

Main Points

1) Demographic PVA wrap-up

- Example: demographic sensitivity of moose to bottom-up and top-down drivers
- Example: stage-structured matrices for hirola as a guide to conservation
- extinction debts and refugee species

2) Conservation above the level of species

- defining “stakeholders”
- Example: sage grouse as umbrella species in the Intermountain West

Pre-reading: Tuesday 26 September: NA

Thursday 28 September: NA

Field Trip: Thursday 28 September. Meet 920 sharp outside Berry Center entrance on Lewis. If you need Jake to contact your professor from an earlier class, let him know.

Presentation #1 Groups: must meet with Jake before 3 October.

Extra Credit: due Thursday 28 September at 5pm as a .doc emailed to Jake. Help session Tuesday 26 September.

Terms: sensitivity, refugee species, extinction debt, ecosystem management, stakeholders

Example Without Correlations in Vital Rates

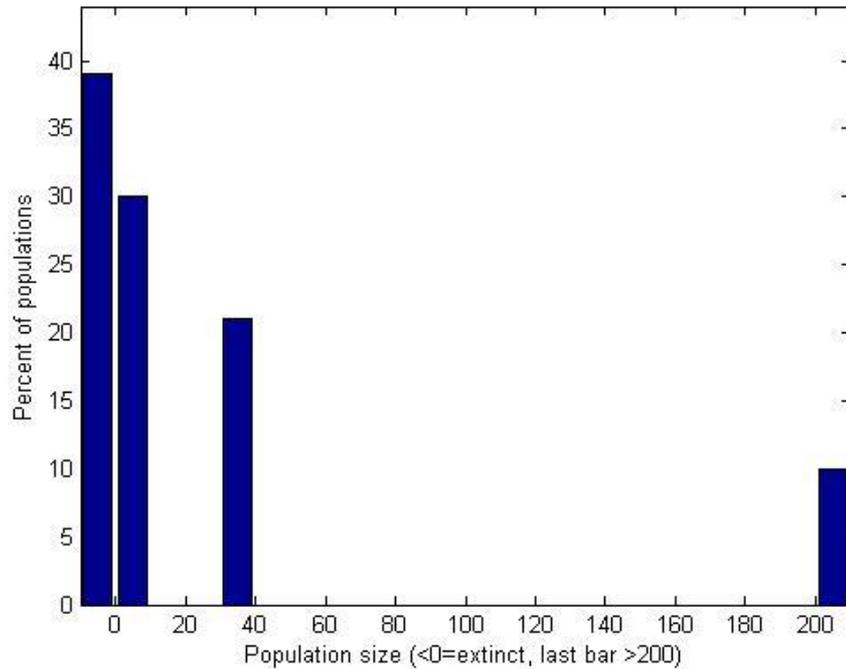
$$\begin{array}{c} \bar{A} \\ \left[\begin{array}{ccc} 1 & 0.1 & 1 \\ 0.8 & 0 & 0 \\ 0 & 0.8 & 0.09 \end{array} \right] \end{array} * \begin{array}{c} n_0 \\ \sim \\ \left[\begin{array}{c} 10 \\ 10 \\ 10 \end{array} \right] \end{array} = \begin{array}{c} n_1 \\ \sim \\ \left[\begin{array}{c} 21 \\ 8 \\ 8.9 \end{array} \right] \end{array} \quad \lambda = 37.9/30 = 1.26$$

$$\begin{array}{c} \bar{A} \\ \left[\begin{array}{ccc} 0.1 & 1 & 0.1 \\ 0.08 & 0 & 0 \\ 0 & 0.08 & 0.9 \end{array} \right] \end{array} * \begin{array}{c} n_0 \\ \sim \\ \left[\begin{array}{c} 10 \\ 10 \\ 10 \end{array} \right] \end{array} = \begin{array}{c} n_1 \\ \sim \\ \left[\begin{array}{c} 12 \\ 0.8 \\ 9.8 \end{array} \right] \end{array} \quad \lambda = 22.6/30 = 0.75$$

