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What Makes Good Habitat for Sage-grouse in Utah?

By Simona Picardi, Utah State University

Understanding what makes good habitat for a species is necessary for conservation because conserving wildlife is often tied to conserving the habitat they thrive in. Ecologists address this question by observing where a species occurs and comparing those locations with what is available around. Looking at what resources are used in the context of what is available allows us to quantify habitat selection by identifying what features animals seek after and what they avoid across the landscape. Species distribution is the result of habitat selection: where a species does or does not occur depends on the environmental characteristics of occupied and unoccupied areas that individuals select for or avoid.

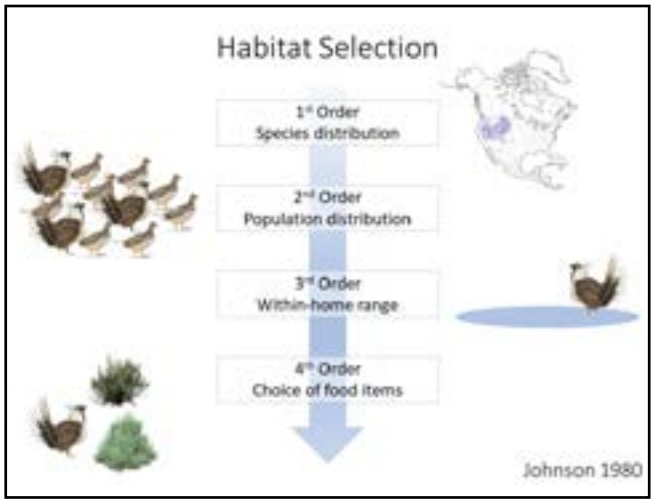

Figure 1. Greater sage-grouse select habitat as various scales. Understanding sage-grouse habitat selection at different scales is important to species conservation.

Habitat selection is a process that happens across several spatio-temporal scales (Figure 1). At the broadest scale, habitat selection determines where the range of a species is located (what is called "first-order habitat selection"). First-order habitat selection is often a result of climate and other factors that vary over broad spatial gradients. At a finer scale, characteristics of the habitat within the species range determine where exactly populations are found. This is referred to as second-order habitat selection and it often depends on factors such as the distribution of key vegetation or local climatic differences. At even finer scales, habitat selection determines where individuals place their home ranges within the population range and, at the finest scale possible, how they select for food items.

Information on habitat selection at different scales is not all equally useful for conservation in practice. For example, if the goal is to identify priority habitat to preserve within a given portion of the species range, information on first-order habitat selection is of limited use because it is too coarse. Knowing what factors determine the distribution of a species at the continental scale does not help us define what habitats we should prioritize within smaller units within it. In the U.S., state wildlife agencies are the authority for management and conservation of wildlife species that are not listed under the Endangered Species Act. The science that informs these management decisions needs to be at an appropriate scale in order to be useful.

To further complicate the picture, habitat selection also depends on the availability context. Animals will select or avoid habitat features differently according to what options they have. Because habitat selection depends on

Continued on Page 2.

In This Issue

what is available, the general environmental context around populations matters. Even populations of the same species may exhibit different patterns of habitat selection in parts of their range that strikingly differ from one another. This is common for wide-ranging species, whose population distribution spans over a broad environmental gradient and conditions at different extremes do not look alike. This is why it is especially important to evaluate habitat selection in peripheral areas of a species' range so that management actions can be tailored to local needs.

Sage-grouse are a wide-ranging species distributed across much of the American West. Because they are sagebrush obligates, their distribution mirrors the distribution of sagebrush steppes across the continent. However, there is more to habitat selection of sage-grouse than just sagebrush. Range-wide studies have determined that other factors are important to determine where sage-grouse occur, such as topographic features, neighboring vegetation types, and the amount of human disturbance in their surroundings. However, range-wide studies have little applicability in terms of management at the scale of single states, and especially for states that lie at the periphery of the sage-grouse range. Utah is one of those states.

While sage-grouse occupy large, uninterrupted sagebrush steppes in core areas of their range, such extensive patches of sagebrush do not occur in Utah. The rugged terrain and dramatic elevation gradient found in Utah is also not comparable to the topography of any other areas of the sage-grouse range. Elevation differences also result in a different climatic context in Utah compared to elsewhere in the sage-grouse range. However, no Utah-specific information on what makes good habitat for sage-grouse populations was published until recently.

