

Surveying Suburban Barred Owls in Olympia, Washington

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Abstract

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Barred Owls (*Strix varia*) are a common medium sized owl on the east coast of the U.S. into Canada. Occupying forestes, this generalist can also be found in suburban areas. Over the past 50 years the Barred Owl has expanded its range west into the Pacific Northwest (PNW). The endangered Spotted Owl (*Strix occidentalis caurina*) is an old growth obligate that was severely impacted by commercial logging. The competition between these two species has led researchers to lethally remove Barred Owls. However, Barred Owls often reoccupied locations where they had been removed. This study aims to better understand the distribution of Barred Owls in the Pacific Northwest. The West peninsula of Olympia, Washington is a mix of dense urban areas, suburban areas, and fragmented forest. An audio-broadcast survey was conducted for two months during the summer of 2022 to locate Barred Owls. Responses were classified, based on the maximum number of owls recorded in a single survey, into Single, Pair, and (if young were located) Family. Forty-two individual Barred Owls were located in 15.77 km². Eleven young Barred Owls were confirmed at six locations. A 500m radius buffer was created around all result locations to characterize the habitat. One family was in a neighborhood that contained more developed areas than forest cover. Barred Owls were found on the west Olympia peninsula in densities similar to those on the east coast. The suburban populations of Barred Owls need further study to detail territories, numbers, and potential impacts on the Spotted Owls.

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Introduction

Barred Owls (*Strix varia*) are medium-sized owls common throughout eastern North America. Barred Owls are identified by the brown bars that run horizontally along its chest and vertically on its stomach. Their wings and tail also have brown stripes which, combined with its front, give this owl a dark brown and gray/white appearance. Their calls range from the common “who cooks for you, who cooks for you all” to sounds similar to monkeys or laughing. Barred Owls begin breeding in late winter to early spring when calling increases as pairs select, prepare, and defend the nest. Nesting in cavities, they have adapted to environments such as forests, fragmented farmlands, and even swamps (Clement et al., 2019; Dykstra et al., 2012; Gagné et al., 2015; Hindmarch & Elliott, 2015).

Barred Owls have been able to expand their range through Canada and into the Pacific Northwest (PNW) (Livezey, 2009a). The Barred Owls now overlap the historic range of the Northern Spotted Owls (*Strix occidentalis caurina*) (Wood et al., 2020). Conservationists have been working to understand the relationship between the Barred and Spotted Owls (Buchanan et al., 2004; Diller et al., 2016; Jenkins et al., 2019; van Lanen et al., 2011; Wiens et al., 2021a). Currently, Barred Owls are viewed as an aggressive and invasive detriment to the federally endangered Spotted Owl (Livezey, 2010). Researchers have attempted to remove Barred Owls to benefit the Spotted Owl, but other Barred Owls tend to reoccupy such sites (Diller et al., 2014). Habitat characteristics are important factors influencing the interactions between Barred Owls and Spotted Owls. In areas of co-inhabitation Spotted Owls more often utilize steep slopes and higher elevations, while Barred Owls primarily occupy the lower elevations regardless of cover

type (Hamer et al., 2007). As a generalist, Barred Owls can occupy more diverse habitats, even those not typically associated with large raptors.

Olympia, Washington (Figure 1) is an ideal location to survey for suburban Barred Owls because it has a mix of residential, fragmented forests, and downtown developed areas. Barred Owls have been seen and heard in locations around Olympia (personal observations and Observations · INaturalist, 2022). If Barred Owls can thrive in developed urban areas of Olympia, they would likely be found in all urban areas in the PNW. If areas similar to Olympia, Washington and Portland, Oregon have thriving Barred Owl populations, the forests surrounding those areas could be populated by their young. Management practices must acknowledge suburban source populations and adapt conservation toward old-growth preservation.

