



## ECOSYSTEM-BASED MANAGEMENT EMULATING NATURAL DISTURBANCE

EMEND Insights #19

### Ecological Messages:

- Despite similar nesting habits, Northern Saw-whet and Boreal Owls use different habitats within the Boreal region of Alberta.
  - Northern Saw-whet Owls are found in deciduous-dominated forests near croplands and forest edges created by soft linear features.
  - Boreal Owls are most often encountered in open conifer-dominated forests (e.g., 45% forest cover), but low footprint of linear features.
- Northern Saw-whet Owls used forest areas harvested with  $\geq 20\%$  retention, while Boreal Owls were found mostly in unharvested blocks, with one nest in 50% retention.

### Management Implications:

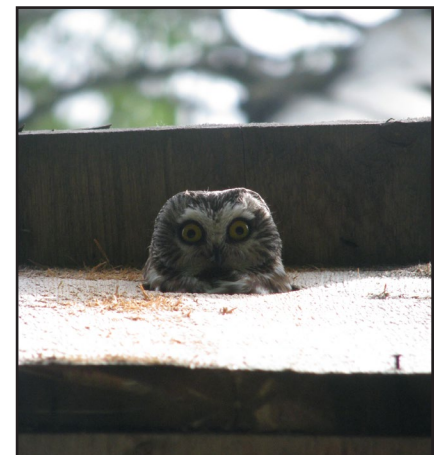
- Conservation efforts for Northern Saw-whet Owls and Boreal Owls require different strategies that account for species-specific habitat preferences.
- Unharvested coniferous forests are important for conserving Boreal Owls.
- Work on these owls is challenging given small sample sizes that are possible.

## Who lives where? Responses to forestry by cavity-nesting owls

**Research led by Zoltan Domahidi, Scott Nielsen, Erin Bayne, and John Spence**

Canadians are frequent admirers of owls, from the graceful Snowy Owl to the Great Horned Owl, Alberta's provincial bird. However, some species of owl remain poorly-studied in this province, in part due to the challenges of studying species that are active at night.

This study aims to improve the understanding of two small-bodied forest owls in Alberta, the Northern Saw-whet Owl and the Boreal Owl, that nest in abandoned woodpecker cavities. We analysed how climate, disturbance, and land cover variables recorded at different scales around automated recording units affect owl distribution. Owl response to variable retention harvesting was also assessed by deploying and checking nest boxes within a harvested landscape.



*Northern Saw-whet Owl (Aegolius acadicus) in a nest box. Photo by Z. Domahidi.*

Northern Saw-whet Owls were found across a broad range of habitats, though most commonly in deciduous-dominated forest patches within agricultural areas, and positively associated with edges created by soft (i.e., vegetated) linear features. Indeed, they were found nesting in stands harvested with  $\geq 20\%$  retention within a separate nest-box study in this project.

Boreal Owls, in contrast, were mainly found in coniferous forests, although they were more frequent in forests with openings. They were negatively associated with increasing amounts of grassland within their home range and with high densities of linear features. They were also more sensitive to forest harvests, nesting mainly in unharvested blocks with a single nest observed in a 50% retention treatment block.

This study identifies the habitat conditions that are most likely to support each of these owl species and may help forest managers predict important areas of habitat on the working landscape. While sample sizes were low, the responses of these species to retention treatments suggest that the Boreal Owl requires unharvested areas in coniferous forests for nesting.

## Silent forest predators

Owls are an amazing group of birds. These birds of prey have extensive adaptations that allow them to fly silently, see in the dark, hear prey beneath the snowpack, and more. But they can also be vulnerable to changes in their habitat: some species are sensitive to heat stress, and some reproduce slowly. While some species like the Great Horned Owl are successful across a wide range of habitats in North America, others, like the Northern Spotted Owl, are so highly specialized that forest management has significantly affected their populations.

This presents a conservation challenge, since ***to conserve a species threatened by human activities, we need to understand its ecology—and owls have traditionally been difficult to study.*** Many owl species are nocturnal, so they are not captured by the usual early morning surveys used by large-scale projects like the Breeding Bird Survey. A common approach for surveying owls is to drive out at night and broadcast owl calls to provoke replies from owls in the wild. However, these studies also have their limits and are mainly effective for understanding only local populations.

If we want to effectively conserve owls, we need to understand their habitat requirements at multiple scales. ***Our goal in this study was to better understand which habitats are important to the Northern Saw-whet Owl and the Boreal Owl and to assess how they have responded to a range of partial retention treatments applied in the EMEND Project.*** This information will help improve the understanding of where these two species are likely to be found and how forest stands can be harvested in ways effective for owl conservation.

### ABOUT EMEND:

The Ecosystem-based Management Emulating Natural Disturbance (EMEND) Project is a multi-partner, collaborative forest research program. The EMEND project documents the response of ecological processes to experimentally-delivered variable retention and fire treatments. The research site is located in the western boreal forest near Peace River, Alberta, Canada, with monitoring and research scheduled for an entire forest rotation (i.e. 80 years).

## Methods

We collected data about owls at different scales using two methods:

- ***Habitat relationships*** were assessed using data from several hundreds of Autonomous Recording Units (ARUs) deployed across the eastern boreal forest and Peace regions of Alberta. We analysed climate, intensity of human disturbance, and habitat variables at the nest site scale (7 ha) and the home range scale (100 ha) of each recording unit.
- ***Responses of breeding pairs to harvest*** were assessed within and around the EMEND project area using 169 custom-built nest boxes. We deployed nest boxes in EMEND compartments with 20%, 50%, and 75% retention, as well as unharvested controls. We also placed nest boxes in unharvested stands and recent (1–5 years) harvest blocks on the surrounding landscape.