We sought to fill this knowledge gap by quantifying habitat selection of sage-grouse in Utah by leveraging a long-term telemetry dataset collected between 1998 and 2013. Our study was published in the journal Ecology and Evolution in 2020. (The link to this paper and others can be found at: https://utahcbcp.org/publications.) We will use this information work with Utah's local working groups, private landowners, and state and federal land managers to implement Utah's Greater Sage-grouse Conservation Strategy (https://wildlife.utah.gov/sage-grouse/Utah_Greater_Sage-grouse_Plan.pdf).

As expected, we found that sage-grouse select for habitat differently in Utah than they do on average at the range-wide scale (Figures 2 and 3). Specifically, they select for higher elevation and precipitation compared to what is reported by range-wide studies. This reflects the fact that remnant sagebrush patches in Utah are located in high-elevation areas, which are also characterized by higher precipitation and lower temperature. We also found that, surprisingly, anthropogenic development is not as important of a factor in determining sage-grouse distribution in Utah as it has been reported to be across the range. This does not necessarily mean that sage-grouse in Utah are more tolerant of human disturbance, but perhaps it reflects the fact that development is not as pervasive in sage-grouse habitat in Utah as it is elsewhere in their range, and thus sage-grouse do not have to try as hard to avoid human structures.

Our results provide the first Utah-specific information on sage-grouse habitat selection. This information can inform management actions for conservation of sage-grouse habitat in Utah to ensure that interventions are tailored to the behavior of sage-grouse in this unique context.

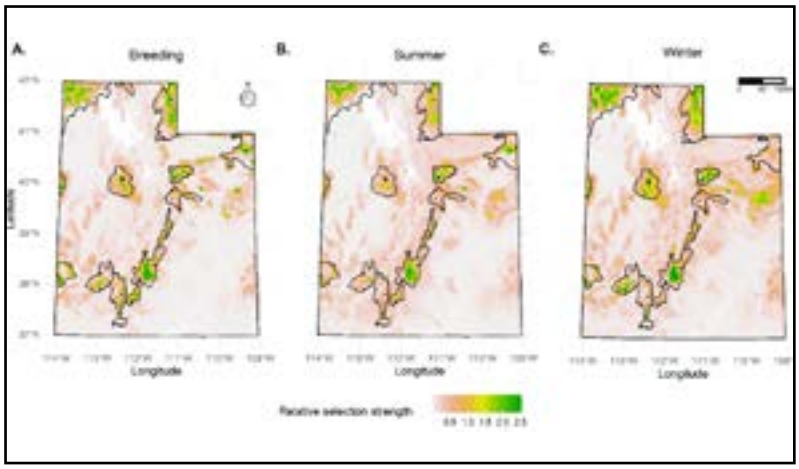

Figure 2. Seasonal maps of sage-grouse habitat selection in Utah. The heat color gradient represents the relative strength of selection of sage-grouse for each pixel on the map compared to average conditions found across the landscape in each season. Values greater than 1 represent selection over average conditions, while values less than 1 represent avoidance.

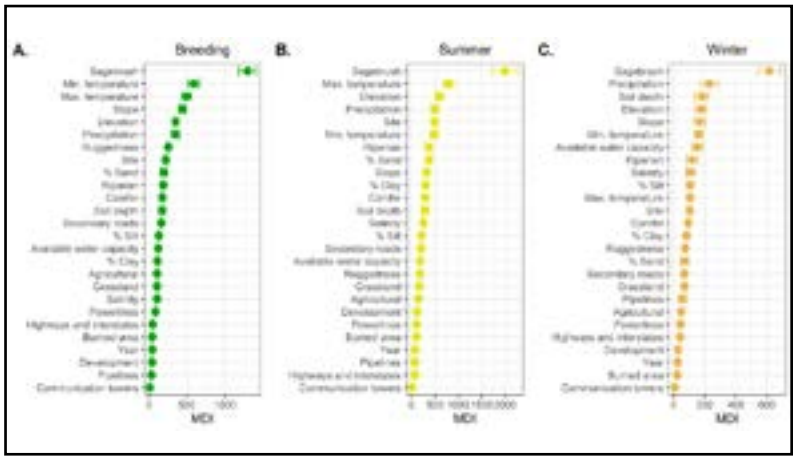

Figure 3. Factors determining habitat selection of sage-grouse, ranked in decreasing order of importance. Because this is a relative ranking, no conclusions can be made on which factors are important or unimportant, only in their relative contribution to determine where sage-grouse occur in Utah.

