

NOISE POLLUTION'S EFFECT ON BARRED OWL HABITAT SUITABILITY

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Background

- As the human population increases, the amount of environmental noise is increased with transportation networks. This has raised many questions in several biological fields, including ecology (Shannon et al., 2015).
- Research shows that noise pollution affects foraging and hunting behavior across a wide range of wildlife species. Barred owls (*strix varia*) are nocturnal predators and rely on the sound of prey rustling to detect prey and hunt. Anthropogenic noise may disrupt an owl's ability to hunt for prey and ultimately survive (Senzaki, Yamaura, Francis, & Nakamura, 2016).
- Habitat suitability indexes are useful tools for aiding in a species' habitat management. As anthropogenic effects become more common in the natural world, these indexes may be altered. In this case, noise pollution may affect the barred owl's modeled habitat suitability index.

Motivation

- Environmental impact assessments need to consider the potential effects of road noise on habitat quality and population viability (Finch, Schofield, & Mathews, 2020). It is unclear whether barred owls (*strix varia*) avoid habitats with excessive anthropogenic noise, or if they are even affected by the noise at all. Research on this may have potential to give a better understanding for barred owl habitat suitability through improved habitat suitability indexes
- We propose to evaluate how anthropogenic noise pollution affects the habitat suitability for barred owl in forested areas**

Hypothesis

- We hypothesize that there is a relationship between anthropogenic noise pollution and barred owl (*strix varia*) habitat suitability

Predictions

- We predict that habitat suitability for barred owl (*strix varia*) will be highest in areas with noise amplitude that is 30 decibels or lower (Figure 1). Noise amplitude greater than 30 decibels will have a negative correlation with habitat suitability for barred owls (Figure 1).

