Climate-Change Effects on Wildlife




Mount Rainier National Park Climate Change Workshop

March 2, 2011

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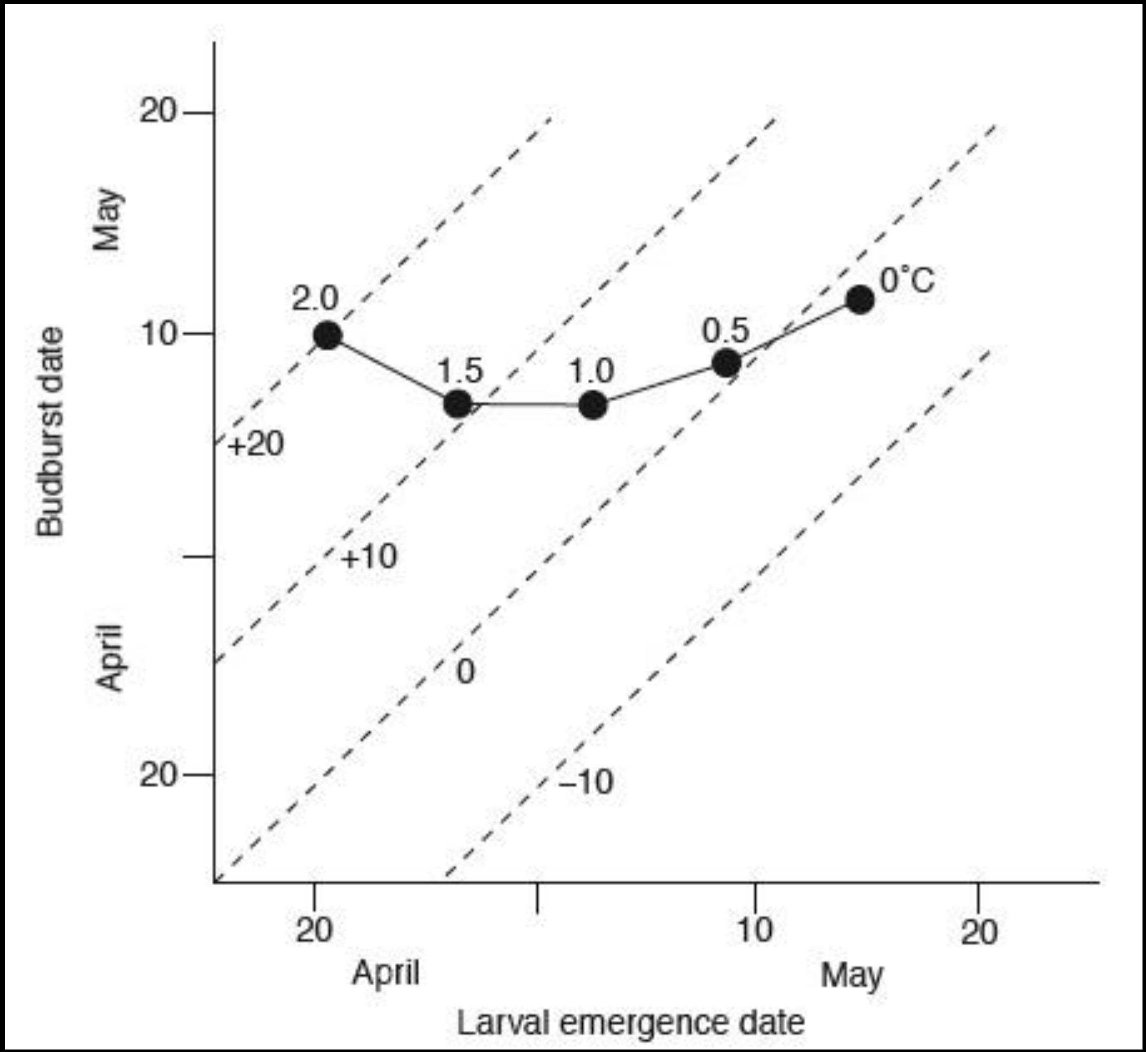
Photos: Northern Guardian News Paper

