Characteristics of Stopover Sites in the Neotropical Migrant, the Flammulated Owl (*Psiloscops flammeolus*)

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INTRODUCTION

Migration routes have significant implications for avian population dynamics and conservation. Seasonal geographic movements between breeding and wintering grounds require the utilization of and passage through a diversity of habitat types and environmental conditions, making them a key driver of highly significant ecological interactions (Webster and Marra 2005). The ecosystem type and environmental conditions of the breeding grounds, stopover sites, and wintering grounds are essential for the success and fitness of avian migrant populations.

The study of stopover site ecology is significant in examining the gap between breeding and wintering ground interactions. Stopover sites are any location that a migratory bird uses as a refueling site between migratory destinations. Stopover sites play a critical role in the health, fitness, and abundance of migratory birds, as demonstrated by Studds et al. (2017) who found that the abundance of migratory shore-birds declined rapidly, up to 8% per year, as a result of stopover site habitat destruction. For this reason, studying and conserving stopover sites is of the utmost importance.

The Flammulated Owl (*Psiloscops flammeolus*) is the second smallest owl species in North America. The Flammulated Owl is a migratory species, with populations traveling to and from their wintering grounds in Central America to their breeding grounds in the western United States and Canada every year. Like all long-distance migrants, the Flammulated Owl is unable to carry the energy it needs to support itself during migration, therefore emphasizing the importance of stopover sites for individual and population fitness and for breeding ground reproductive success.

From 2017-2019, we placed miniature GPS trackers (Lotek pinpoint trackers™, hereafter referred to as pinpoints) on male Flammulated Owls captured in the Manitou Experimental Forest in Woodland Park, Colorado in order to better understand their migration routes.

Primary Objectives:

- Characterize stopover site primary vegetation type**, Hypothesis:** Because Flammulated Owls rely heavily on pine ecosystem ecology on both their breeding and wintering grounds, we hypothesize that this vegetation type will be consistent in their stopover habitat
- Determine geographic proximity of primary stopover sites, **Hypothesis:** Despite a disparity in wintering ground site, individuals will show greater similarity in the geographic location of stopover sites
- Determine the most common stopover locations across the four GPS tracked individuals, **Hypothesis:** The most common stopover locations will be within the Sierra Madres and the Spanish Peaks

Figure 1. Male Flammulated Owl observes his surroundings after being captured.

METHODS

- Capture territorial males by attracting them into mist nets using recordings of Flammulated Owl calls or captures at nest sites.
- We attached GPS pinpoints to territorial males with backpack harnesses. A GPS harness unit weighs approximately 1.3 grams, which is 3% of a Flammulated Owl's mass (50 grams).
- Mist nets with playback are set up the following year to recapture the GPS PinPoint in order to gather the information on the GPS unit.
- For each GPS PinPoint deployed and then recaptured, download the locations on Google Earth and quantify each stopover location's elevation, duration, and vegetation habitats using ArcGIS.
- An individual stopover site is characterized as any location in which an owl spends greater than or equal to three days in an area with a radius no greater than 20 km

Figure 2. The research team handles a Flammulated Owl. Eliza D. Stein and Brian Linkhart, Ph.D. attach a PinPoint GPS unit to a male Flammulated Owl.

Figure 3. GPS PinPoint unit attached to the back of a territorial male Flammulated Owl.

RESULTS & DISCUSSION

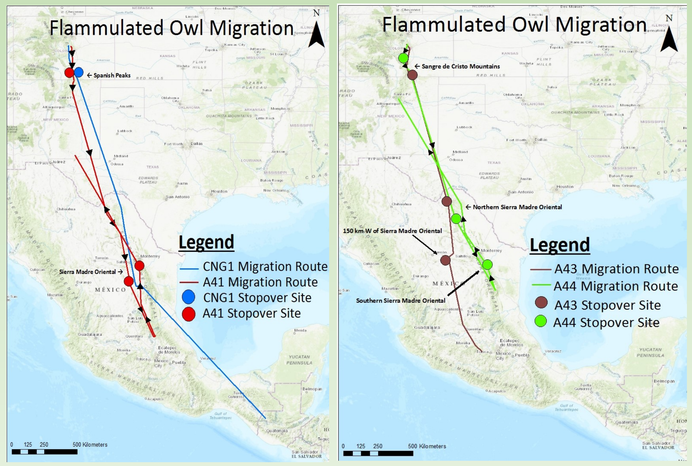

Figure 4. Two maps which each display two Flammulated Owl migration routes.

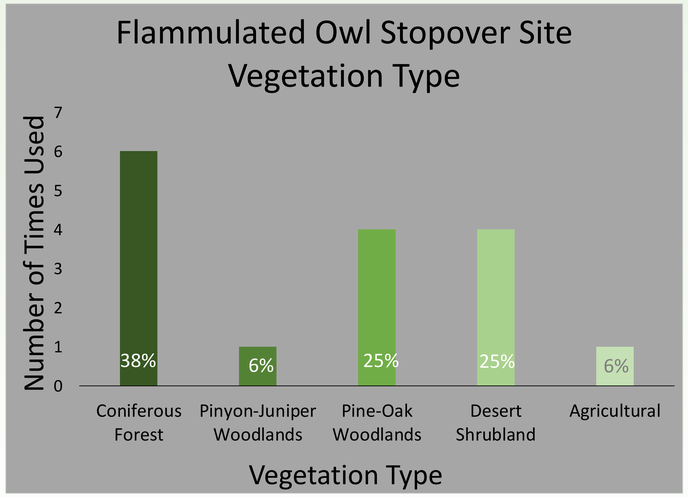

Figure 5. Migration stopover sites quantified by type of habitat.

- Flammulated Owls can have quite different wintering ground locations, but still utilize similar stopover sites (Figure 4).
- All recorded GPS birds migrating south to their wintering grounds were recorded utilizing the Spanish Peaks or the nearby Sangre de Cristo Mountains as stopover sites (Figure 4).
- Two out of two recorded birds had stopover sites within the Sierra Madre Oriental Range on the migration back to their breeding grounds (Figure 4). The two other birds which did not have GPS points within the Sierra Madre Oriental Range could have used the range as a stopover site as well, but the GPS units ran out of battery before their return flights to breeding grounds.
- Five different types of habitat were recorded (Figure 5); Flammulated Owls primarily selected stopover sites with coniferous forest habitat.

CONCLUSIONS

- Flammulated Owls preferentially select areas of coniferous forest as stopover sites, followed by pine-oak woodlands
- Desert shrubland habitat is also shown as a common stopover site, although this is primarily because these shrubland sites are adjacent to their forested roost sites
- The most common stopover locations are sites within the Spanish Peaks and Sierra Madre Oriental Range.
- Different stopover sites are geographically close compared to the geographic disparity between observed wintering grounds, emphasizing the ecological and conservational importance of these stopover locations

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