Distributions of Population Sizes After 5 years

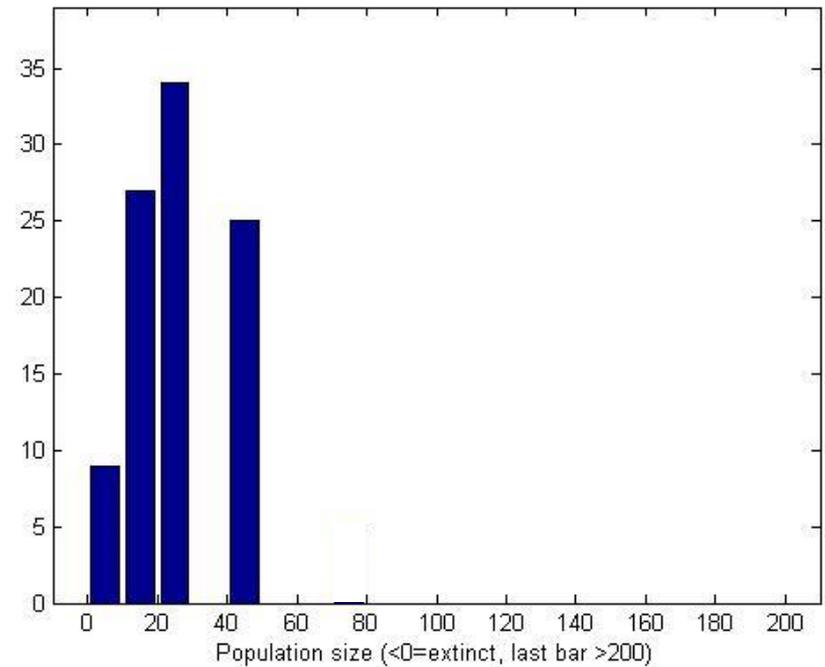
Correlations in vital rates

λ_t 's = 1.83, 0.18



No correlations in vital rates

λ_t 's = 1.26, 0.75



The Concept of Demographic Sensitivity

- **Demographic sensitivity = how small changes in a vital rate influence λ**

The Concept of Demographic Sensitivity

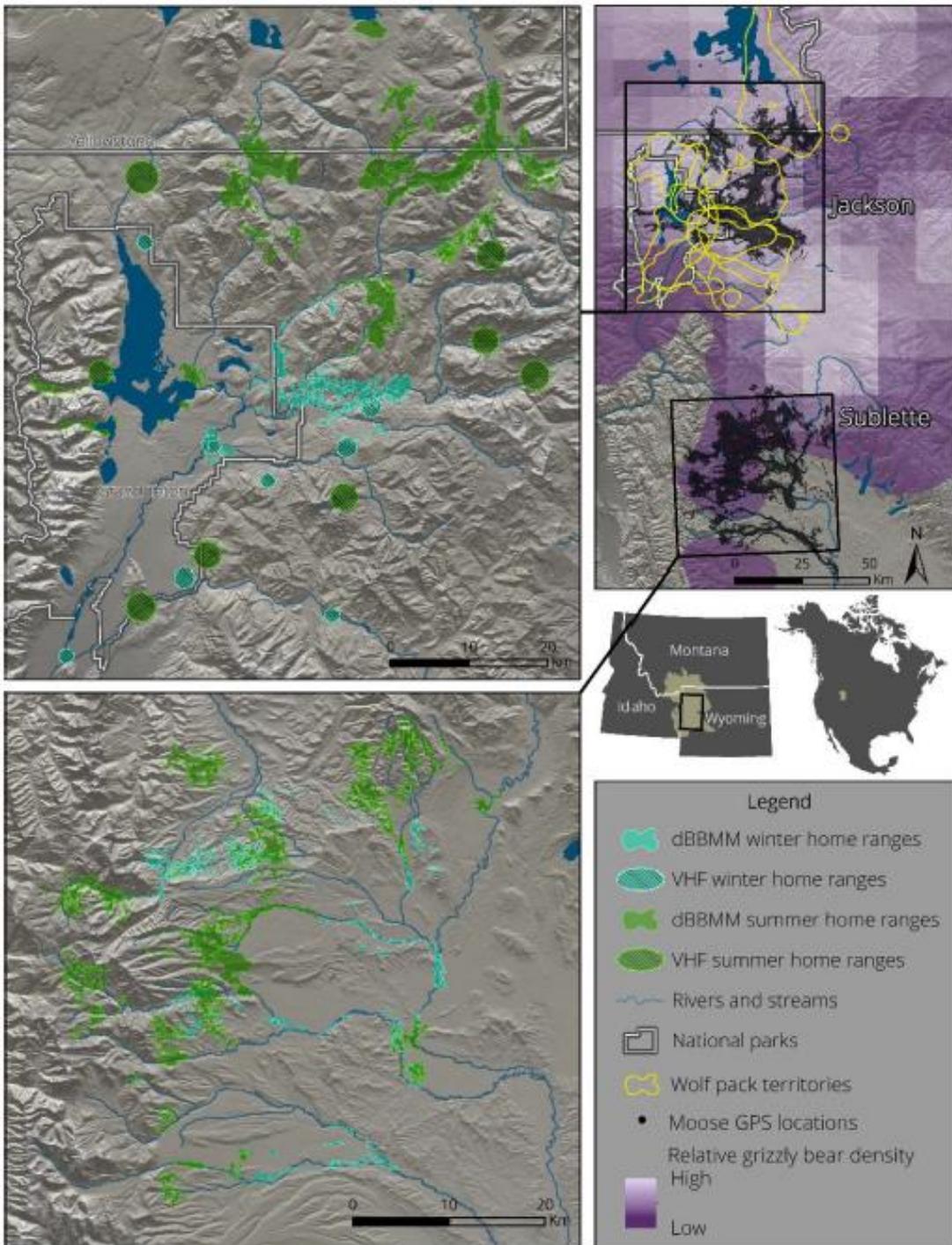
- **Demographic sensitivity** = how small changes in a vital rate influence λ
- **Used in age- or stage-structured populations to target age/stage classes for conservation**



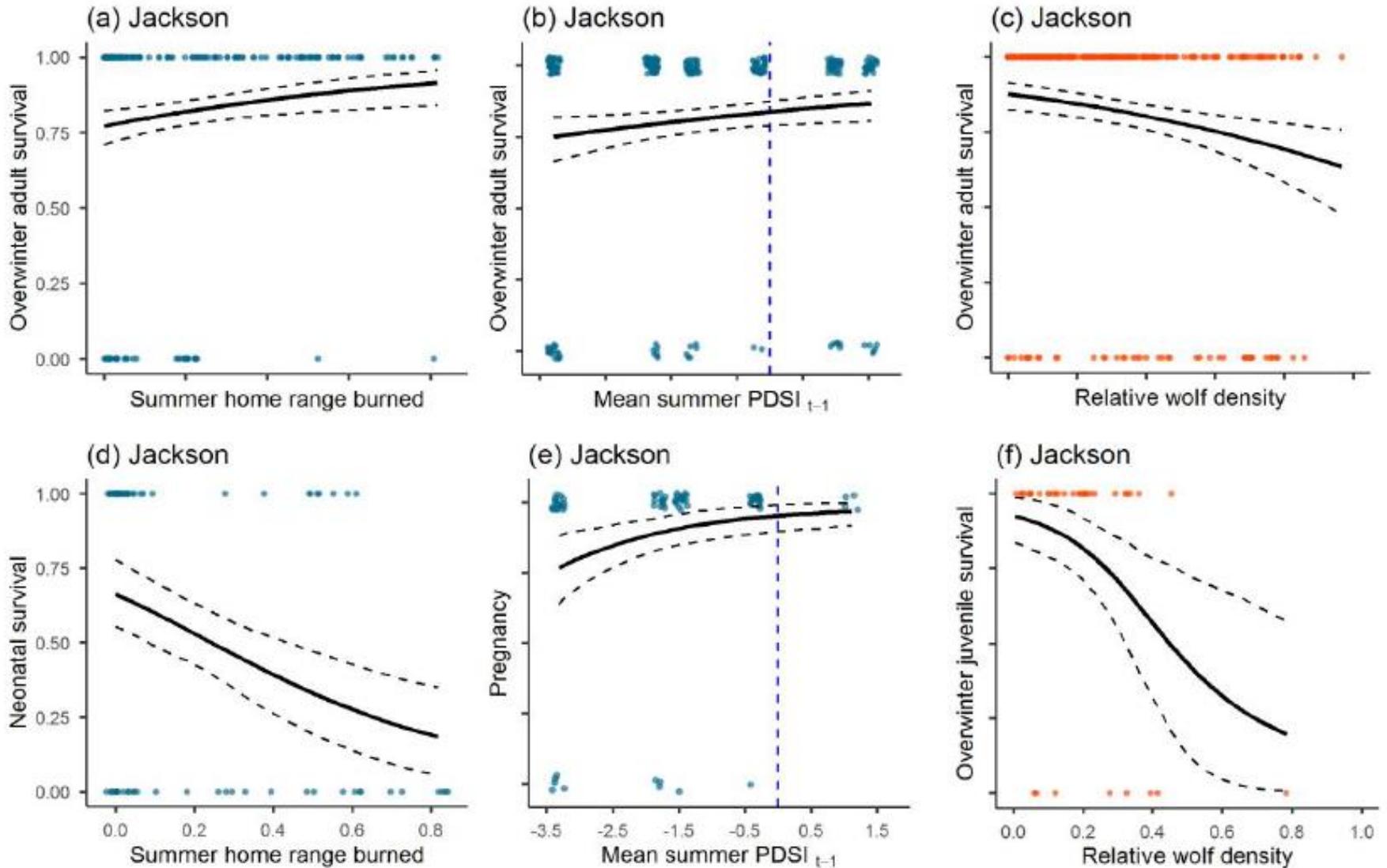
$$\lambda = \begin{bmatrix} 0 & 0 & (S_a F T) \\ S_j & 0 & 0 \\ 0 & S_y & S_a \end{bmatrix}$$

Moose Demographics in Sublette and Teton Counties

- Differ in exposure to predators and fire
- Measured vital rates through time to build stage-structured matrix models