The goal of this study was to survey the West Olympia Peninsula and identify and quantify the suburban Barred Owl population living there. The importance of this study is that suburban Barred Owls may be the source population that is recolonizing the forests and outcompeting the Spotted Owls. Conservationists cannot address this problem unless the size and range of the Barred Owl population is identified across the entire landscape, including urban areas. Therefore, adequate, and effective population surveys of PNW Barred Owls are rare but are necessary as sources of information about their impact on the success of Spotted Owl conservation. Audio broadcasts surveys were conducted for two months during the summer of 2022 to locate, not only individual Barred Owls, but also families and young. Results have been summarized and mapped using ArcGIS Pro and ArcGIS Online to provide detailed records of Barred Owls in Olympia, Washington.

West Olympia Peninsula



Figure 1. A satellite image of the West Olympia Peninsula with the extent of the survey area.

Literature Review

The important goal of this project is to identify and better understand Barred Owl presence in suburban areas in the PNW. Since 2014, researchers have attempted to determine the relationship between the Barred and Spotted Owls (Diller et al., 2014; Hamer et al., 2007; Jenkins et al., 2019), including removal experiments with Barred Owls being killed by the thousands (Wiens et al., 2021a). Although similar in size and appearance, Barred Owls are far more adaptable to various habitats and prey than the Spotted Owls. In the PNW only one report details Barred Owls found along a suburban gradient (Rullman & Marzluff, 2014). However, on the East Coast Barred Owls have been studied in detail in suburban environments of Charlotte, NC (Gagné et al., 2015; JS Mason, 2004) as well as in Clemson, SC (Clement, 2020).

Owls

Barred Owls are a member of the Genus *Strix* which include two other North American species; Great Grey Owls (*S. nebulosa*), and Spotted Owls. The Great Grey Owl's range is in the northern forests of the United States and Canada. The Spotted Owl is a resident of the Old Growth forests of the PNW. On the east coast, Barred Owls are considered a keystone or indicator species that signify forest health and diversity (McGarigal & Fraser, 1985). Management utilizes this species to conserve productive forests and environments.

Barred Owls are characterized as a generalist species that consume a wide variety of prey and utilize a broad range of habitats. Mating occurs during early spring and successful pairs can

raise 2-4 young per year. Nesting primarily in cavities the Barred Owl was classified as a forest dependent species that requires large tracts of contiguous forest to find suitable habitat (Bosakowski & Smith, 1997). Recent studies and accounts indicate that the Barred Owl is more adaptable than once thought (Bierregaard, 2018; Clement, 2020; Rullman & Marzluff, 2014). Taking advantage of a wide variety of prey options has enabled Barred Owl success in the swamps of the south, cities on the east coast, and the forests of the north.

Barred Owl diets consist primarily of small mammals (mice, rats, voles, shrews, squirrels, and rabbits), birds, reptiles, amphibians, crustaceans, fish and more. A study in the PNW (Wiens et al., 2014) found ninety-five prey species ranging from the more common mammals, insects and amphibians to fish, snails, and birds. Barred Owl presence can be used to understand the abundance and amount of smaller prey species whether in the forest or urban environments. Any prey small enough to swallow whole is digested while the hair and bones are regurgitated out in the form of a pellet. These pellets can be studied to give a detailed record of their diet. Urban Barred Owls, in a study in British Columbia, primarily consumed rats (54.5%) as well as field voles (19.3%) (Hindmarch & Elliott, 2015). They found sixteen different prey species (Orders Rodentia, Lagomorpha, Soricomorpha, Passeriformes, Anura, and Coleoptera) being utilized by Barred Owls. Barred Owls are resourceful and opportunistic, often consuming a resource when it is more readily available. Livezey et al. (2008) recorded Barred Owls feeding on earthworms and slugs. Although they tend to rely on a few abundant species, their wide variety in diet has allowed them to find sufficient food across North America and continue to expand their range.

Breeding season begins around January when Barred Owls increase vocalizations which cement pair bonds and re-establish territory (Johnsgard, 2002). Frequently erupting in raucous caterwauling, Barred Owls can regularly be heard calling during dusk and into the night. Nesting begins around March when females lay a clutch of 2-4 eggs. Once the chicks hatch, they spend a few weeks in the nest then begin to fledge and explore their territory (Johnsgard, 2002). The young and adults use high pitches EEE-eeee's to communicate. As the young develop, they learn to fly and call using the adult vocalizations. Surveying during the breeding season allows researchers to record not only the territorial owls, but also the young they produce.

