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Is Habitat Use by Greater Sage-Grouse Proportional to Availability of Plant Morphotypes?

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Abstract

Greater Sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) select sagebrush plants for food that are high in protein. However, sagebrush produce toxins called monoterpenes that can inhibit enzymatic reactions and interrupt cellular processes and therefore result in decreased intake by sage-grouse. Moreover, species, subspecies, populations, and morphotypes of sagebrush can vary in the concentration of toxins produced. Preliminary analysis has shown that different morphotypes of sagebrush have different chemical profiles, and this may influence selection at a scale below species. Our research aims to determine whether sage-grouse select specific morphotypes of sagebrush to maximize biomass consumed per bite or minimize toxin consumed per bite and, how that selection changes with plant density or abundance. We flushed radio-marked sage-grouse and identified their foraging site using tracks and fresh pellets. At each used patch, we performed density counts for each morphotype of sagebrush along a transect, and recorded the volume and number of bite marks for each plant. We will evaluate if sage-grouse browse certain morphotypes in proportion to their availability, or if they differentially select morphotypes to browse based on biomass per bite or toxin concentration per bite. This research contributes to a growing understanding of how sage-grouse select and use habitats throughout the year, which is increasingly important as habitat availability decreases, the distribution of specific morphotypes change and remaining landscapes are degraded. Additionally, this research provides insight about plant-herbivore interactions and how herbivores select plants to consume, based on biomass intake rates, toxin concentration, or availability of plants.

Keywords

sage grouse, plant morphotypes, habitats, landscape degradation, toxin concentration

Disciplines

Animal Sciences

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Background

Plant and Herbivore Interactions

- Many animals select plants that are high in protein for reproductive success
 - Selective foraging: Behavior where animals avoid toxins and meet nutritional needs
- Plants have defense mechanisms to deter herbivores
 - Thorns
 - Unpalatable
 - Difficult to digest
 - Produce toxic chemicals

Study System

- Greater Sage-grouse (*Centrocercus urophasianus*) consume 100% sagebrush (*Artemisia* spp.) in winter months (Patterson 1952)
- Grouse select plants that are high in protein and low in toxins (Frye et al. 2013)
- Sagebrush produce toxins known as monoterpenes as a defense toxin that can:
 - Inhibit enzymatic reactions
 - Interrupt cellular processes
 - Decrease plant digestibility
- Sage-grouse can see and smell the plant chemicals because the compounds emit light at different Wavelengths



Sagebrush Morphotypes

- Within a landscape there are different sagebrush species
 - *Artemisia arbuscula* and *A. t. wyomingensis*
- Within a sagebrush patch there are different sizes of individuals
 - Small, medium, and large (Figure 1)
- Morphotypes have distinct structural and chemical features that may influence selection below a species level