Stage-specific Vital Rates

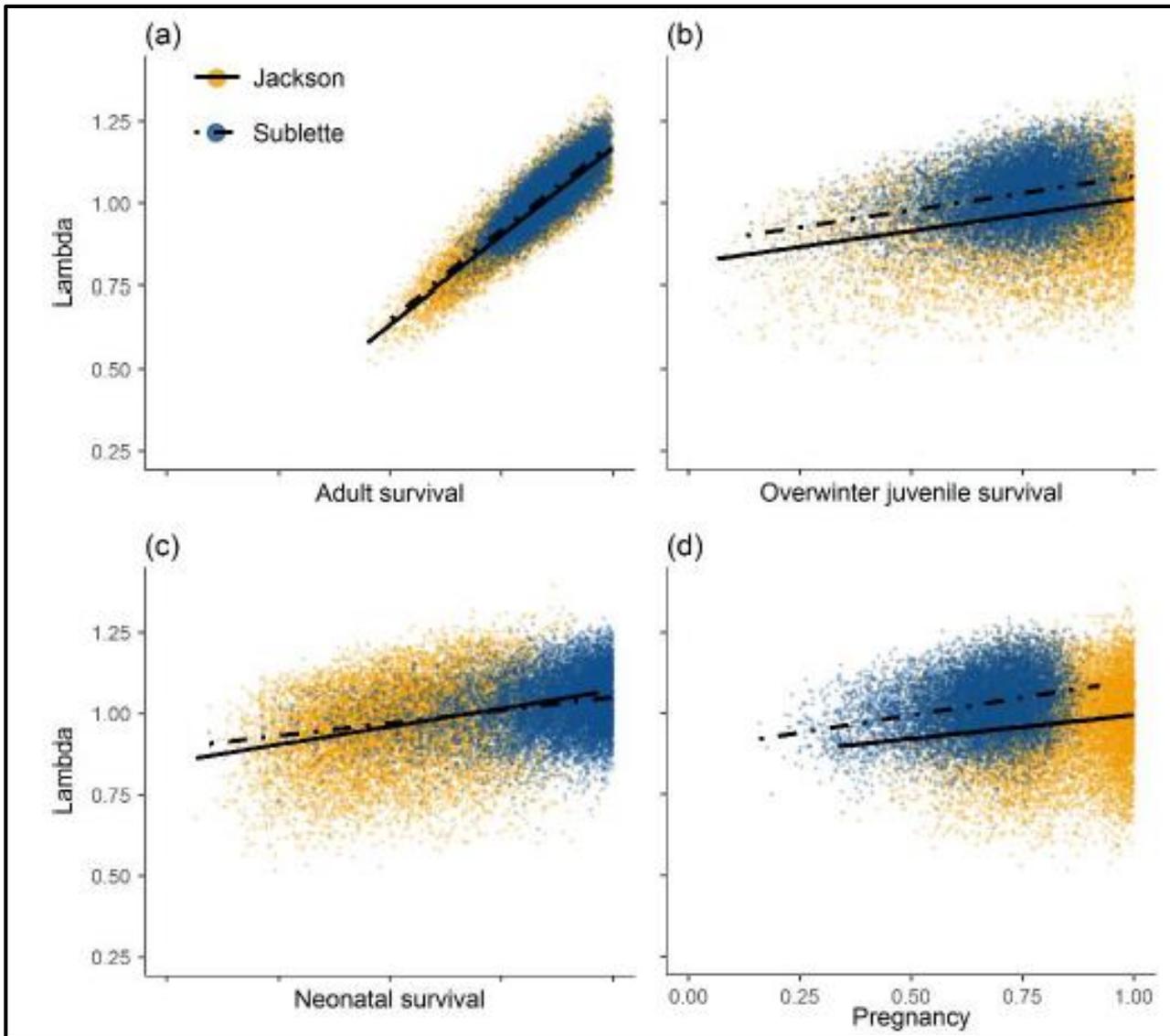


Discussion Q:

If we plot λ as a function of vital rates, we see differences in sensitivity to vital rates.

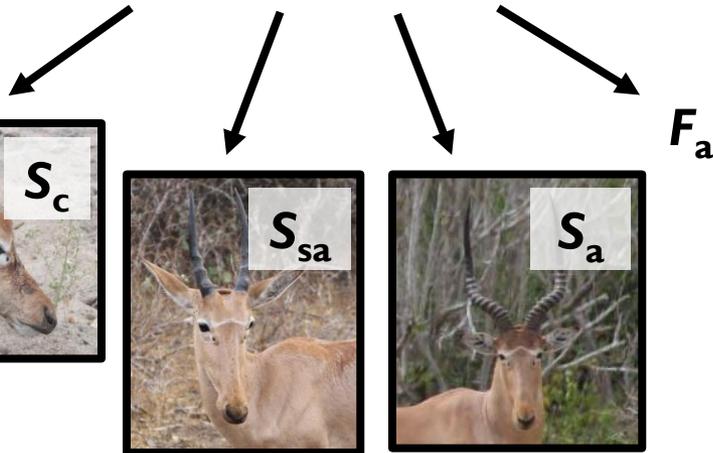
What are those differences?

How might they be used to guide conservation efforts?