### GETTING TO KNOW NORTHERN SAW-WHET AND BOREAL OWLS

We studied two small-bodied, cavity-nesting owl species that are common in North America, but have not been well-studied in the boreal forest (particularly the Boreal Owl, which typically nests in remote locations). Both species nest mainly in abandoned Pileated Woodpecker or Northern Flicker nests.



Northern Saw-whet Owl



Boreal Owl



## Key Findings

### *Similar species, different habitat requirements*

Although Northern Saw-whet Owls and Boreal Owls have similar nesting requirements (they depend on cavities excavated by large-bodied woodpeckers), their habitat associations across the Boreal Natural Region of Alberta differ.

***Boreal Owls responded to the amount of forest cover at the nest site scale, with more observations recorded in more open forests*** (averaging c. 45% forest cover in the 7-ha nest site scale) and low amounts (<20%) of permanent grassland. They were also ***negatively associated with landscapes with high densities of linear footprints*** (i.e., >4–5% of the 100-ha home range scale) and were positively associated with landscapes with colder winters (see Box 2).

In contrast, ***Northern Saw-whet Owls were found within landscapes dominated by deciduous forests (>80% of 100-ha home range area) and were positively associated with cropland at this 100-ha scale.*** In general, they were detected closer to the edges where forest adjoined soft (i.e., vegetated) linear features, showing a positive association with some types of fragmentation. They were also more common in regions with cooler summers, warmer winters, and less snowfall.

#### **OWLS AND CLIMATE CHANGE**

While landscape variables like forest and grassland cover were associated with Boreal Owl presence, climate variables were the most important predictor of their distribution. Expected warming and associated northward shifts in Alberta's forests will likely negatively affect the Boreal Owl, which was found in areas with cooler winters and is typically associated with coniferous forests—habitats likely to become less common in the province. Further research is needed to investigate whether this sensitive species can occupy different forest types as it does in other parts of North America.

### *Retention benefits Northern Saw-whet Owls more than Boreal Owls*

Despite the large number of nest boxes deployed at EMEND and on the surrounding landscape, only four Northern Saw-whet Owls and four Boreal Owls used them. While this sample size is low, there were some clear differences in the habitats used by these individuals.

Of the Northern Saw-whet Owl nests, two were in 20% retention and one each were in 50%–75% retention treatments, but exclusively in deciduous-dominated and mixedwood stands. One of the Boreal Owl nests was in a 50% retention treatment but the remaining three were in unharvested stands, exclusively within coniferous-dominated forest types.

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*The different habitat associations and nesting requirements of these two species suggests that differences in both amount and type of retention and landscape context (e.g., proximity to agricultural areas or grasslands) will affect habitat suitability these two owl species.*

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## Management Implications

This study was, at its core, a fact-finding mission directed at two owl species that have not been well-studied in Alberta's boreal forest. However, our findings have several potential applications for forest management.

Our predictive models, based on data collected across the Boreal Natural Region, can be used to ***develop maps which show where these owls are likely to occur, helping forest managers identify potential high-value habitats within their management areas.*** These predicted high-value habitats could be candidates for reserves, timing restrictions and retention harvest. We expect that the most effective approach to maintain these species in managed boreal landscapes will involve consideration of cumulative impacts (e.g., harvest blocks, linear features, etc.) when placing retention patches or designing harvest patterns, both small-scale (7 ha) and large-scale (100 ha) habitat associations of each species, and future climate threats.

Our nest box study, while limited by low sample sizes, offers important new insight into the effects of different harvest treatments on cavity-nesting owls. A key takeaway is that mitigative measures designed with one species in mind may not always benefit others:

- The **Northern Saw-whet Owl**, more of a habitat generalist, was able to exploit a wider range of habitats including stands harvested with 20–75% retention. **High-retention treatments within deciduous-dominated and mixedwood stands may conserve potential nesting habitat for this species**, provided adequate nesting opportunities—cavity trees or nest boxes—are available (see Box 3).
- The **Boreal Owl**, a habitat specialist, nested almost exclusively in unharvested conifer-dominated stands, with a single occupied nest box in a 50% retention block. These results suggest that **unharvested coniferous reserves, rather than dispersed retention, are more likely to benefit this species**. Large coniferous retention patches and small selection harvests should be studied in the future to determine whether they provide suitable nesting habitat for this elusive species, and under which landscape contexts.

### ANCHORING RETENTION AROUND EXISTING AND POTENTIAL NEST TREES

An important limiting factor for cavity-nesting owls is the availability of trees that are soft enough to be excavated by woodpeckers, but not so soft that predators can easily break in. Cooke et al. (2010) recommend **retaining large-diameter (>35 cm dbh) aspen with false tinder conks (Phellinus tremulae) and other signs of damage/decay**, as such trees are preferred for excavation by, among others, Pileated Woodpecker and Northern Flicker. **Large-diameter trees and snags with existing cavities are also valuable retention anchors** to potentially provide habitat for cavity-nesting owls, other birds, and mammals.

### Further reading

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### ECOSYSTEM-BASED MANAGEMENT EMULATING NATURAL DISTURBANCE



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