Using Small Unmanned Aerial Systems to Model Sagebrush Height

By Ryan Howell, Ryan Jensen, Steve Petersen, and Randy Larsen; Brigham Young University

Small Unmanned Aerial Systems (sUAS) have become increasingly useful tools in wildlife and wildlands management in recent years (Figure 1). Their marriage with global positioning system (GPS) and smart phone technology has made them flyable "out of the box" for hobbyists and commercial pilots alike. This is especially true with multi-rotor systems, most of which are capable of automated take off, flight along a pre-drawn path, and landing. Using sUAS provides a relatively inexpensive system for acquiring high temporal and spatial resolution imagery to answer various questions concerning habitat analysis.

Two-dimensional analysis of sUAS imagery is well documented. Three-dimensional analysis has typically been conducted using light detection and ranging (LiDAR) systems, which work by emitting hundreds of thousands of laser pulses over a given area and recording how long it takes the pulse to return to the sensor to create a point cloud. These systems are understandably complicated, data-heavy, and expensive. An emerging technology is photogrammetry, which, to oversimplify it, uses the overlap of 2 dimensional (2D) images to generate a similar point cloud as what you would acquire with LiDAR, but all you need is a drone with a normal camera. The technology itself has been used for decades to create elevation models, but has only recently been applied to plant height, and even then it is mostly used in forestry applications.

Figure 1. Small unmanned aerial device (drone) used in this research study.

We tested the viability of using photogrammetry derived from sUAS imagery to perform height measurements of sagebrush as a potential tool to monitor sage-grouse habitat, taking into account accuracy and flight time. To do this, we generated 70 points and measured the tallest point of the nearest sagebrush to that point. We then tested different combinations of 3 different flight parameters: height (100, 150, 250, and 390 feet, with larger pixel size but shorter flight times as you get higher), photo capture settings (continuously take pictures as the drone flies vs. pause for each picture, increasing flight time but reducing motion blur), and single-pass vs. double-pass (for multiple view angles, which increases flight time). Simply put, we were looking for the combination that was the best balance between accuracy and flight time.

Figure 2. On the ground comparison of 3 dimensional modeled sagebrush height (left) and field photograph (right).

We were able to generate 3D models of sagebrush height using 2D sUAS imagery (Figures 2 and 3). A full example model can be found at https://www.melown.com/cloud/link/5KyzFAJHA0rEp1C7R0l0. We found that the parameters that increase flight time (lower flight, drone pause, and double pass) generally improved accuracy, but only marginally. The average difference between ground truth and modeled height using the drone imagery was approximately 25 cm (10 inches). We also discovered that applying a statistical correction to the data using linear regression greatly improved the accuracy, reducing the difference in measured plant height to about 10 cm (4 inches). This difference was consistent for every flight, so our conclusion is that if you have the capabilities to perform statistical correction, you should fly as high as possible and apply the correction to decrease flight time and data collection volume.

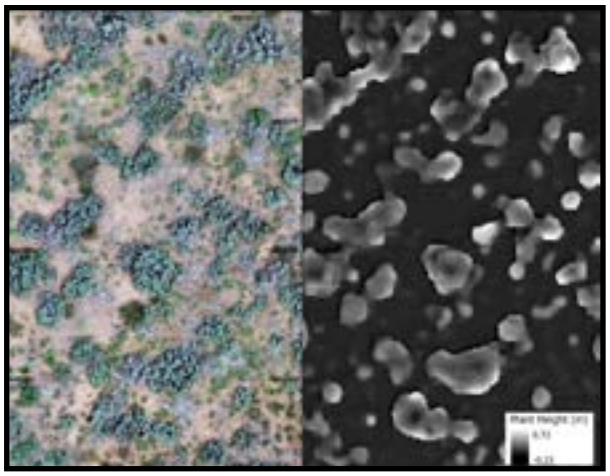

Figure 3. Comparison of aerial imagery (left) and plant height raster values (right).