Barred Owls utilize an incredible diversity of habitats across North America. Researchers find Barred Owls in deep forests with large territories, urban areas nesting in backyard trees, and swamp/marsh land in the south. Allen (1987) stated that Barred Owls prefer expansive woodlands and claimed that tens of hectares of forest would not be enough to sustain them. This opinion has changed, and studies now find Barred Owls in urban areas with very little forest cover (Bosakowski & Smith, 1997; Clement et al., 2019; Dykstra et al., 2012; Rullman & Marzluff, 2014). As their environment changes, species adapt and evolve, and different geographical regions will have different habitat suitability. Barred Owls have been able to, in less than a century, expand north, adapt to urban areas, and continue to find new suitable habitat in western North America (Livezey, 2009a). Spotted Owls are considered a species dependent on old growth and require contiguous, higher elevation, forests to maintain their population (Hamer et al., 2007; Jones et al., 2018; Spies et al., 2018). Conversely, Barred Owls use habitats according to their availability, indicating their generalist nature (Hamer et al., 2007).

Owl habitat and territory size is very different across North America. The Barred Owl was described as a species that “requires an expansive forested area that contains large mature and decadent trees that provide cavities suitable for security and reproduction” (Allen, 1987). However, Barred Owls can also inhabit urban areas like the suburbs of Charlotte, North Carolina (Bierregaard et al., 2008) and here in Olympia, Washington (Observations · INaturalist, 2022). These urban areas provide insight about the minimum requirements of Barred Owls. One study of urban Barred Owls in Clemson, South Carolina found that Barred Owl home ranges were an average of only 0.5 km² (Clement et al., 2019). Habitat requirements vary widely based on geography and availability of resources. Barred Owls have adapted to a wide variety of forest stand sizes, compositions, canopy closures, and more. Urban areas can provide all these needs if development has left patches of forest and fields, or if neighborhoods contain old trees for nesting (Bierregaard, 2018).

Range Expansion & Implications-

Currently, most species are impacted directly or indirectly by anthropogenic climate change. While some species, such as the Spotted Owl, have been declining as human disturbance affects their habitats; others, such as the Barred Owl, have been expanding their range (Boal et al., 2018). Barred Owls are not the only species that have taken advantage of the changes in climate and habitat. Avian species have expanded their ranges to utilize regions where climatic patterns are “typical of pre-expansion distribution” (Johnson, 1994). Blue Jays have expanded their range west and have benefited from urbanization and increased food supplies (K. G. Smith, 1978). Eastern Screech Owls have also been observed benefiting from increased temperatures due to the earlier availability of food sources (Gehlbach, 2012).

Barred Owls have been common throughout Eastern North America for centuries. Scientists began to record Barred Owls moving north into Canada, eventually making their way into the PNW. The first account of a Barred Owl in the PNW was around 1965 (Livezey, 2009a). Possibly utilizing areas of human disturbance and fragmentation, these adaptable owls found large tracks of forest as well as mixed urban areas (Livezey, 2009b). Barred Owls have since completely overlapped the historic range of the Northern Spotted Owls (Livezey, 2009a). Also, studies of displacement tend to exclude habitat change and focus only on detection to indicate competition (Kelly et al., 2003). Considered an aggressive invasive species, Barred Owls have entered the territory of resident Spotted Owls (Dugger et al., 2011). Studies that measure territory attributes find there is very little overlap of home ranges between barred and spotted owls (Hamer et al., 2007). Also, studies of displacement tend to exclude habitat change and focus only on detection to indicate competition (Kelly et al., 2003).