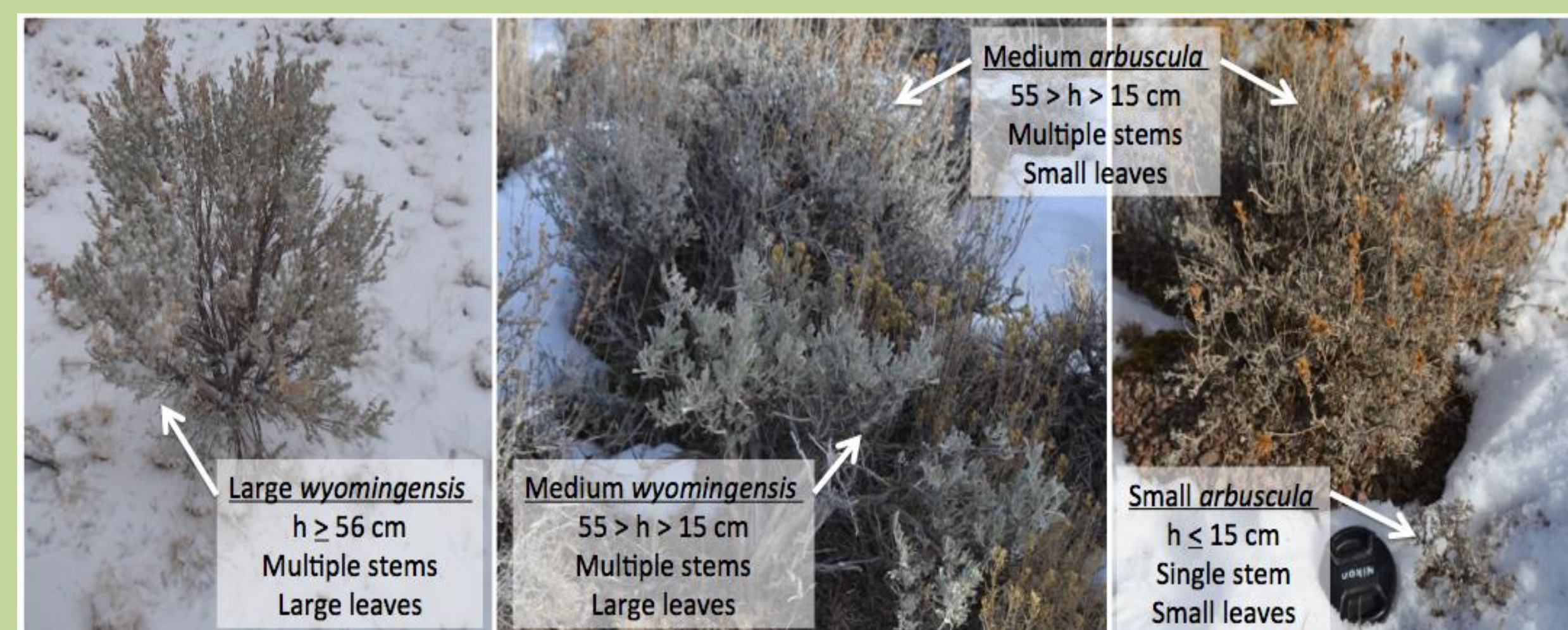


Figure 1. Morphotypes of sagebrush found at the Raft River site, Cassia County, Idaho, USA. Left: a large *A. t. wyomingensis* plant. Center: a medium *A. t. wyomingensis* plant in front of a medium *A. arbuscula*. Right: a small *A. arbuscula* on the bottom right and a medium *A. arbuscula* in the center. Photo by Fremgen, 2013.

Objective

- Do Sage-grouse select specific sagebrush morphotypes?
 - Do Sage-grouse maximize biomass consumed per bite or minimize toxin consumed per bite?
 - How does selection change with plant density or abundance?

Hypothesis

We hypothesize that sage grouse are choosing a specific sagebrush species based on its nutritional values and low chemical concentration.

Methods

Identified Browsing at Patch Site

- Field Site: Raft River, Idaho
- Flushed radio-marked sage-grouse and identified their foraging site using tracks and fresh pellets
- Performed density counts for each morphotype of sagebrush along 10 m transects in cardinal directions (North, South, East, West)
- Recorded the volume and number of bite marks for each plant (Figure 2)
- Statistics will be done on the proportion of used plants versus available plants in the patch using a Chi-squared analysis.
- Simulated bite biomass will be compared using ANOVA tests comparing each species of sagebrush