Blair Wolf, UNM

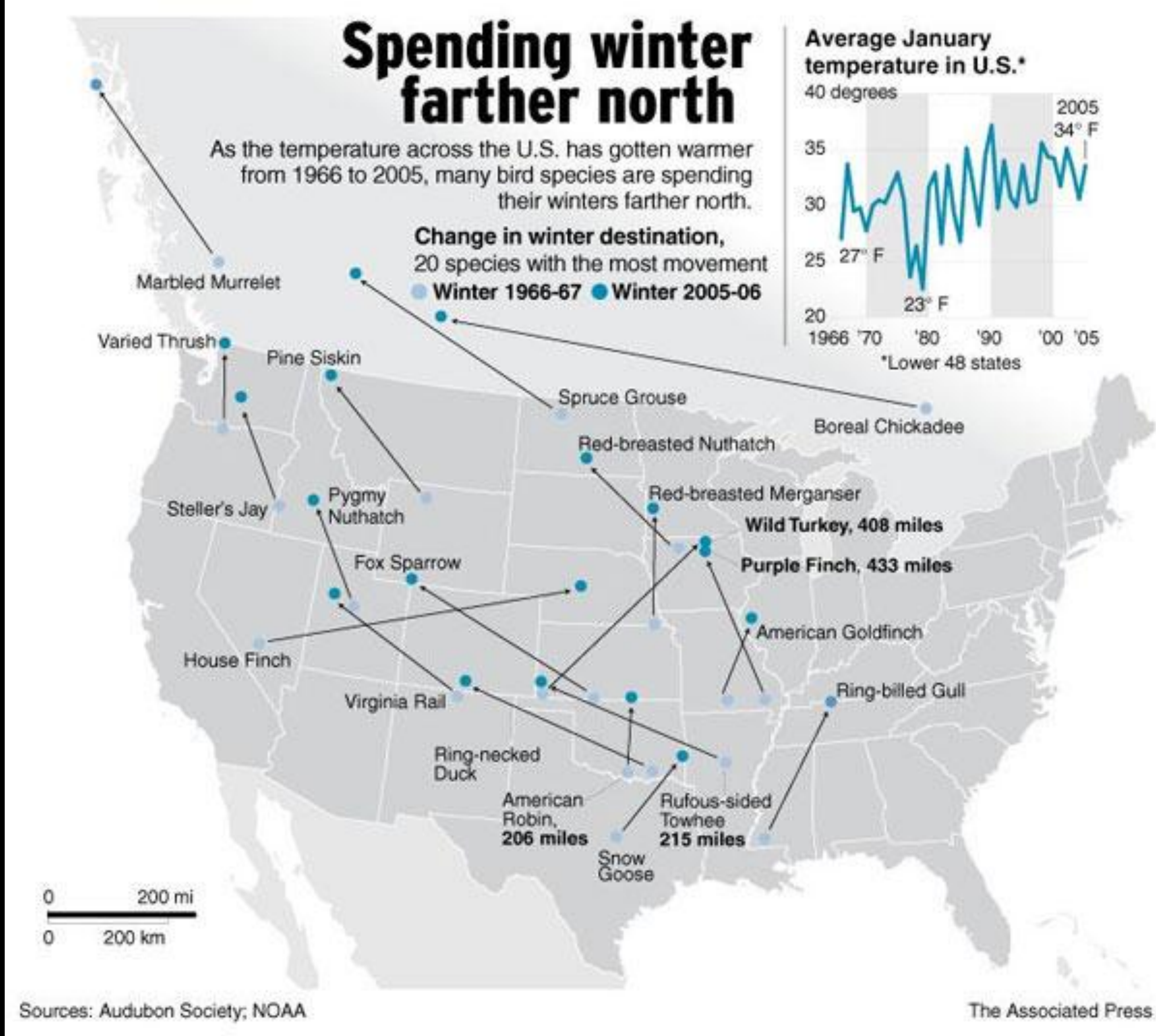
Phenology and Distributions

Earlier spring events

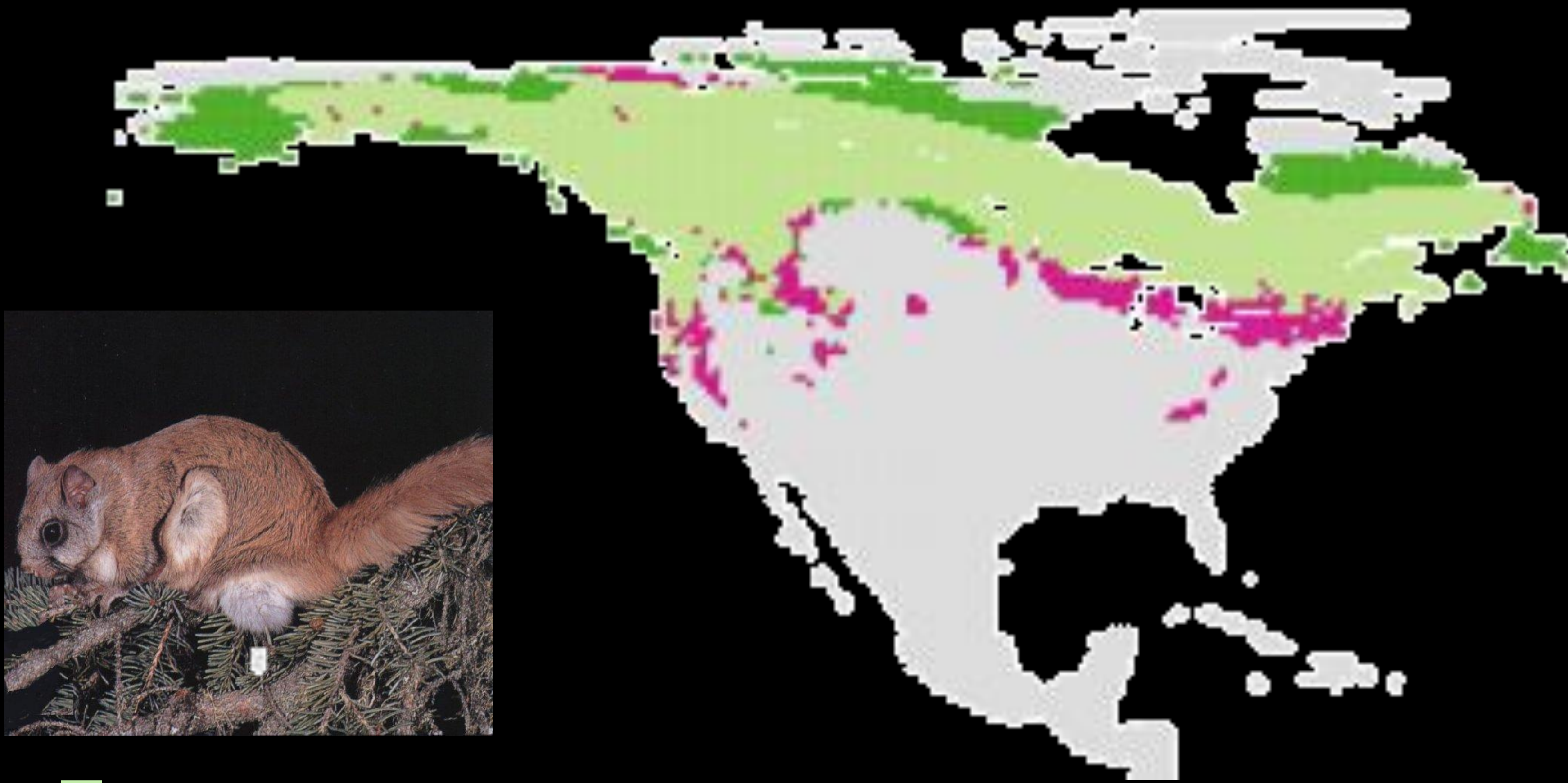




Dewar & Watt 1992

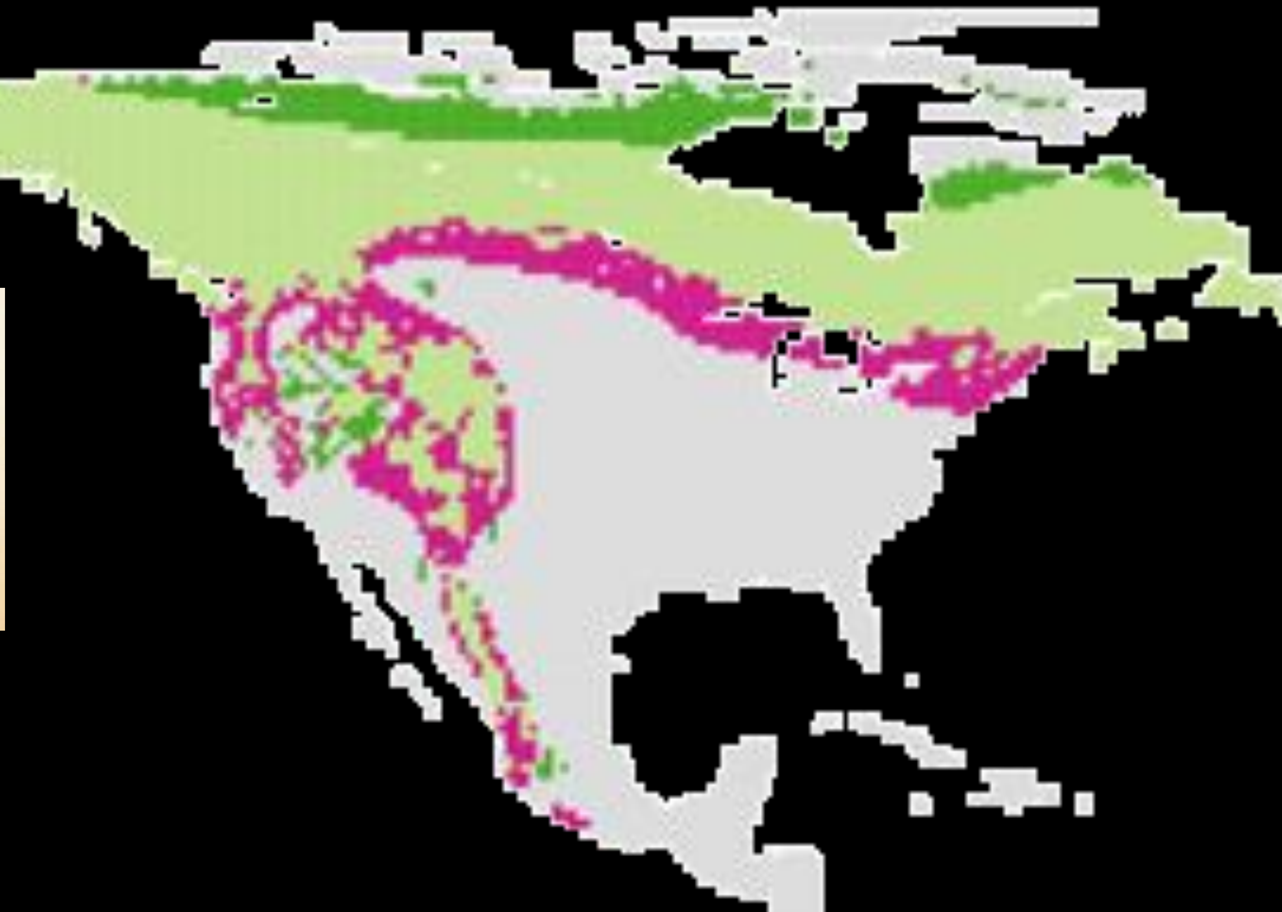

Spending winter farther north
As the temperature across the U.S. has gotten warmer from 1966 to 2005, many bird species are spending their winters farther north.
Change in winter destination,
20 species with the most movement
Winter 1966-67
Winter 2005-06
Average January temperature in U.S.*
40 degrees
35
30
25
20
1966
'70
'80
'90
'00
'05
2005
34° F
27° F
23° F
*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

Northern Flying Squirrel (HADCM3 A1B)

