4-20-2015

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

Jacqueline Peña

Marcella Fremgen

John C. Connelly

Jennifer Forbey

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Jacqueline Peña, Marcella R. Fremgen, John W. Connelly, Jennifer Sorensen Forbey

Department of Biological Sciences, Boise State University, 1910 University Dr., Boise, Idaho, 83725

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 (*Artmisia* 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

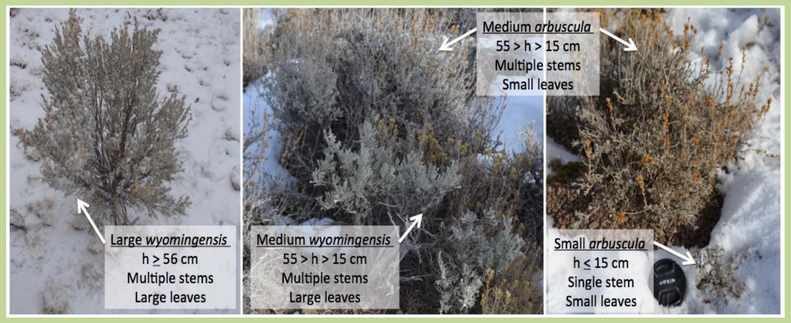

Figure 1. Morphotypes of sagebrush found at the Raft River site, Cassia County, Idaho, USA. Left: a large *A. t. wyomingensis* plant. Center: a medium *A. t. wyomingensis* plant in front of a medium *A. arbuscula.* Right: a small *A. arbuscula* on the bottom right and a medium *A. arbuscula* in the center.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

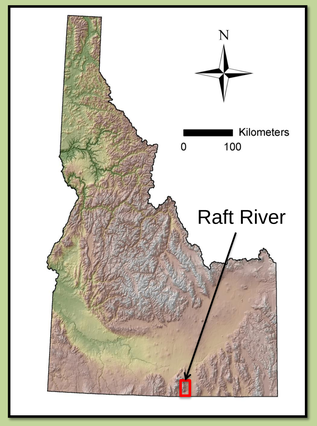

Figure 2. Left: Sage-grouse (*Centrocercus urophasianus*) browse is easily identifiable, with bright green meristematic tissue indicating fresh browse. Older browse is generally reddish-brown in color. Red circles indicate leaves that have been brown. Right: Map showing location of Raft River, Idaho.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

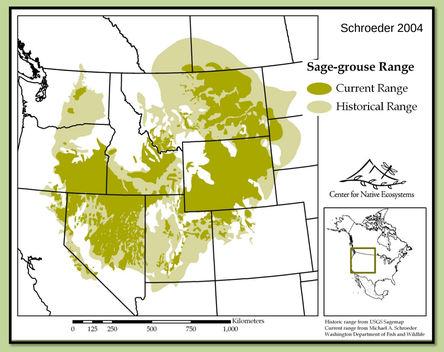

Figure 3. Map showing Sage-grouse current range (dark green) and historical range (light green). Sage-grouse range mirrors sagebrush range, and has been significantly impacted by fragmentation, habitat loss and degradation. Photo by Schroeder, 2004.

Literature Cited

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Acknowledgements

We thank Chris Ellis, Chelsea Merriman, Sharone Nehorai, Andrea Gibbons, and Lisa Cross for field work. The National Science Foundation IOS-1258217, the National Institutes of Health, Idaho INBRE Program (P20 GM103408), Idaho Department of Fish and Game,the Bureau of Land Management, andthe Boise State McNair Scholars Program provided funding.