Researchers are interested in the relationship between the two species (Baumbusch, 2016; Hamer et al., 1994; Long & Wolfe, 2019; Sovern et al., 2014; Wiens et al., 2021a). Barred Owls are being removed from areas near Spotted Owl territories to test their impact on Spotted Owls (Diller et al., 2016). These studies have difficulty completely removing the Barred Owls. The Spotted Owls must have old growth forest to survive, but the Barred Owl is more generalized (Buchanan et al., 2004). Research in the Pacific Northwest is focused on the areas where Barred Owls have replaced or compete with Spotted Owls in the forests. Diller (2014) spent seven years trying to completely remove Barred Owls from areas with Spotted Owls. He mentions that recolonization by Barred Owls allows for easier removal, however, does not indicate where the owls came from. Recolonization is viewed by Diller (2014) as a minor consideration although he

admits “Reoccupation of sites by Barred Owls will likely vary based on proximity to and size of a source population and the presence of non-territorial owls, variation in annual reproductive success, availability of habitat, and size of the area from which Barred Owls have been removed.” Recolonization may come from urban and suburban areas where Barred Owls occur at higher densities (Rullman & Marzluff, 2014). In California, research aims to better understand the dispersal of juvenile Barred Owls to determine where removal efforts would be most effective at minimizing immigration from source populations (Peery et al., 2018).

A recent paper focused on removal of Barred Owls in California, Oregon and Washington found that the impact of Barred Owls on Spotted Owls could only be detected using meta-analysis (Wiens et al., 2021a). Their results show an increase in estimated mean annual rate of population change from -12.1% in control areas to -0.2% in areas with removals. However, this study found it difficult “detecting a strong effect of Barred Owl removal for some individual study areas” (Wiens et al., 2021a). In fact, the individual study areas often showed no changes between control and treatment areas. For example, mean change in apparent survival contained confidence intervals that were below zero for three out of the five study locations. They assert that removal of Barred Owls alone is not sufficient to stabilize Spotted Owl populations because the lack of recruitment and older forests are key factors limiting Spotted Owls. They also claim that any lapse in management would allow barred owls to rapidly recolonize and “erode conservation gains” (Wiens et al., 2021a). However, the supplemental information they provide shows that the total number of Barred owls removed increased in three of the five locations during the experiment (Wiens et al., 2021b). The success and total distribution of Barred Owls has been under-acknowledged and their removal only temporary. Removal of Barred Owls is the latest step in Spotted Owl management that started with the Northwest Forest Plan.

The Northwest Forest Plan (U.S. Department of Agriculture Forest Service, 1994) was created in 1994 to guide forest management toward the conservation of threatened species. Unfortunately, after two decades of management suitable habitat decreased on both federal and private lands (Spies et al., 2018). The fragmentation of the PNW has negatively affected spotted owls while simultaneously increasing Barred Owl habitat. The historic changes of the PNW may have created an “extinction debt” where long-lived species decline or become extinct from prior habitat change (Jones et al., 2018). This may be a factor in the spotted owl decline over the entire population. Jones et al. (2018) only found reduction in Spotted Owl populations resulting from extinction debt and not from severe wildfires or Barred Owls. The type and extent of habitat determines the species, and the northwest has been transformed into a patchwork of various aged stands, separated by clear cuts, waterways, and high elevation habitats. Some studies have found Barred Owls at lower elevation with more gentle slopes, while Spotted Owls tend to rely on the higher elevation slopes (Singleton et al., 2010). The high elevations remain the last stronghold of the Spotted Owl perhaps because of the lack of profitable timber or the difficulty to harvest it. Although many researchers focus on the relationship between the two owl species, others call for the conservation of old growth trees and to restore the habitat of degraded forest ecosystems (Jones et al., 2018; McMullin & Wiersma, 2019; Strittholt et al., 2006).

One complicated aspect of the range expansion of Barred Owls is their ability to hybridize with the Spotted Owl creating so-called “Sparred Owls”. Studies of these hybrids have found that they are most often between a female Barred Owl and a male Spotted Owl (Haig et al., 2004). The viability of the hybrids indicates that the two species are very close genetically (Hamer et al., 1994), but they are still considered two distinct species that had no previous gene flow between them (Haig et al., 2004). As the Barred Owl becomes more common in the PNW

the hybridization of the two species has increased (Spies et al., 2018). Other species also experience hybridization when range expansion occurs. Blue Jays (*Cyanocitta cristata*) have expanded westward, and records indicate they have hybridized with the resident Stellar's Jay (*Cyanocitta stelleri*) (K. G. Smith, 1978). Smith (1978) found that similar to the Barred Owl, Blue Jays are utilizing habitats that native corvids do not use. Other studies on captive falcons have observed that morphological differences alone (phenotype) cannot be relied on for species identification, with the implication that genetic testing will be the main driving force to conserve species (Eastham & Nicholls, 2005). Current literature acknowledges that Barred Owls are interacting with Spotted Owls in more ways than previously thought. Hybridization complicates the legislation of conservation (Spies et al., 2018).