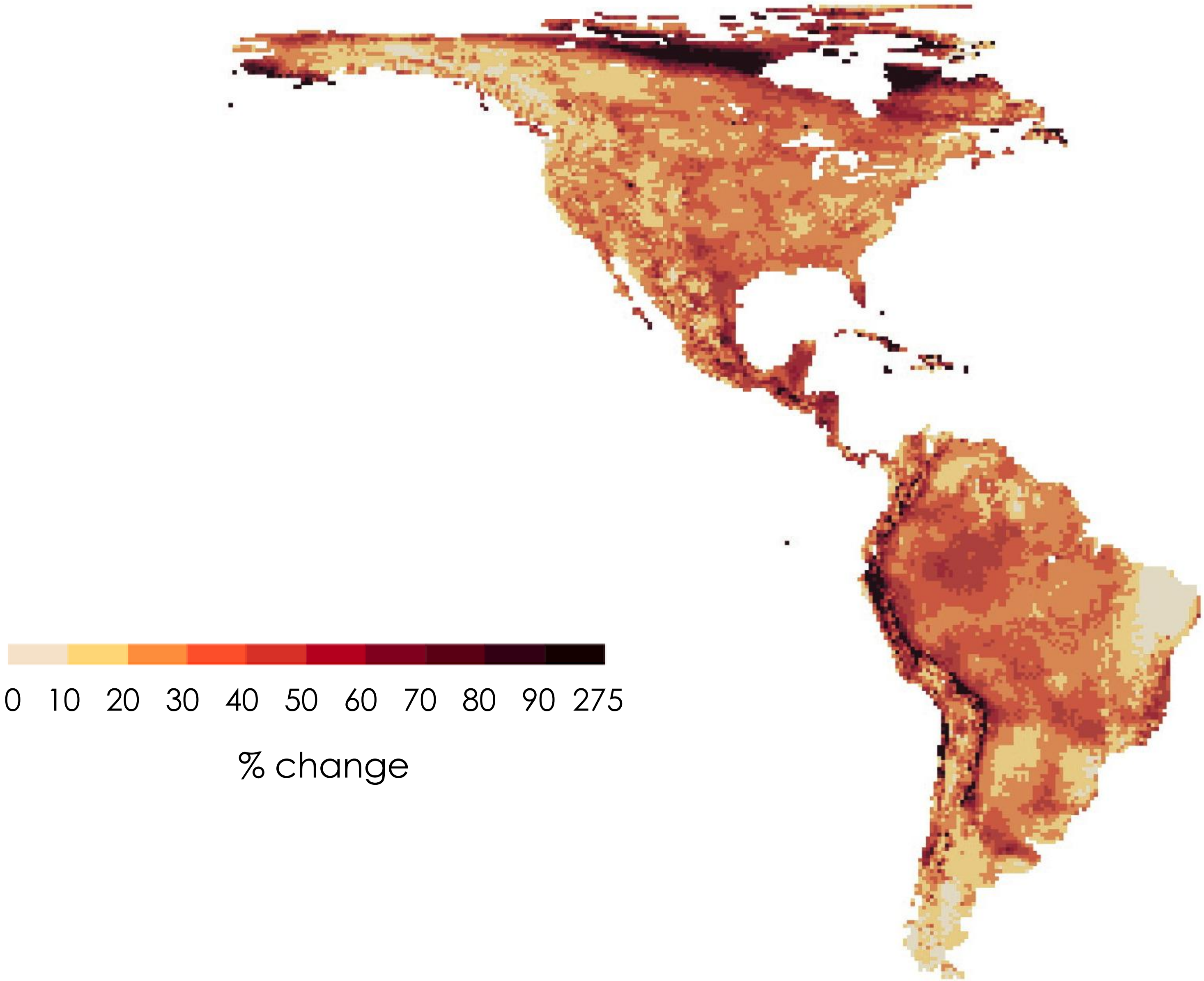


stable
expansion
contraction

Northern Goshawk (HADCM3 A1B)