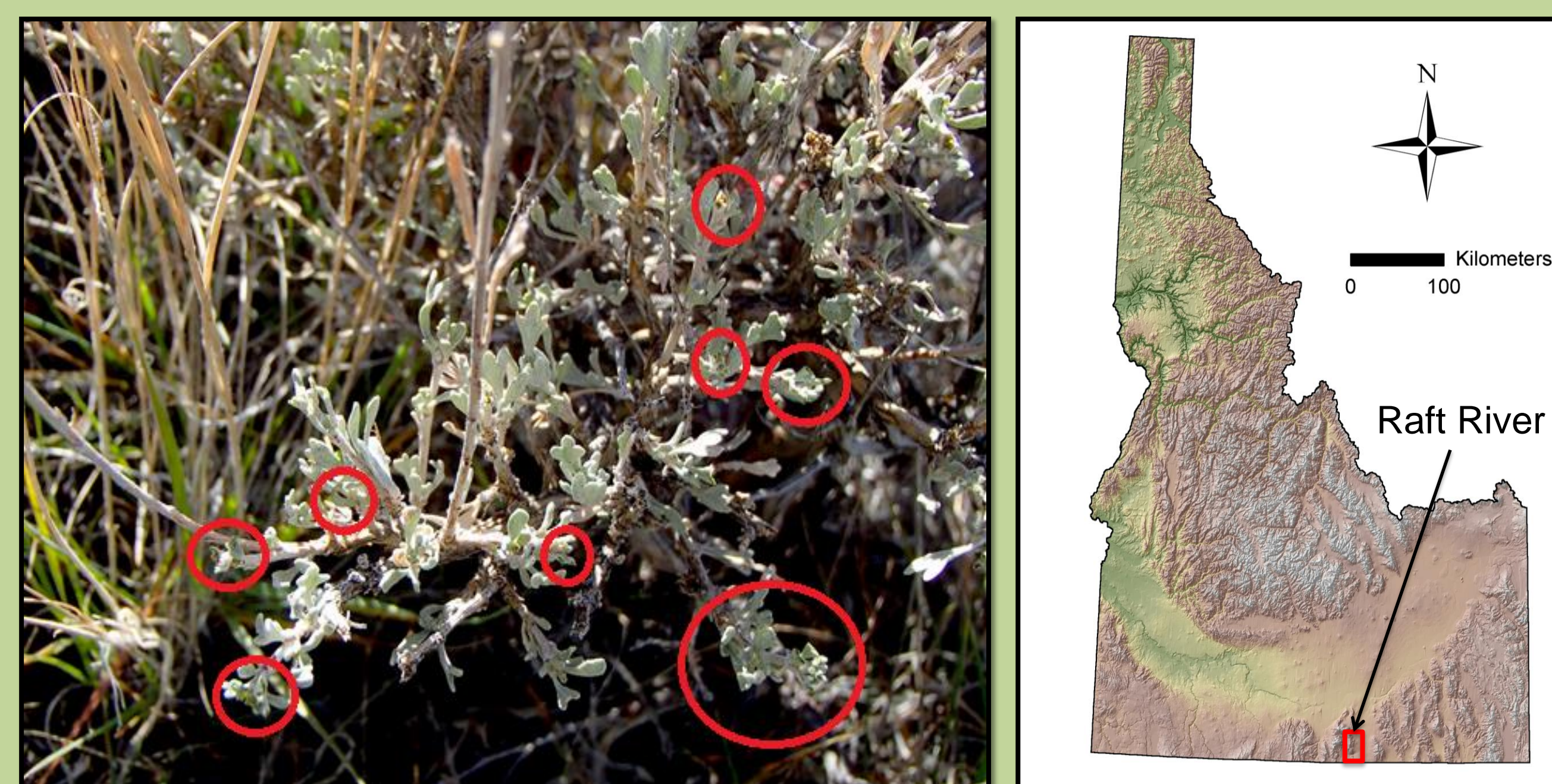


Figure 2. Left: Sage-grouse (*Centrocercus urophasianus*) browse is easily identifiable, with bright green meristematic tissue indicating fresh browse. Older browse is generally reddish-brown in color. Red circles indicate leaves that have been brown. Right: Map showing location of Raft River, Idaho. Photos by Fremgen, 2013.

Anticipated Results

- We are evaluating if Sage-grouse browse certain morphotypes in proportion to availability.
- We are evaluating if Sage-grouse are differentially selecting morphotypes based on biomass per bite or toxin concentration per bite.
- Sage-grouse appear to be selecting medium *Artemisia arbuscula*, followed by small *A. arbuscula* (observation from data).
 - Shows that morphotypes do play a role in browsing because it has a higher quantity of bite marks
 - However, Sage-grouse can forage on *A. tridentata wyomingensis*.

Significance of Study

- Contributes to a growing understanding of how sage-grouse select and use habitats throughout the year
- Advances knowledge for habitat availability and landscape degradation as the distribution of morphotypes change, which may influence Sage-grouse habitat use (Figure 3)
- Provides insight about plant-herbivore interactions and how herbivores select plants to consume, based on biomass intake rates, toxin concentration, or availability of plants.