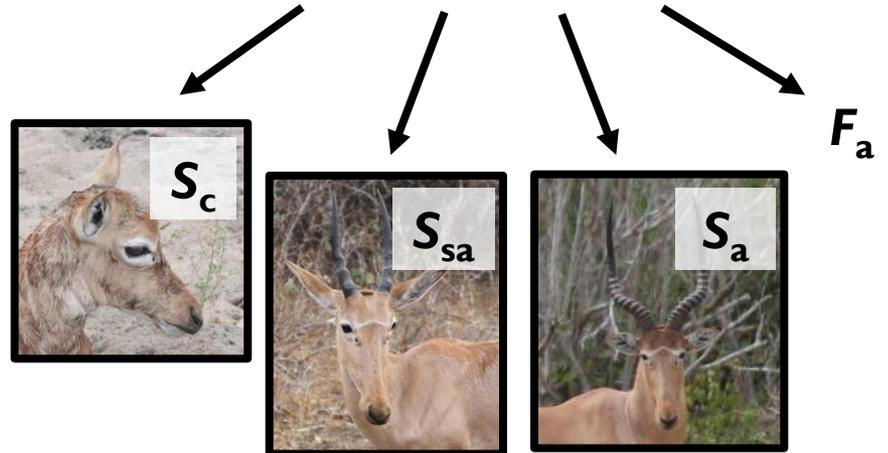


Distinguishing Demographic Impacts from Demographic Sensitivities

predation



range quality

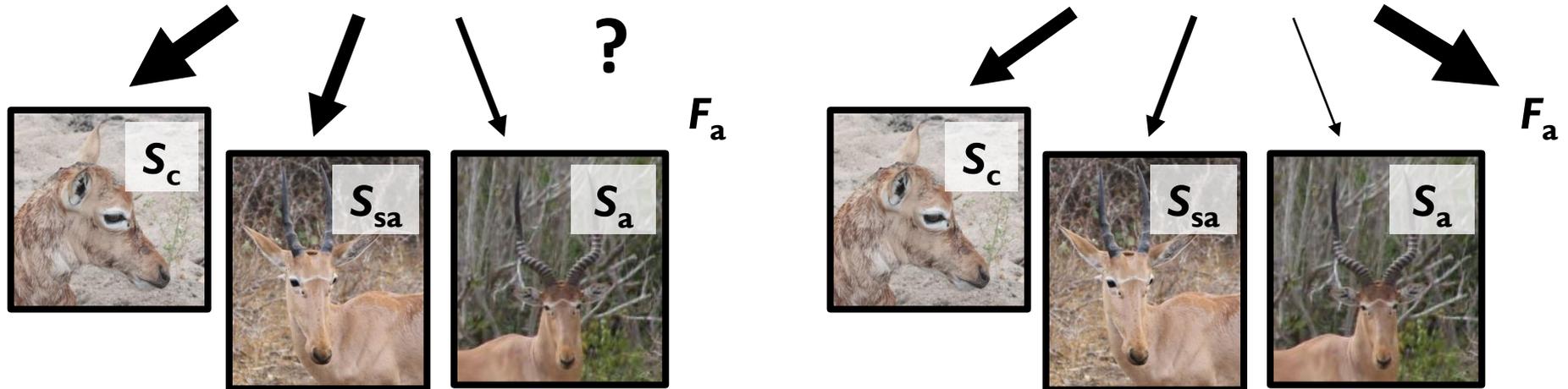


Distinguishing Demographic Impacts from Demographic Sensitivities

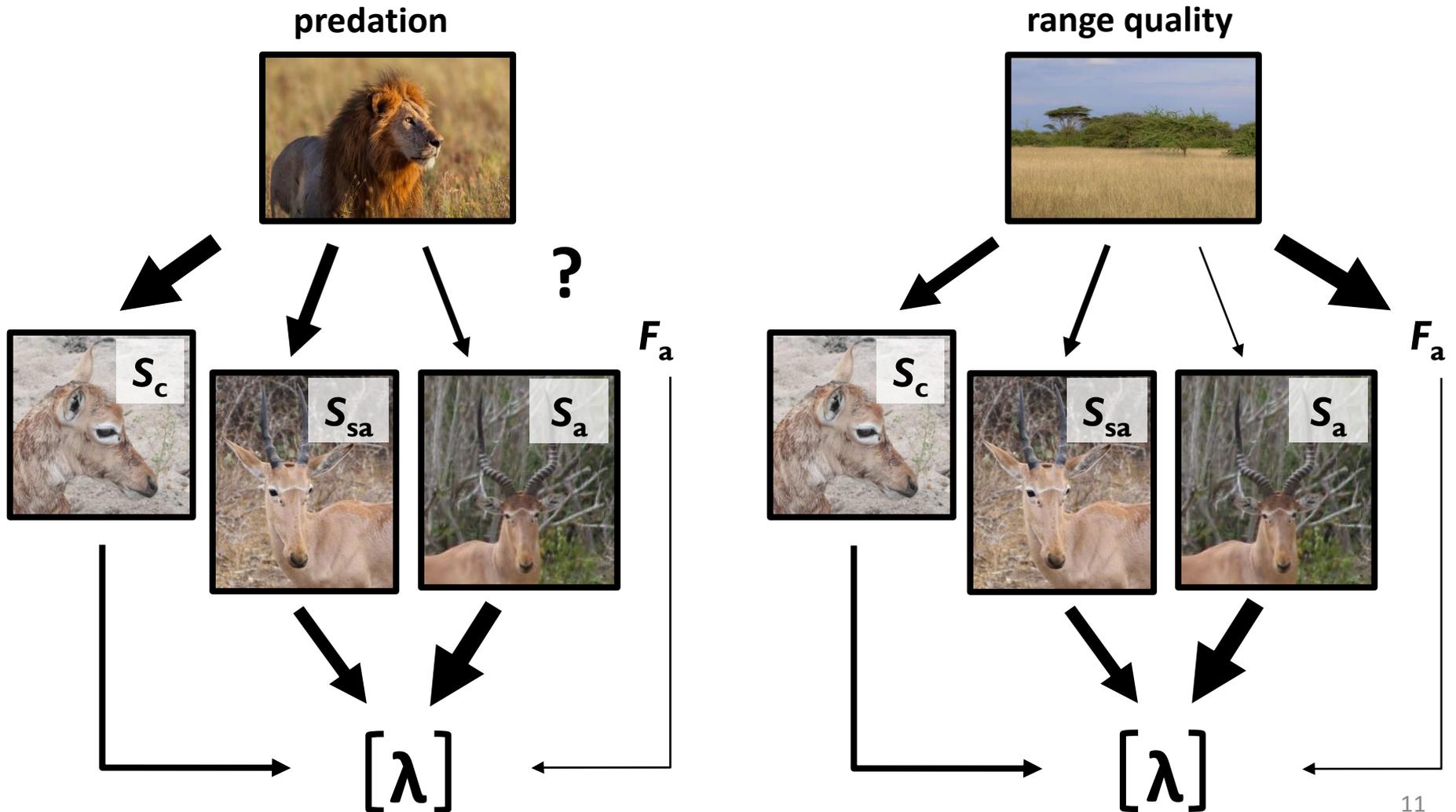
predation



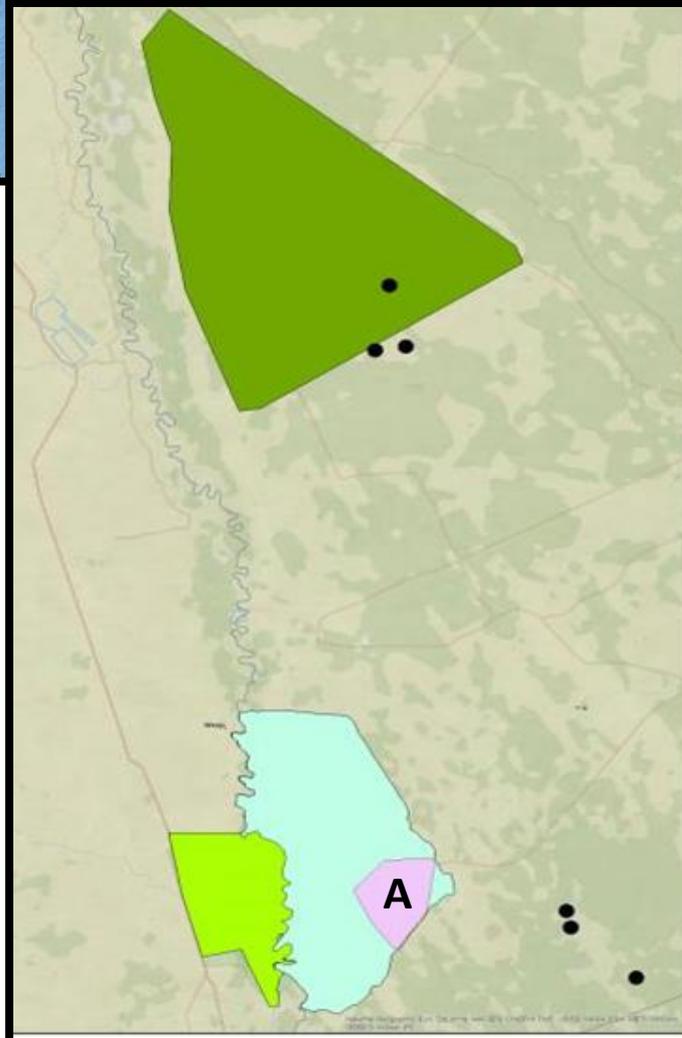
range quality



Distinguishing Demographic Impacts from Demographic Sensitivities



Environmental Settings: Predator-Proof Sanctuary



A. Predator-proof sanctuary

↓ large carnivores

↑ grass abundance

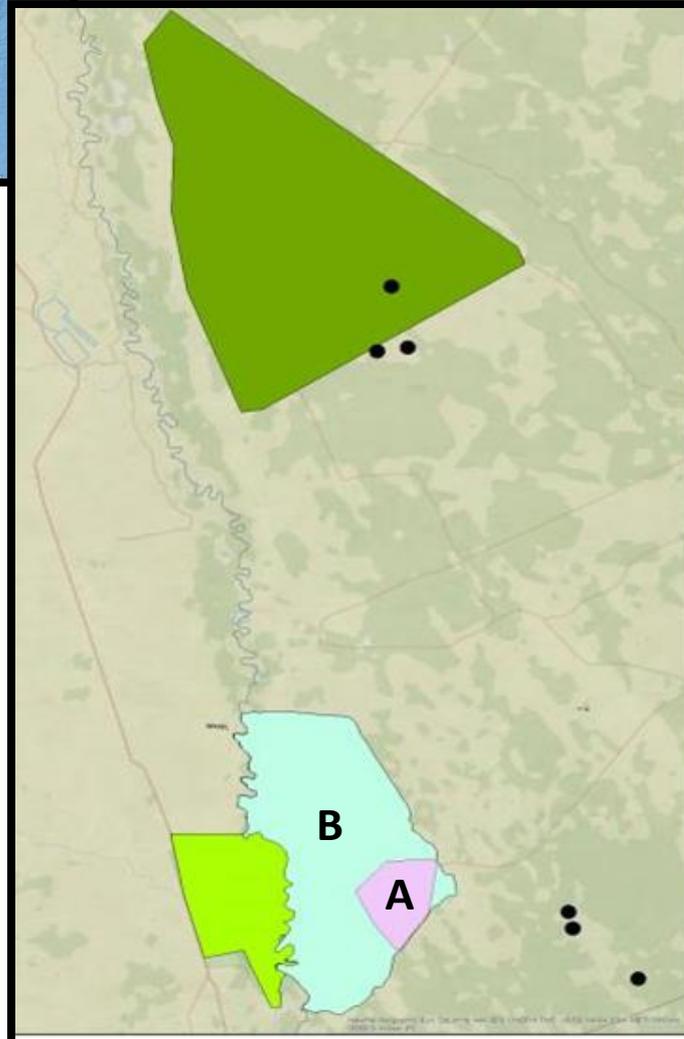
Legend

- Capture Sites
- Predator Proof Sanctuary
- Arawale National Reserve
- Ishaqbini Conservancy
- Tana River Primate Reserve