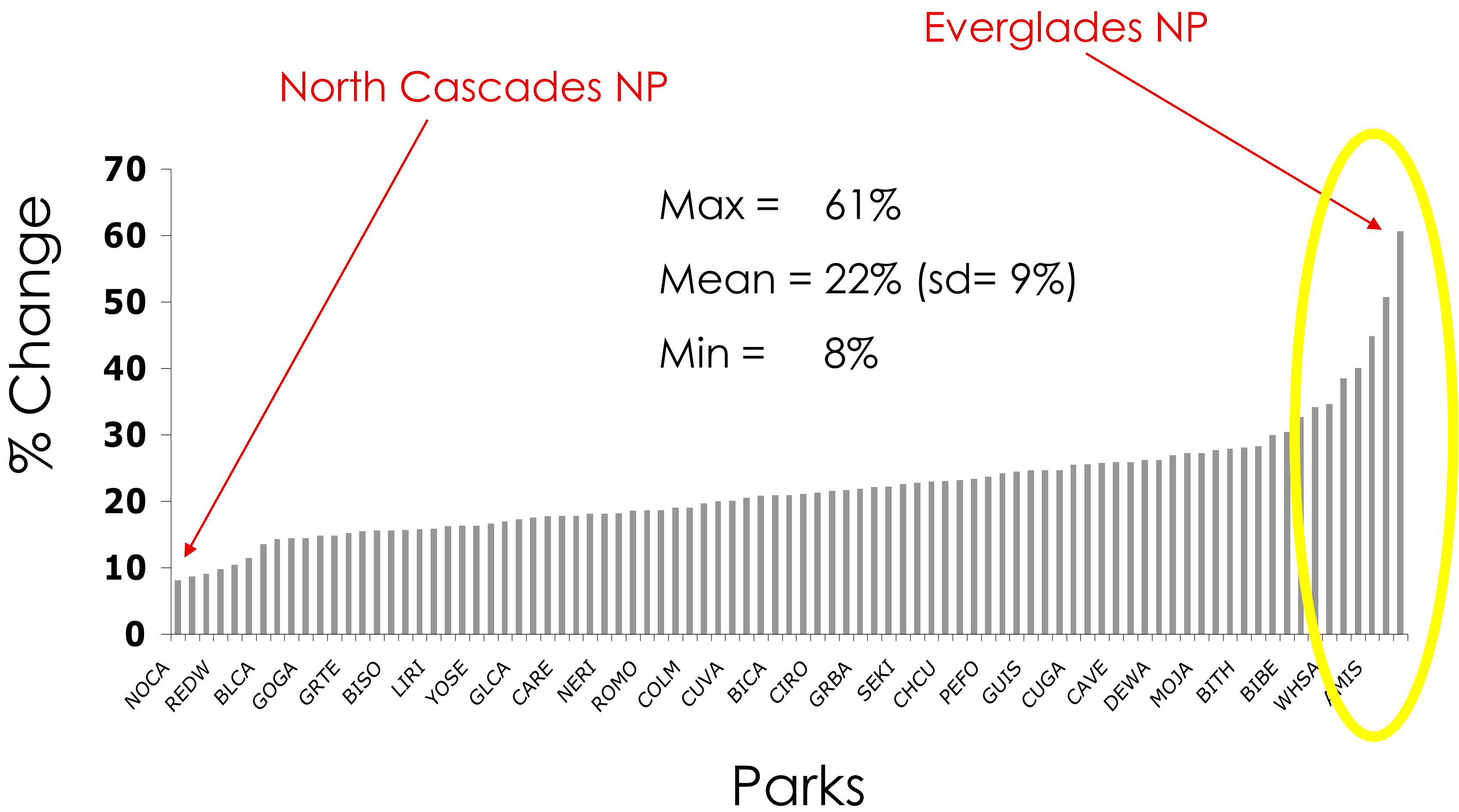


Species turnover

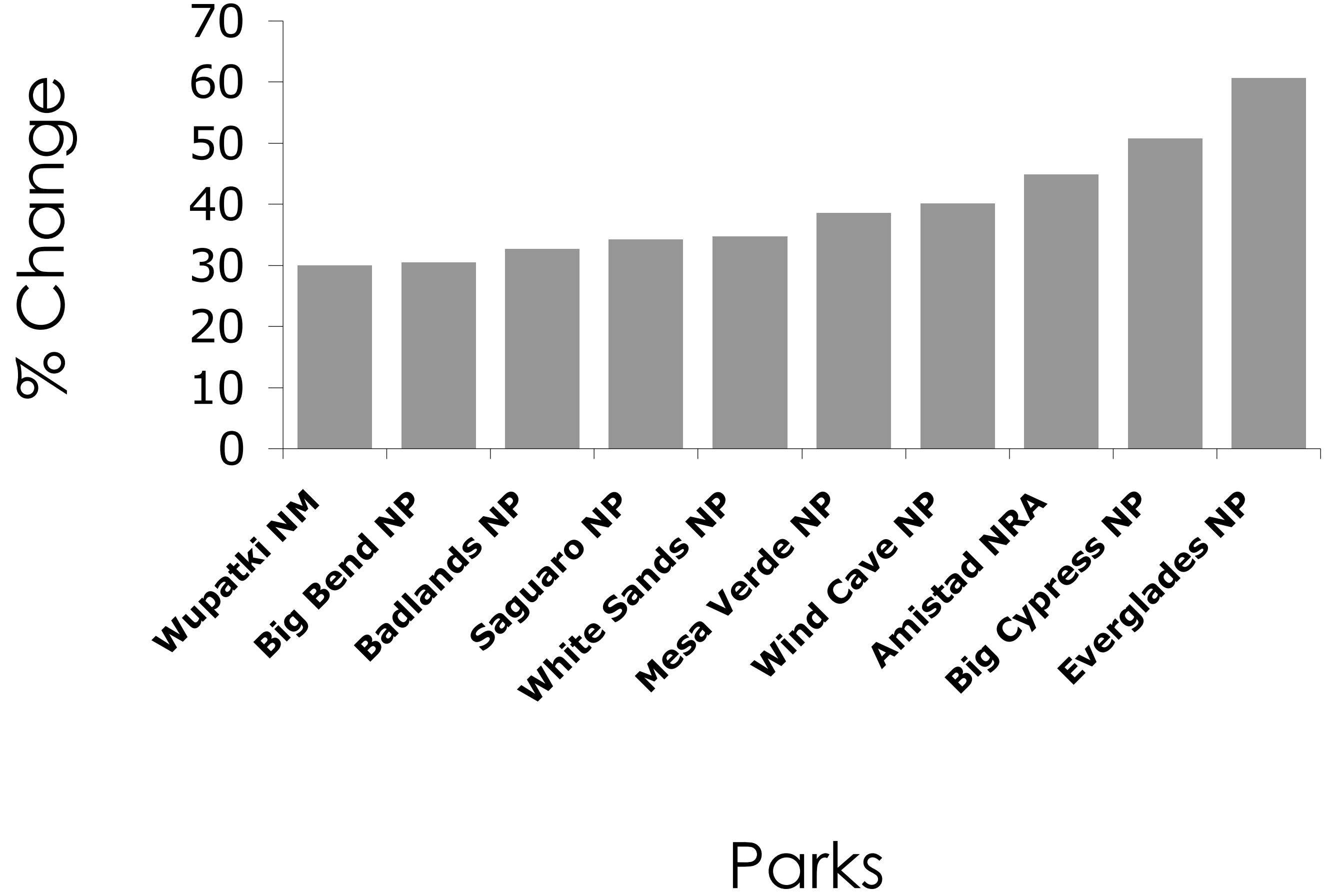


(A1B)

Species Change in National Parks



Species Change in National Parks



Potential Species Change in Badlands National Park

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Potential Losses

Western Grebe
Black Tern
Northern Pintail*
American Wigeon*
Long-eared Owl*
Brewer's Sparrow
Mountain Bluebird*
American Redstart
Eastern Phoebe
Ovenbird
Lazuli Bunting
Cedar Waxwing

Total = 168 spp.

Change
Maximum = 56%
Minimum = 29%

Potential Gains

Cassin's Sparrow
Green Heron
House Finch
Marsh Wren
Northern Cardinal

Mount Rainier National Park

Potential Losses

Common Yellowthroat
White-tailed Ptarmigan
Lincoln's Sparrow
White-breasted Nuthatch