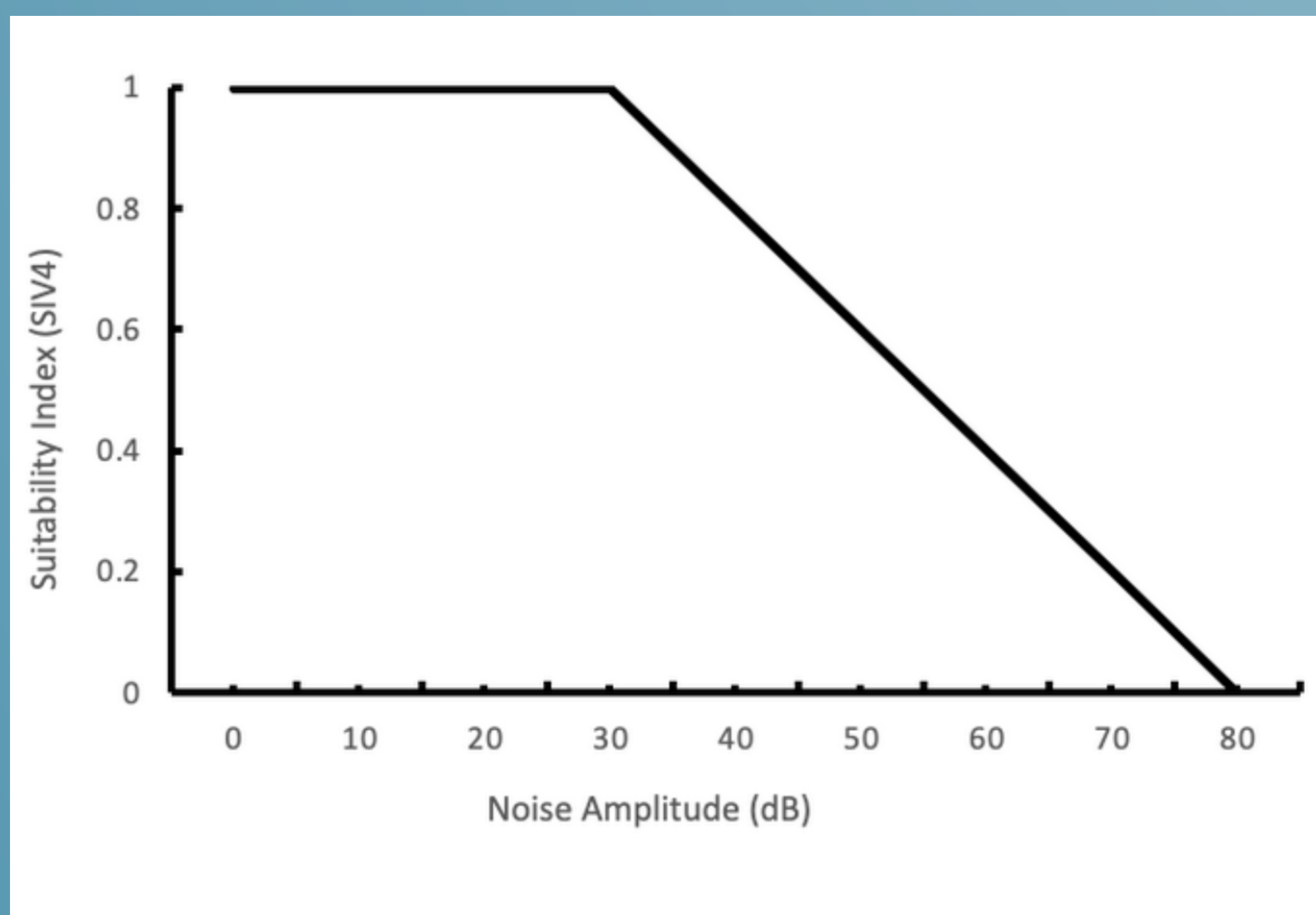


Figure 1. Predicted index of the negative correlation between habitat suitability and amount of decibels (dB) from traffic or other anthropogenic noise pollution. This is a depiction of what may be added to the US Department of Interior's Habitat Suitability of Barred Owl (*strix varia*)

Study Design

- We will conduct field research in the University of Vermont Jericho Research Forest in Jericho Vermont. The interstate route 89 runs just under the south western side of the forest, and there is enough acreage of forest to reach undisturbed areas. This allows us to conduct both a treatment and control in similar forest conditions.
- Barred owls (*strix varia*) will be safely trapped and harness-mounted transmitters will be attached to track them through satellite (Figure 2). Previous studies have shown that the transmitters do not affect the owl's normal activities (Therrien et al., 2012). The transmitters record the owl's movement in 30-second intervals, which can be continuously plotted on a map to determine the barred owl's home range.



Figure 2. A barred owl (*strix varia*) flies with a tracking device attached. Shows that the barred owl exhibits regular behavior while carrying the light-weight tracker. Photo by Hal Beral (<https://www.time.com/owls/>)

- Plotting the home ranges of all the tracked owls can be used to map the incidence of barred owls (*strix varia*) in the Jericho Research Forest. This barred owl incidence map can then be layered over a noise level concentration map of Jericho, which may be created by measuring noise amplitude around the researched forest. By layering the two maps, we may see if there is a lower incidence percentage in areas with higher average noise amplitude in Jericho.
- The second part of this study includes testing the degree of influence that different amounts of noise amplitude have on barred owl hunting. This includes setting up speakers that emit a given decibel of sound (Figure 3). The owls are lured with bait and an artificial prey rustling noise and their prey detectability is observed through trail cameras. The amount of time it takes for the barred owl to locate the artificial rustling noise and bait will be recorded and the prey detectability will be analyzed