Environmental Settings: Ishaqbini Conservancy



B. Ishaqbini conservancy

↑ large carnivores

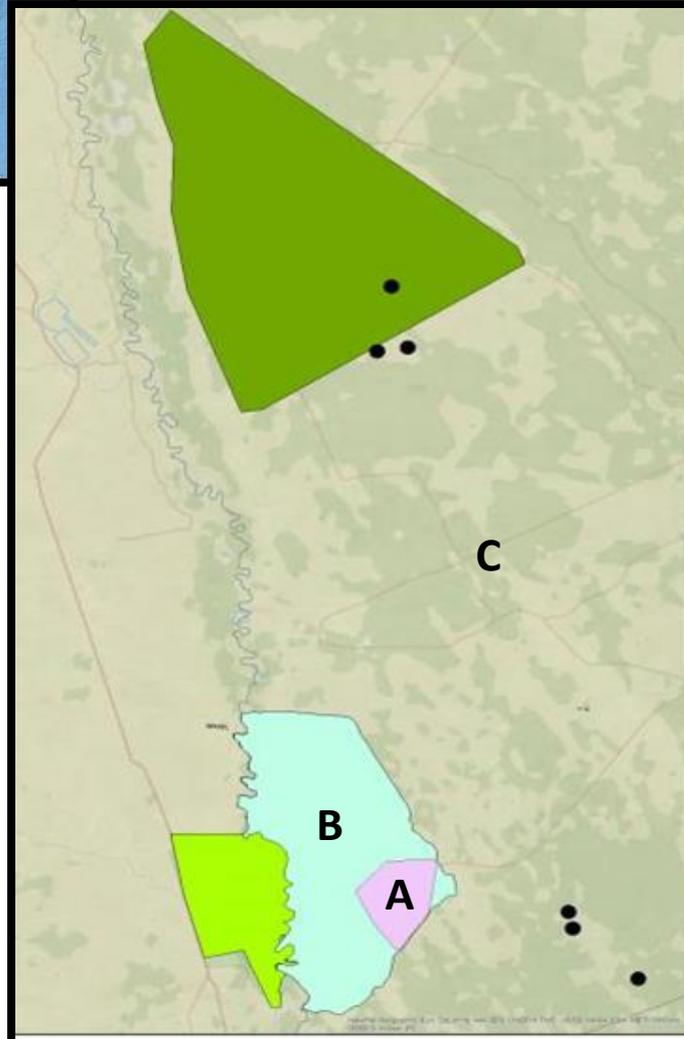
↑ grass abundance

Legend

- Capture Sites
- Predator Proof Sanctuary
- Arawale National Reserve
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Environmental Settings: Ijara Rangelands



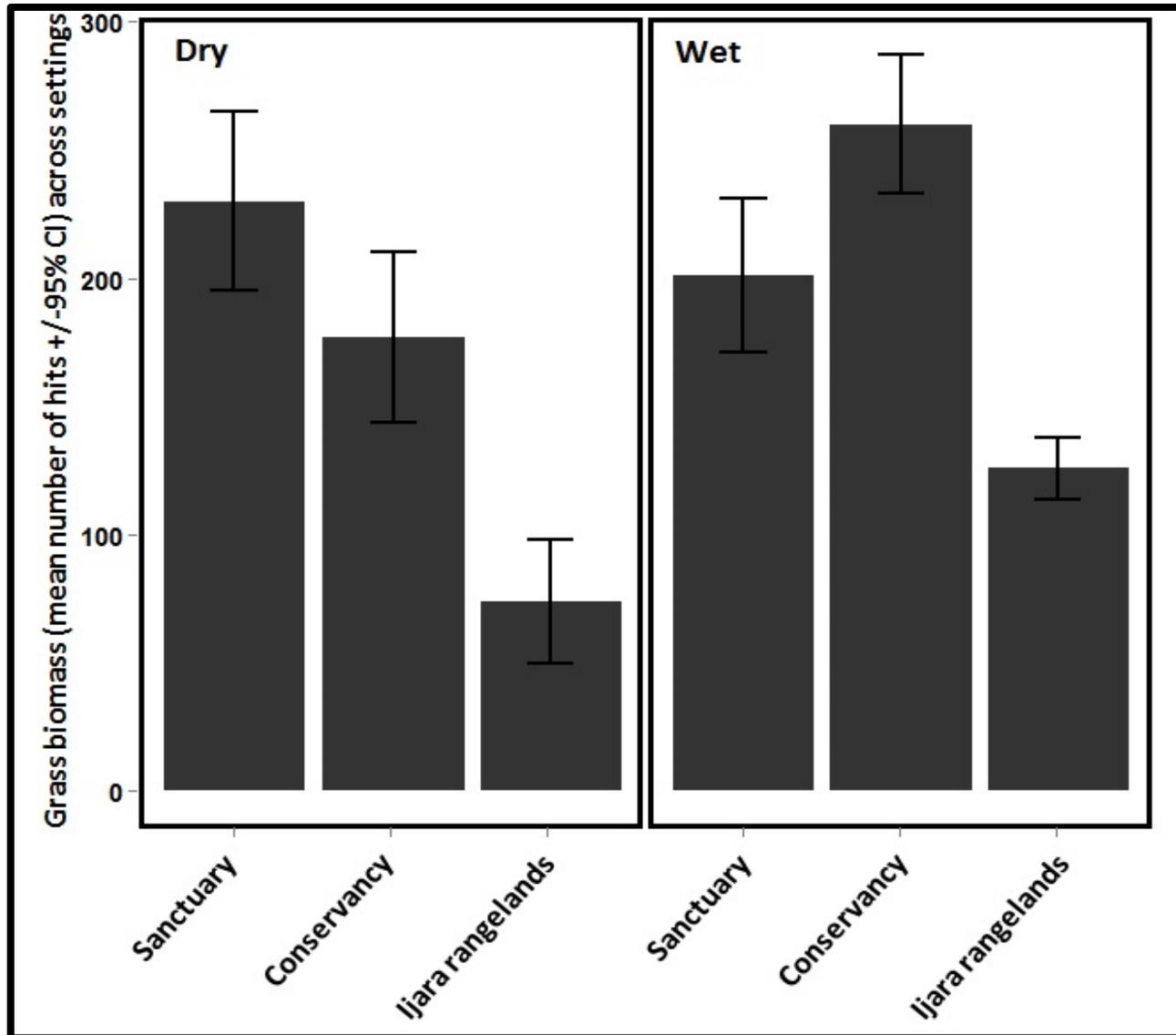
C. Ijara rangelands
↑ large carnivores
↓ grass abundance

Legend

- Capture Sites
- Predator Proof Sanctuary
- Arawale National Reserve
- Ishaqbini Conservancy
- Tana River Primate Reserve



Grass Abundance Between Settings

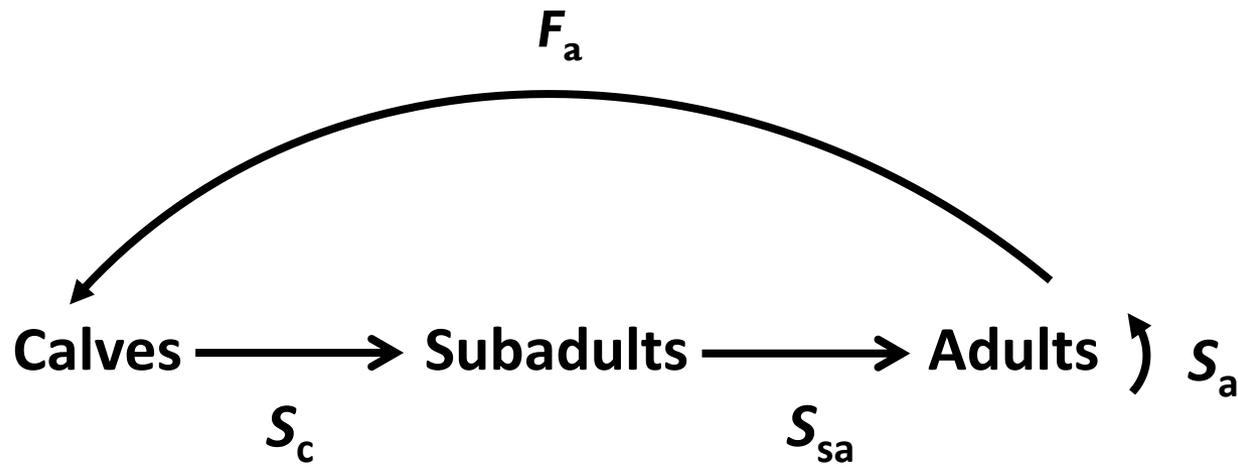


Large Carnivore Activity Between Settings

Predator species	Conservancy (sightings day ⁻¹ km ⁻²)	Ijara rangelands (sightings day ⁻¹ km ⁻²)
Cheetah	0.10	0.09
Caracal	0.08	0.07
Wild dog	0.04	0.04
Lion	0.04	0.03
Leopard	0.02	0.01