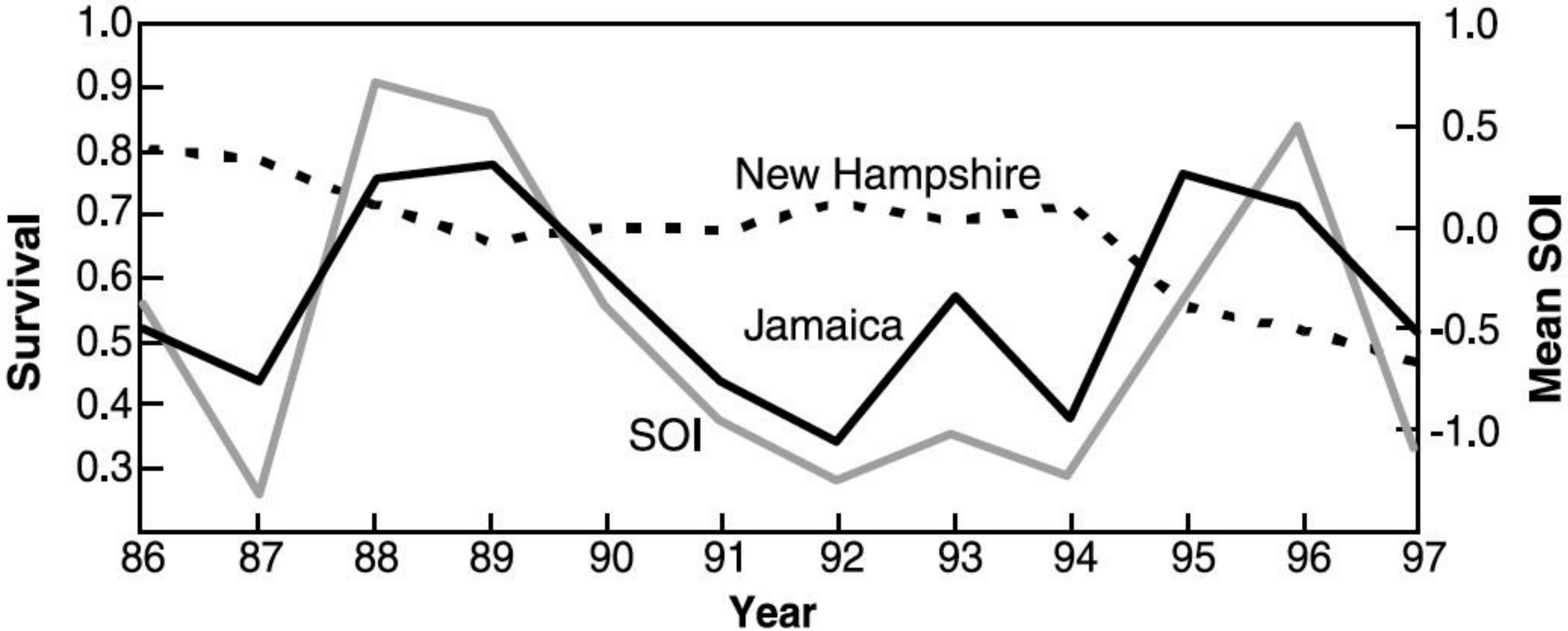
Change

Maximum = 24%
Minimum = 13%

Potential Gains

Black-chinned Hummingbird
Long-eared Owl
Canyon Wren
Ruddy Duck
Black-billed Magpie
Spotted Towhee
Vesper Sparrow
Ruby-crowned Kinglet

Sillett et al. 2000







NEWS & VIEWS

EXTINCTIONS

A message from the frogs

Andrew R. Blaustein and Andy Dobson

The harlequin frogs of tropical America are at the sharp end of climate change. About two-thirds of their species have died out, and altered patterns of infection because of changes in temperature seem to be the cause.

One of the worries about global climate change is that it will raise the transmission rates of infectious diseases[1]. On page 161 of this issue, Pounds and colleagues[2] provide compelling evidence that anthropogenic climate change has already altered transmission of a pathogen that affects amphibians, leading to widespread population declines and extinctions.

According to the Global Amphibian Assessment (GAA)[3], around a third of amphibian species (1,856) are classified globally as 'threatened'. The tenuous hold these animals have on life is especially evident in tropical America, where, for example, 67% of the 110 species of harlequin frog (*Atelopus*; Fig. 1) endemic to the region have died out in the past 20 years[3]. A pathogenic chytrid fungus, *Batrachochytrium dendrobatidis*, is implicated as the primary cause of *Atelopus* population crashes and species extinctions[4,5]. Now, Pounds *et al.* offer a mechanistic explanation of how climate change encourages outbreaks of *B. dendrobatidis* in the mountainous regions of Central and South America: night-time temperatures in these areas are shifting closer to the thermal optimum of *B. dendrobatidis*, and increased daytime cloudiness prevents frogs from finding 'thermal refuges' from the pathogen.

The authors defined an 'extinction' as

optimal growth of the pathogen. Mid-elevation *Atelopus* communities are not only the hardest hit by extinction, but they also harbour the most species, so biodiversity in these areas is in double jeopardy. These results corroborate the GAA findings[3] for a broad array of amphibians that the percentage of extinct or threatened species is largest at middle elevations. This is contrary to the expectation that higher-elevation species would be more prone

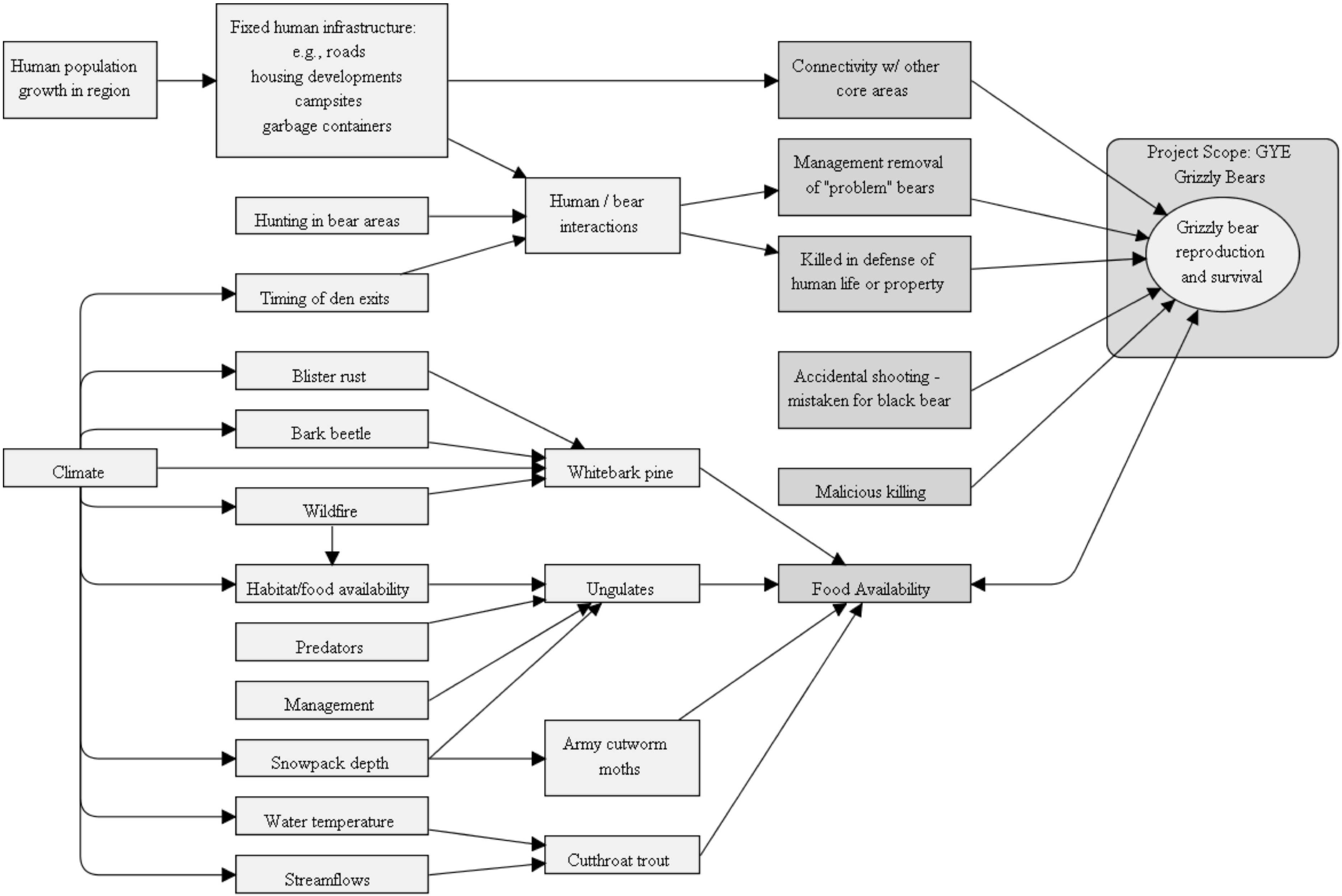
F. BREM

Figure 1 | Amphibian alarm call. The Panamanian golden frog is one of roughly 110 species of harlequin frog (*Atelopus*), many of which are dying out. Although this species still survives, its numbers have fallen significantly.