Using sUAS to measure sagebrush height turned out to be an effective method to quickly measure large stands of sagebrush. This greatly decreases the subjectivity of field measurements (although it is still important to perform ground-truth measurements if employing sUAS), and allows for a complete census of the area of interest. This data is easy to incorporate into a geographic information system to measure view shed for nest sites, model habitat selection, and perform other fine-scale analysis.

More information can be found in our published manuscript:
Howell, R.G.; Jensen, R.R.; Petersen, S.L.; Larsen, R.T. Measuring Height Characteristics of Sagebrush (*Artemisia* sp.) Using Imagery Derived from Small Unmanned Aerial Systems (sUAS). Drones 2020, 4, 6.
The link to this paper and others can be found at:
https://utahcbcp.org/publications.

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If it's not good for communities, it's not good for wildlife.

Monitoring Raven Activity in Occupied Sage-grouse Habitats in Utah

By Nicki Frey, Utah State University

Figure 1. Raven eating an egg. Photo courtesy of Jack Spencer.

Sagebrush plant communities provide the visual cover needed to protect nesting birds from avian and mammalian predators. Human disturbances to include roads, landfills, transmission lines, improper livestock grazing, and wildfires can affect natural plant succession processes. While these disturbances may impact the greater sage-grouse (grouse), other wildlife such as the common raven can benefit.

Human disturbances have been linked to increased raven populations rangewide and higher local densities in arid sagebrush habitats. Recent breeding bird survey data suggested that raven populations have increased in some areas of the western U.S. by as much as 700% Research has linked increased raven populations to reduced grouse nesting success and recruitment (Figure 1). Ravens also have been observed attacking and interfering with male and female grouse while lekking. This harassment may constitute an indirect negative effect to grouse breeding success, by decreasing the amount of time grouse can spend attracting and interacting with potential mates. Further, ravens focused on grouse at leks may then follow females as they search for nesting sites, thereby increasing the potential for nest depredation. Breeding, territorial pairs of ravens many cache grouse eggs and depredate multiple grouse nests while rearing their own chicks. Increased predation rates are often found in habitats associated with human disturbance.

The Bureau of Land Management (BLM) and their partners have been implementing habitat improvement projects designed to restore sagebrush communities and offset the negative impacts caused by human disturbances. Starting this month, we will partner with the wildlife biologists in the BLM Cedar City Field Office to study raven distribution and movements in sage-grouse management areas (SGMAs) of southern Utah (Hamlin Valley, Bald Hills, Panguitch). The research will also investigate the level of raven harassment on grouse leks and nest depredation by ravens.

The project's goal is to increase the BLM's knowledge of ravens in southern Utah, including their population numbers, their use of intact and treated habitats, and their interactions with grouse. We will be using cellular radio-telemetry to track ravens throughout the year, particularly when they are in known occupied grouse habitat. We will also conduct fecal analysis and use trail cameras to detect raven depredation of nests in grouse habitat (Figure 2).

Figure 2. Raven photo from trail camera. Photo courtesy of Nicki Frey.

Utah's Community-Based Conservation Program Mission

Utah's Community-Based Conservation Program is dedicated to promoting natural resource management education and facilitating cooperation between local communities and natural resource management organizations and agencies.

www.utahcbcp.org

Notice of Upcoming Local Working Group Needs Assessment

In the next few weeks, we will be asking our all local working group members how we can better serve you. COVID-19 has affected how the Utah Community-Based Conservation Program (CBCP) facilitators and staff have engaged with each local working group. We have strived to engage local working groups in local conservation efforts and planning and keep members informed about new science and emerging policies using virtual and on-line formats. Although these formats have allowed all to stay informed, they may have impeded the traditional networking that the local working groups have enjoyed at on-site meetings and field tours. We have noticed that the virtual platforms have resulted in increased participation. We don't know if this increased participation has increased follow-up and conservation actions. The purpose of this short survey is to find out how the Utah CBCP can better serve you now and as we emerge from the COVID-19 social distancing guidelines. We anticipate that 2021 will bring a new policy emphasis on sage-grouse. Let us know what topics you are concerned about or topics you would like to learn more about, and how we can better facilitate that process either virtually or in-person

When you are contacted about participating in the on-line survey, please take a few minutes to let us know what is on your mind and what we can to better address your needs.