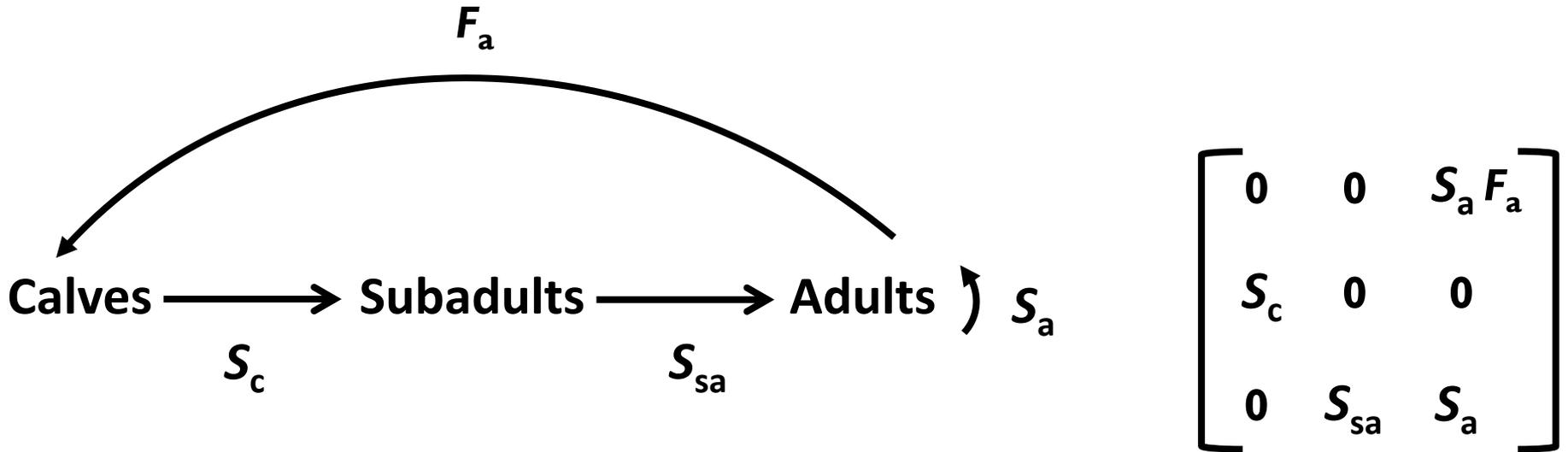


Using Vital Rates to Parameterize Matrices



$$\begin{bmatrix} 0 & 0 & S_a F_a \\ S_c & 0 & 0 \\ 0 & S_{sa} & S_a \end{bmatrix}$$

Using Vital Rates to Parameterize Matrices



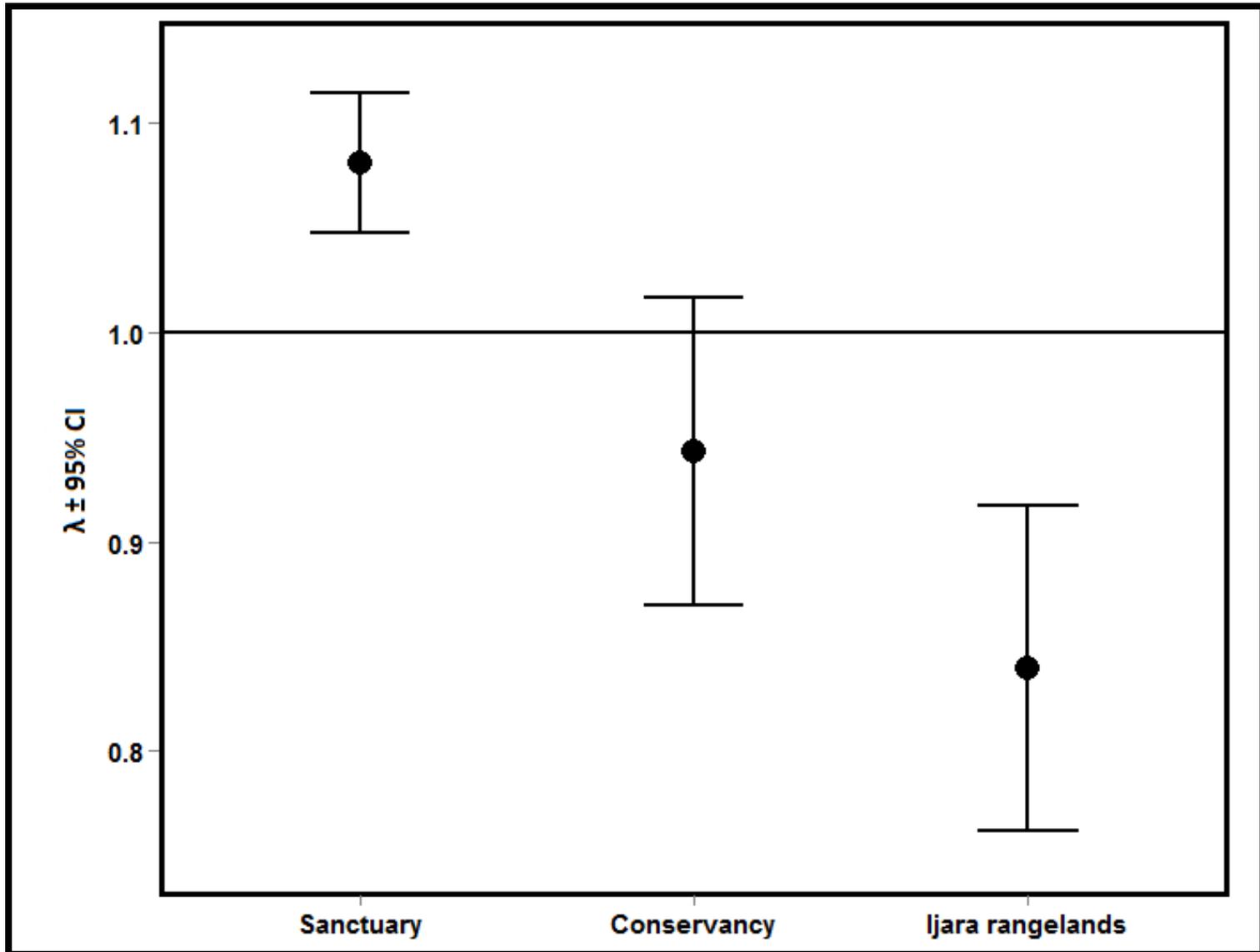
↑ vs ↓ Large carnivores

↑ vs ↓ Grass abundance



x 3
transition years
(2012-2015)