change had been stymied by the so-called 'climate–chytrid paradox', because the climatic conditions favouring chytrid growth seemed to be the very opposite of those created by current climate trends.

Pounds and colleagues' work[2] is a breakthrough as it resolves the paradox and offers a theory to explain the widespread 'enigmatic' declines of *Atelopus* and other amphibians[3]. The authors combine two disparate approaches into one unifying theory, simultaneously explaining how shifting temperatures are the ultimate trigger for the expansion of a pathogenic fungus, and that this infection is the direct cause of *Atelopus* extinctions.

There may be a tragic irony here. The oldest-known hosts of *Batrachochytrium* are African-clawed frogs (*Xenopus*)[7], first recorded in South Africa in 1938. Global trade in these frogs burgeoned in the 1950s following the development of pregnancy tests that used *Xenopus* tissue[7,8]. Museum records suggest that the pathogen achieved a worldwide distribution in the 1960s. So it seems that the expansion in one frog species through trade may have led to the extinction of other amphibian species — a totally unexpected, indirect consequence of human ingenuity.



Human population growth in region
Fixed human infrastructure: e.g., roads housing developments campsites garbage containers
Connectivity w/ other core areas
Project Scope: GYE Grizzly Bears
Management removal of "problem" bears
Human / bear interactions
Hunting in bear areas
Grizzly bear reproduction and survival
Killed in defense of human life or property
Timing of den exits
Accidental shooting - mistaken for black bear
Blister rust
Bark beetle
Climate
Whitebark pine
Malicious killing
Wildfire
Habitat/food availability
Ungulates
Food Availability
Predators
Management
Army cutworm moths
Snowpack depth
Water temperature
Cutthroat trout
Streamflows

