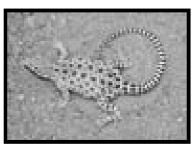
Lizards of Sabino Canyon, Pima Co., Arizona

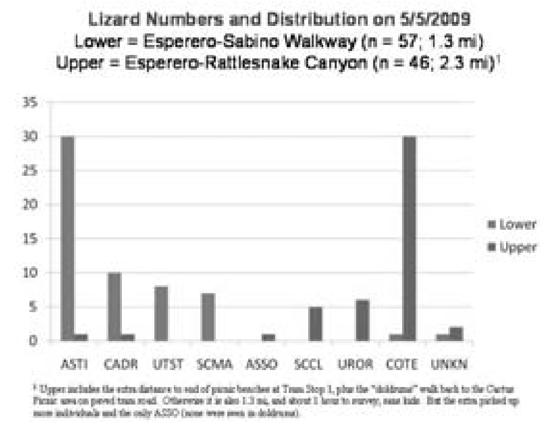
- Western Banded Gecko, *Coleonyx variegatus*
- Eastern Collared Lizard, *Crotaphytus collaris*
- Long-nosed Leopard Lizard, *Gambelia wislizenii*
- Zebra-tailed Lizard, *Callisaurus draconoides*
- Greater Earless Lizard, *Cophosaurus texanus*
- Clark's Spiny Lizard, *Sceloporus clarkii*
- Desert Spiny Lizard, *S. magister*
- Common Side-blotched Lizard, *Uta stansburiana*
- Ornate Tree Lizard, *Urosaurus ornatus*
- Regal Horned Lizard, *Phrynosoma solare*
- Great Plains Skink, *Plestiodon obsoletus*
- Tiger Whiptail, *Aspidoscelis tigris*
- Canyon Spotted Whiptail, *A. burti*
- Sonoran Spotted Whiptail, *A. sonorae* (Q)
- Gila Spotted Whiptail, *A. flagellicauda* (Q)
- Gila Monster, *Heloderma suspectum*
- Madrean Alligator Lizard, *Elgaria kingii*


Photograph © Tom Brennan

Results 2009 Resultados

- 33 Lizard Walks
- 1400 lizards
- 42 lizards per group per lizard walk
- 12 (13) of 16 (17) species seen
- 51% Greater Earless Lizard

Predictions (red flags) over the next 70 years to support Climate Change Hypothesis

- ⇩ common species
- ⇧ uncommon to absent species
- Counterpart species reversal (e.g., Sonoran vs. Chihuahuan)
- Transect-elevation demographic shifts
- ⇧⇩ desert species
- ⇧⇩ grassland species
- ⇩ montane species
- ⇩ riparian species
- Vegetation changes
- Climate and wea her changes
- Parthenogenetic vs. gonochoristic whiptail changes

Complicating Variables

- Weed-species whiptails
- Shifts in vegetation do not imply shift in structure (e.g., Creosote Flats to rocky foothills)
- Vegetation changes may be different pace
- Natural history variables (e.g., competition, predation)
- Extinction model is oversimplistic

Follow up on observations not showing expected trends

The Pitch

- Proposed support, Coronado NF, as FY 2011 Program of Work, as “targeted climate change monitoring” (USFS National Roadmap July 2010)
- Match or support from RMRS
- AGFD and monitoring network (replicates elsewhere, like Block blocks)
- Partners needed for physical characterization and monitoring of vegetation communities and climate change
- RMRS has this expertise, plus the statistical savvy
- Project is primed for grant support

Acknowledgments: SW PARC, Arizona Game and Fish Department, Sabino Canyon Volunteer Naturalists, Rocky Mountain Research Station, Gary Payne, Anne Casey, Elisa Baca, Rick Gerhart, Phil Rosen, Veronica Forrest, Josh Taiz, Paul Simon, Bob Beatson, David Lazaroff, Bill Block, Sharon Coe, Deborah Finch, James Cordes, Tom Jones, Roy Averill-Murray.