Geometric Means in 3 settings for λ





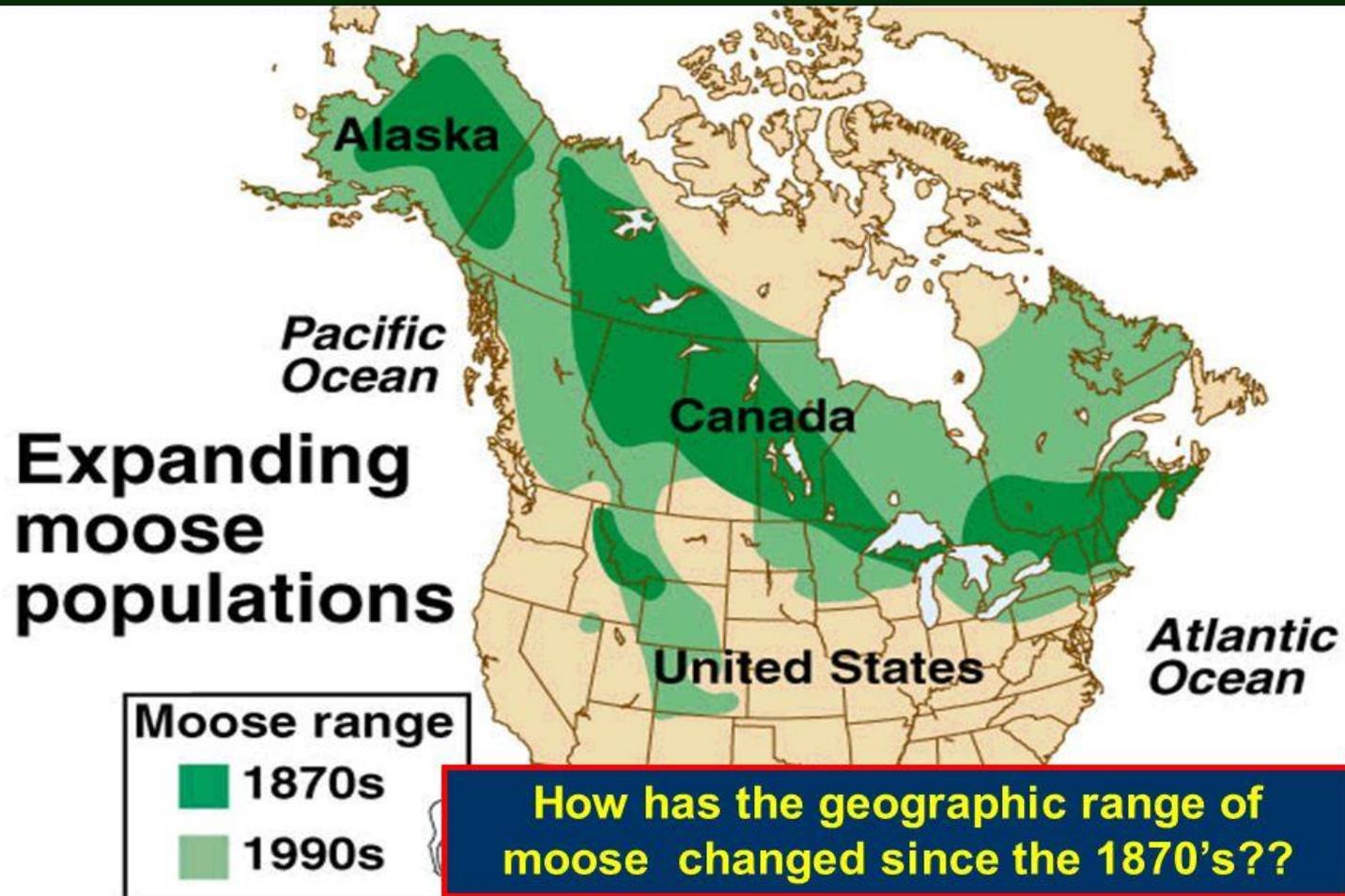
Refugee Species, Extinction Debts, and Shifting Baselines

- **Refugee species** = species whose current distribution is restricted to suboptimal ($\lambda < 1$) habitat.



Refugee Species, Extinction Debts, and Shifting Baselines

Range Changes in Moose Populations



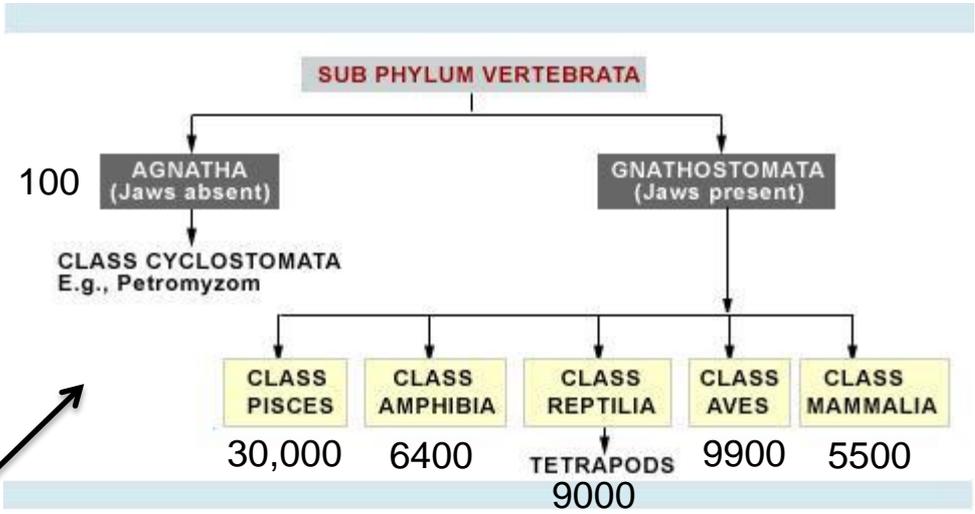
Refugee Species, Extinction Debts, and Shifting Baselines

- **Refugee species** = species whose current distribution is restricted to suboptimal ($\lambda < 1$) habitat.
- **Extinction (or extirpation) debt** = the future extinction or extirpation of species due to past events.

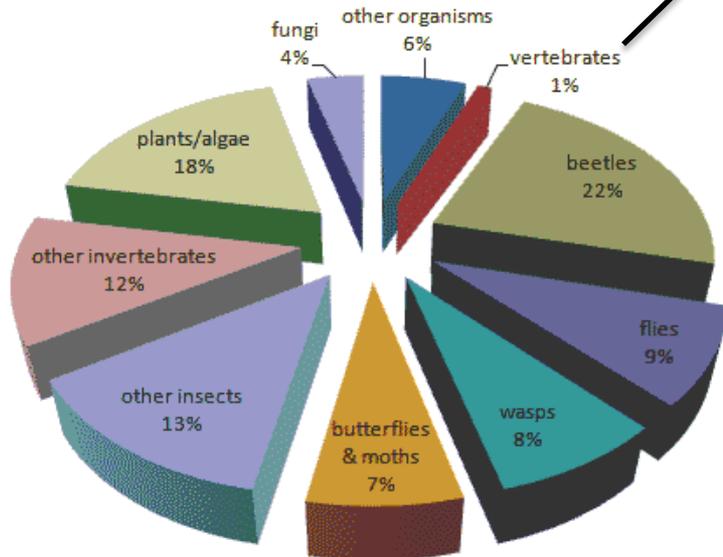


<http://video.nationalgeographic.com/video/news/151112-rare-wyoming-toad-extinction-save-vin>

Conservation Beyond Species

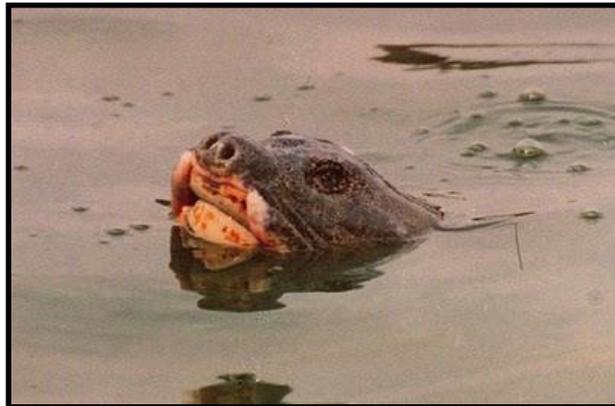


RELATIVE NUMBERS OF NAMED SPECIES



Conservation Beyond Species

- of the 1.7 million species described on Earth, an estimated 40% are threatened with extinction (IUCN 2006).
- most of these are little known, uncharismatic, economically unimportant species that are not foundation, keystone, or umbrella species.