Invasive Species






Species' Sensitivities to Climate Change

Physiological factors

Sensitive habitats

Dispersal abilities

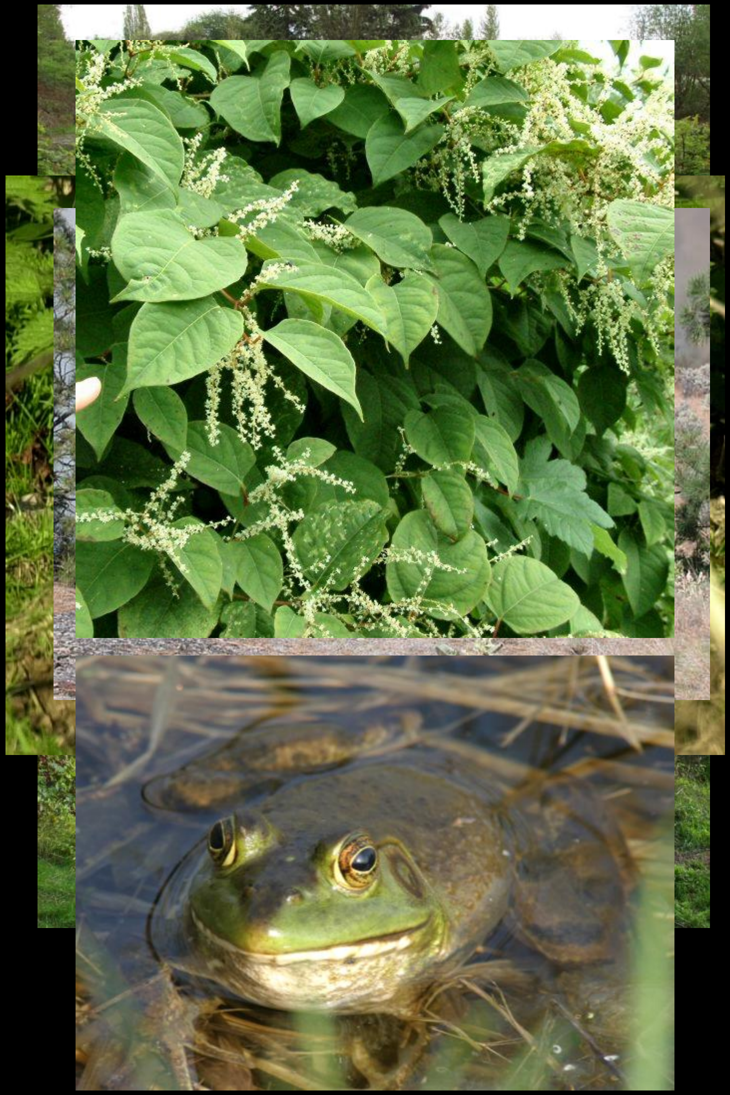
Population growth rates

Interspecific interactions

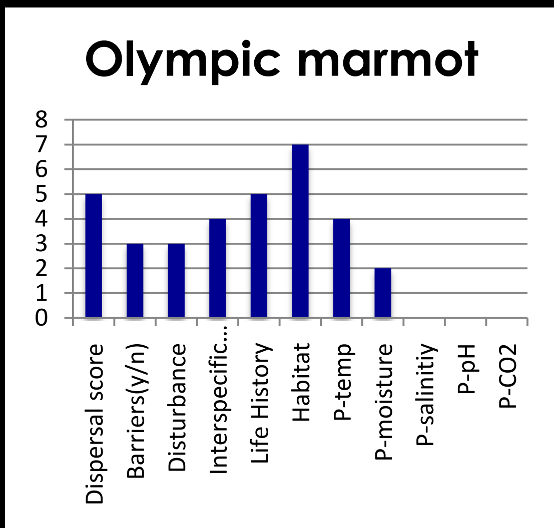
Relative location

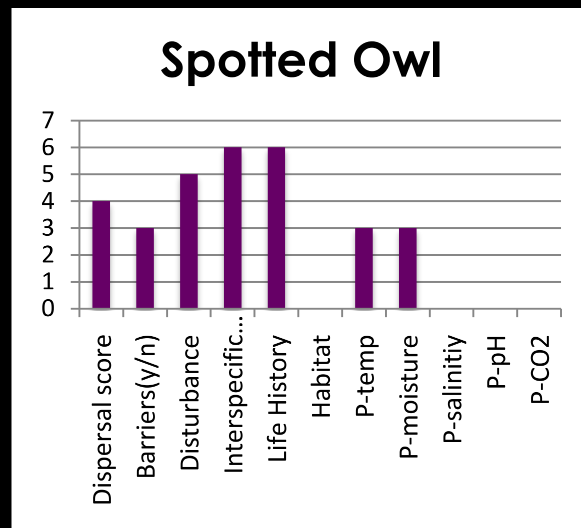
Sensitive disturbance regimes

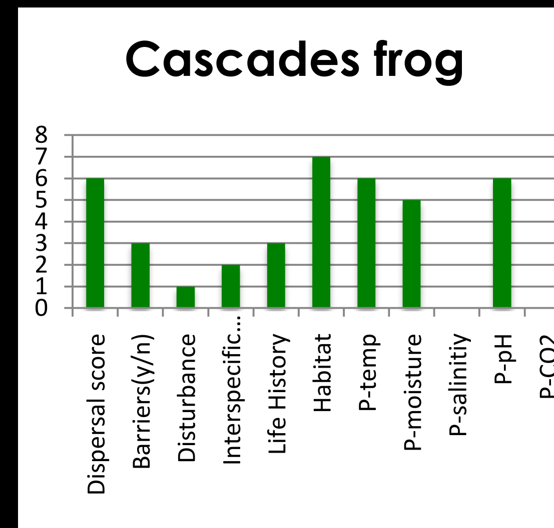
Impacts of other stressors



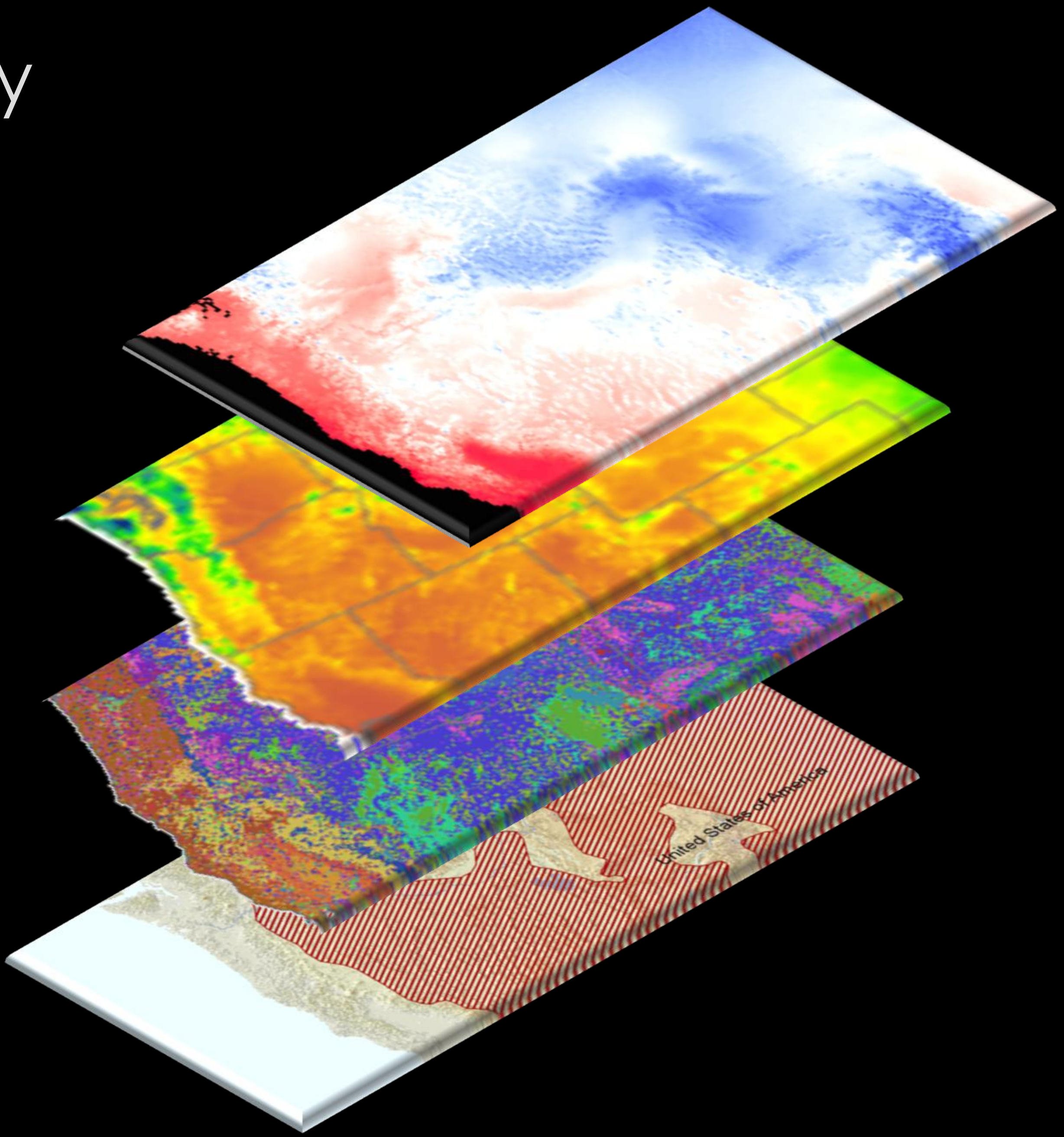
Sensitivities to climate change







Vulnerability



Craig Bienz