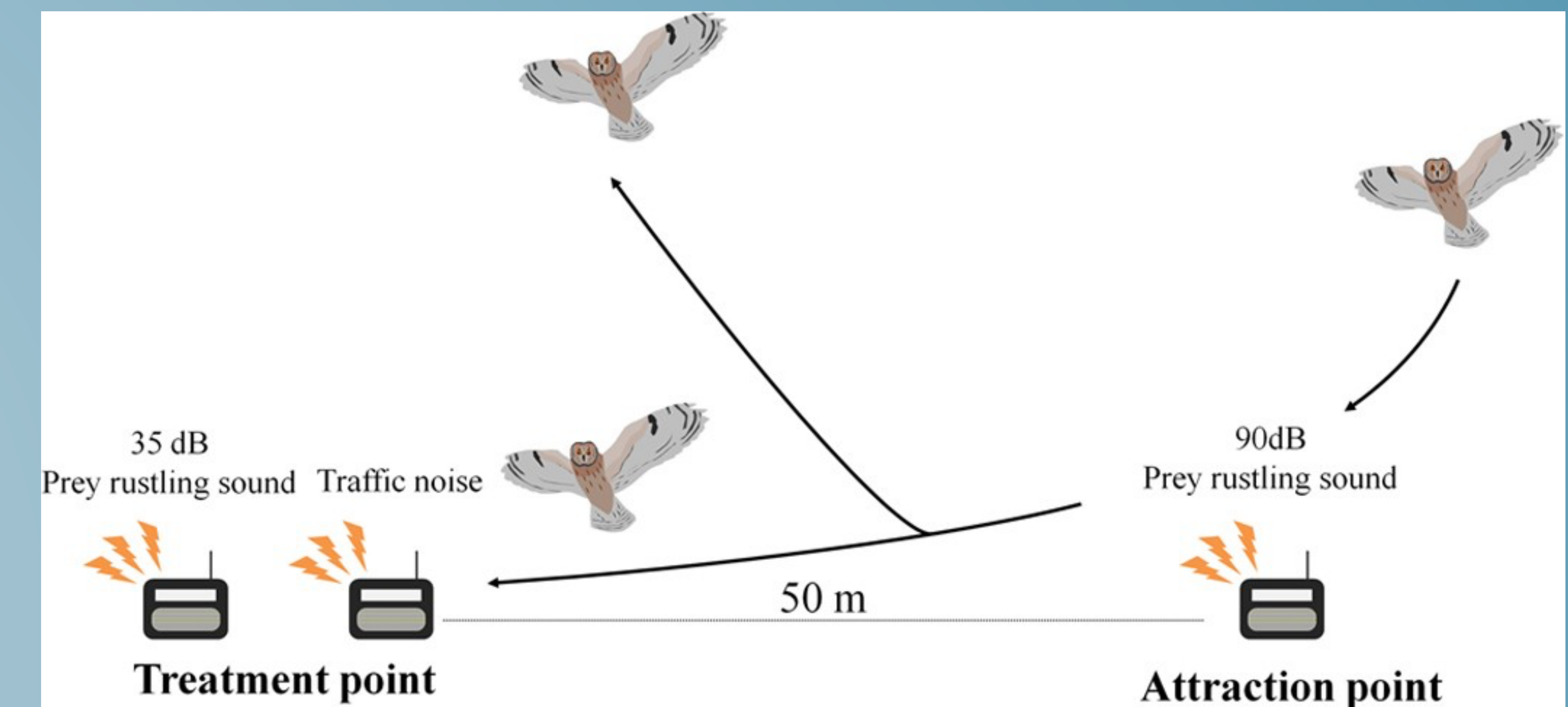


Figure 3. A diagram showing how owls can be lured in with artificial prey rustling noise and how they may respond to added noise (<https://www.nature.com/articles/srep30602>)

Intended Analysis

- Given that our independent variable (Treatment: speaker playing 40 dB, 50 dB, 60 dB, 70 dB and 80 dB. Control: <30 dB) is categorical with >2 categories and our response variable (Amount of time it takes for the rustling noise and bait to be detected), the data will be analyzed by using an analysis of variance analysis test (ANOVA).
- The ANOVA will help determine if there is any relationship between prey detectability (time it takes for owl to locate artificial prey) and noise amplitude in surrounding area. Knowing whether there is a relationship between the independent and depended variables is important for determining if the low incidence of barred owls in areas with high noise amplitude is associated with the owl's ability to detect prey.