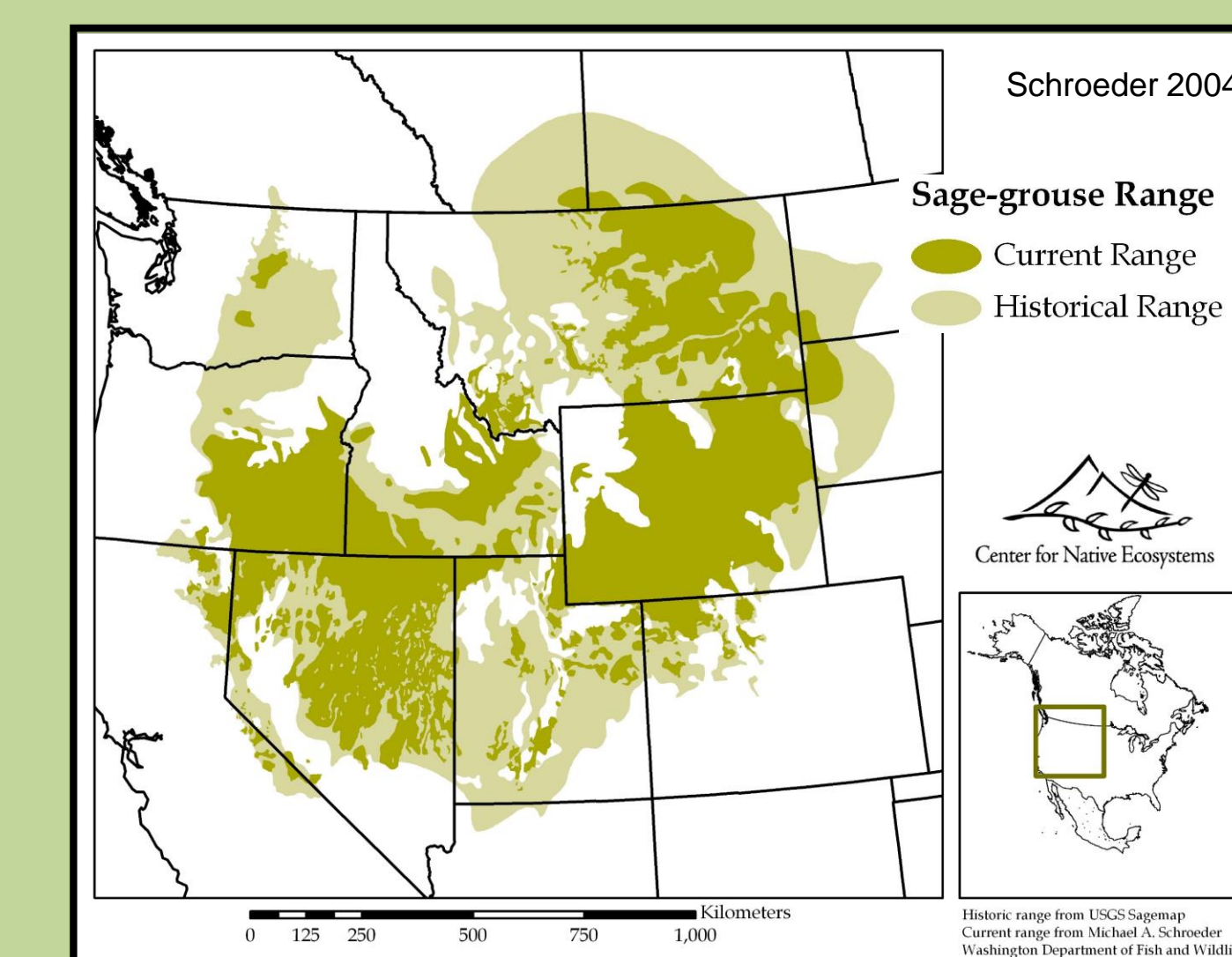


Figure 3. Map showing Sage-grouse current range (dark green) and historical range (light green). Sage-grouse range mirrors sagebrush range, and has been significantly impacted by fragmentation, habitat loss and degradation. Photo by Schroeder, 2004.

Literature Cited

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