Conservation Beyond Species

- **ecosystem management = an approach to maintaining or restoring the composition, structure, and function of ecosystems for long-term sustainability.**

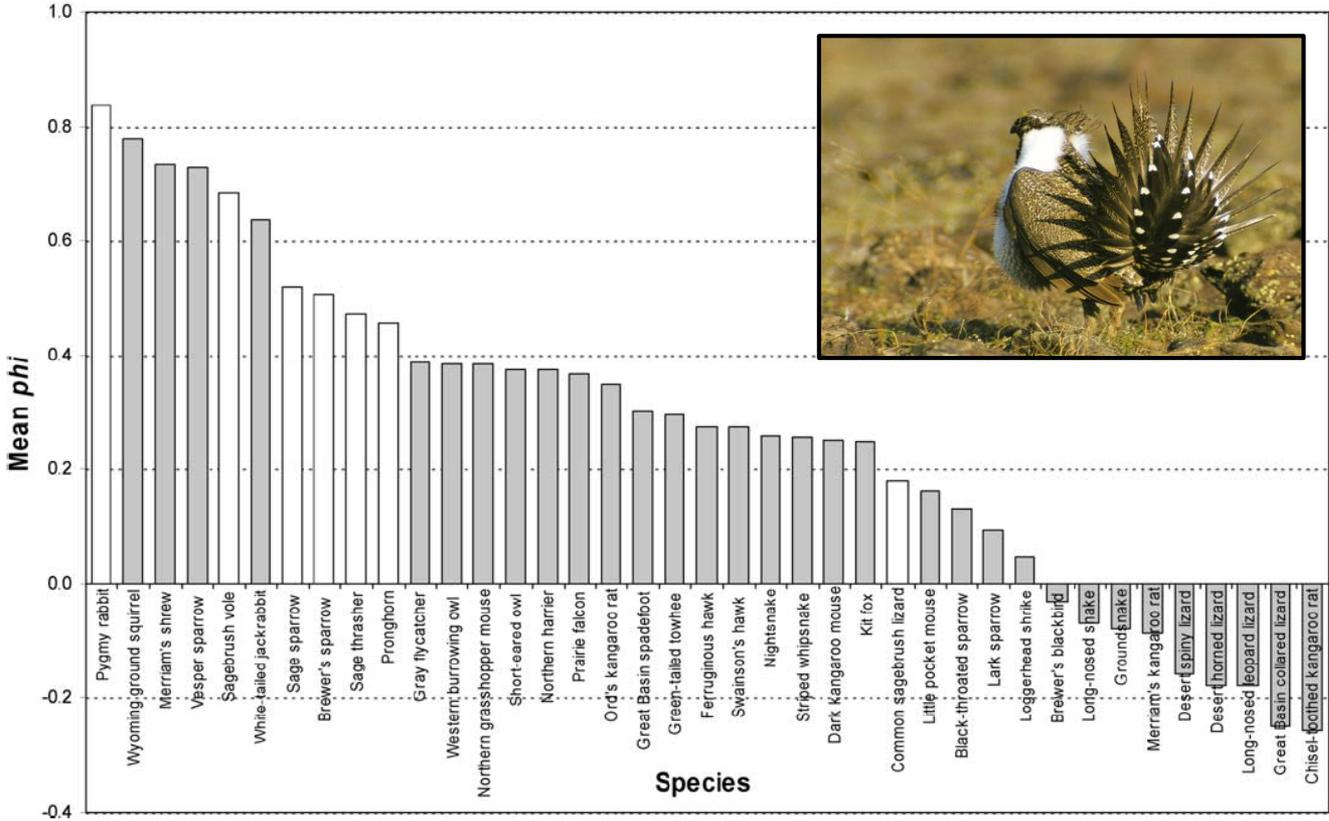
Conservation Beyond Species

- **ecosystem management = an approach to maintaining or restoring the composition, structure, and function of ecosystems for long-term sustainability.**
- **Differs from a species-specific approach in combining ecological, socioeconomic, and institutional perspectives.**
- **Typically characterized by proactivity (as opposed to reactivity).**

Umbrella Species as a Happy Medium?

- **Umbrella species should:**
 - **be relatively widespread**
 - **have resource requirements that overlap with other species of conservation concern**
 - **be neither rare nor cosmopolitan**

Umbrella Species as a Happy Medium?



Conservation Beyond Species

- **conservation beyond species typically involves more stakeholders than does species-level conservation.**

TABLE 13.1 *What Is a Stakeholder?*

Stakeholders are people who want to or should be involved in a decision or action because they have some interest or stake in it. Their level of interest can vary from mild to intense. People can be stakeholders for a variety of reasons; they:

1. have a real or perceived interest in the resource, its use, its protection, or its users;
2. are dependent on a resource (e.g., subsistence users, sole means of livelihood);
3. have a belief that management decisions will directly or indirectly affect them;
4. are located in or near areas about which decisions are being made;
5. pay for the decision;
6. are in a position of authority to review the decisions.

Inclusion of stakeholders in decision-making helps to ensure that their concerns are met early on and that they “buy into” the decision through partial ownership, thus being more likely to support it later.

Source: Modified from materials provided by Dennis A. Schenborn.

(from the Pinedale Roundup by Meg Rawlins)

The drama surrounding wolves and the protection thereof continues. Less than two months after Judge Donald Malloy of the Federal District Court in Montana issued a decision which effectively relisted the predator in Idaho and Montana, the two Idaho senators, Mike Crapo and Jim Risch, introduced a bill that would remove wolves from the list of threatened or endangered species.

Malloy's decision was based on the opinion that the wolves in the inner-mountain region cannot be separated into distinct, state-specific populations. Since the wolves in Wyoming were still protected under the Endangered Species Act, the entire population would be considered protected. This, in effect, nullified the wolf-management plans of Idaho and Montana and canceled the hunting season.

The legislation, introduced Sept. 22 by Crapo and Risch, would separate the wolf populations, exempting those in Idaho, Montana, Washington, Oregon and Utah from the protection of the Endangered Species Act. This would restore state-control of those populations while keeping the Wyoming population under the management of the U.S. Fish and Wildlife Service (USFWS).

“The goal is to get the federal government out of the wolf-management business as quickly as possible,” Kyle Hines, press officer for Risch, said.

Less than a week later, on Tuesday, Risch and Crapo’s Senate colleagues from Montana, Senators Max Baucus and Jon Tester introduced their own version of wolf-management legislation. The bill, like that from the Idaho senators, would exempt Montana and Idaho wolves from the Endangered Species Act.

The Greater Yellowstone Coalition’s Executive Director Mike Clark doesn’t think any state should be exempted from the Endangered Species Act.

“The Endangered Species Act is an effective law that has worked for four decades and should remain intact,” he said in a statement.

Wyoming has failed to develop a wolf-management plan that meets the USFWS’s standards, and, after Malloy’s ruling, officials in Montana and Idaho expressed frustration at being penalized for Wyoming’s actions after their management plans had been approved in 2009.

“The Endangered Species Act shouldn’t allow one state to hold another hostage,” Tester said in a joint statement from the Montana senators.

At the time of the ruling, Governor Dave Freudenthal made a statement noting that Wyoming is unlikely to approve the changes to its management plan requested by the USFWS. This could prevent state-controlled wolf management in Idaho and Montana for the foreseeable future. Wyoming’s proposed plan defines wolves as a predator species, allowing them to be shot on sight. The other states’ plans acknowledge a desirable population size and allow location-specific hunting quotas to maintain that population.

“Idaho manages all other game species successfully, and, as this last season showed, they can effectively manage wolves,” Hines said.

“No one – especially the federal government – knows how to manage wolves in Montana better than Montanans,” Risch said.

Clark said he thought the flurry of bills on this is only “further polarizing the wolf issue.”

“Now is the time for all stakeholders in the region to work together within the parameters of the Endangered Species Act to come up with solutions that eventually return wolf management to the states,” he said.