Expected Benefits

- The Fish and Wildlife Service of the US Department of Interior created a habitat suitability index for barred owls in 1987 (Figure 4). This habitat suitability index is used federally to identify barred owl habitats across the country and aid in habitat conservation planning (Allen, 1987). Since then there has been a significant increase in anthropogenic disturbances globally. Traffic densities have increased by 55% between 1990 and 2011 (OECD Publishing, 2013). By proving that noise pollution influences barred owl habitat suitability, the habitat suitability index can be updated to include a fourth index such as (Figure 1). This may show that barred owl habitat is more limited than once thought and action to find solutions for noise pollution may be prioritized.

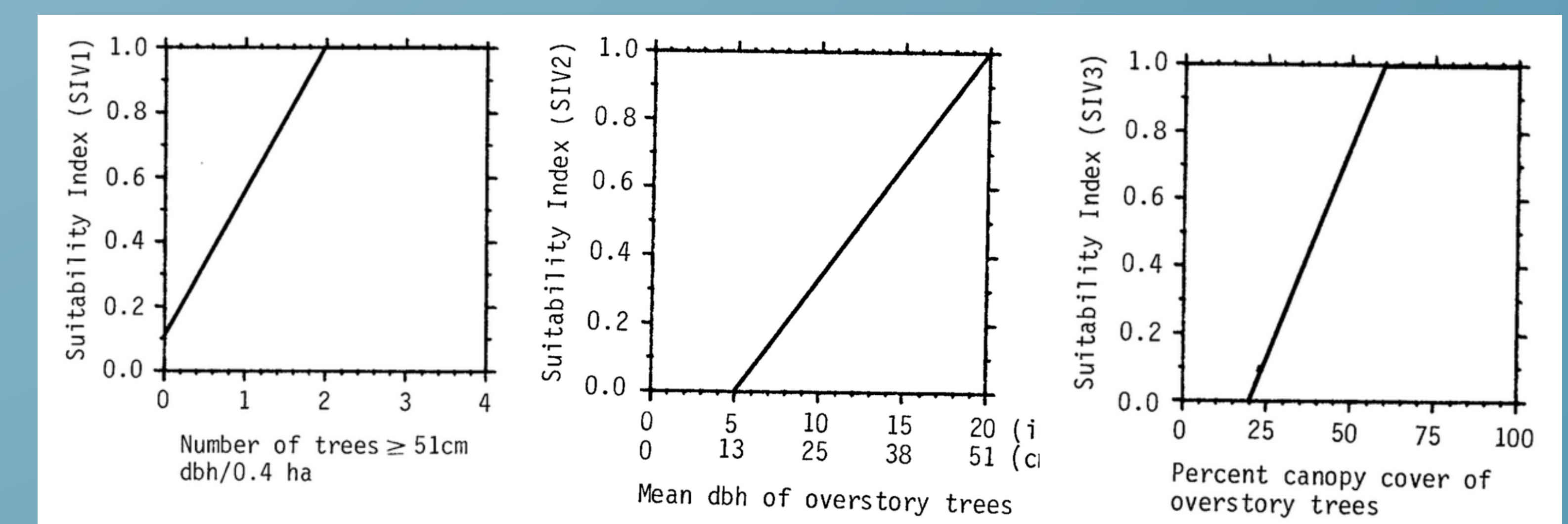


Figure 4. Habitat suitability indexes for the barred owl. A 1.0 indicates that the habitat factor is suitable for a barred owl, whereas a 0.1 shows that the factor is not suitable for barred owl.. Drawn by the Fish and Wildlife Service of the US Department of Interior (<https://apps.dtic.mil/dtic/tr/fulltext/u2/a323026.pdf>)