Urbanization-

Urban and suburban environments have long been associated with a small variety of songbirds and small mammals (Boal et al., 2018). In recent decades researchers have begun describing larger raptors, including Barred Owls, utilizing suburban environments (Bosakowski & Smith, 1997; Clément et al., 2021; Gagné et al., 2015; Rullman & Marzluff, 2014; Tilghman, 2015). Sharp-Shinned Hawks (*Accipiter striatus*) studied in the Montreal area of Canada were not negatively affected when nesting in urban areas (Coleman et al., 2002). In fact, some species like the Cooper's Hawk (*Accipiter cooperii*) have been found in higher densities when nesting in suburban and urban environments (Stout et al., 2007). Dykstra et. al. (2012) found that suburban Red-Shouldered Hawks (*Buteo lineatus*) and Barred Owls nested in locations that were virtually identical. Some owls, like the Great Horned Owl (*Bubo virginianus*), have been shown to actively select habitat that is urbanized and fragmented (D. G. Smith et al., 1999). Barred Owls

in Charlotte, North Carolina and Clemson, South Carolina have been found and studied utilizing urban and suburban environments (Clément et al., 2021; Gagné et al., 2015).

The population of Barred Owls in the northwest occurs in the forests *as well as* in urban areas. Most of the parks around the city of Portland, Oregon have Barred Owls (*Natural Areas / Portland.Gov*, 2022). By having reduced forested habitats, urban areas allow us to understand the minimum requirements of Barred Owls (Clement et al., 2019). These urban areas may continue to supply the surrounding forests with Barred Owls for years to come. Understanding this source population could help inform further decisions about owl conservation in the PNW. The full extent of the Barred Owl expansion has not been acknowledged in the literature. Rullman and Marzluff (2014) found Barred Owls near Seattle, Washington at 76.2% of their survey sites, and suggest that suburban Barred Owls may be the source population that is recolonizing nearby forests (Rullman & Marzluff, 2014). Barred Owls are spread throughout the PNW from the forests to suburban areas (Livezey, 2007, 2009a; Rullman & Marzluff, 2014).

Barred Owls have been able to adapt to human disturbance and benefit from less destructive developmental practices (Clément et al., 2021). In stark contrast, Spotted Owls have been unable to successfully adapt to human interference and their populations continue to decline (Long & Wolfe, 2019). The Spotted Owls cannot find enough arboreal prey outside large tracks of old-growth forests to sustain their population (Wiens et al., 2014). The habitat of the PNW forests has been changing since the first people settled in the area thousands of years ago (Livezey, 2009b). In recent decades industrial logging has vastly changed the forests. These changes decrease total forested habitat which reduces arboreal prey species, increases edge effects and predation risks, as well as alters territory suitability due to buffer zones or decreased water quality (U.S. Department of Agriculture Forest Service, 1994). Barred Owls utilize fields

for hunting and the increase of terrestrial prey in open spaces creates more suitable habitat for the Barred Owls. The adaptability of Barred Owls, compared to the restricted requirements of Spotted Owls, will continue to favor the Barred Owls in the PNW.

Until the suburban Barred Owl population is studied further, we will not know the full extent of the Barred Owl expansion. If the suburban Barred Owls are finding suitable habitat and reproducing, they will continue to thrive outside of Spotted Owl conservation efforts. This project will help to understand the extent of suburban Barred Owls and how successful they are in Olympia, Washington. The importance of this study is that suburban Barred Owls may be the source population that is recolonizing the forests and outcompeting the Spotted Owls. Acknowledging the existence of the suburban Barred Owl populations will help better inform Spotted Owl conservation in the PNW.

Methods

To locate Barred Owls on the West Olympia Peninsula in Washington State, potential habitats were surveyed using audio broadcasts to call the owls and elicit a response. Surveys were conducted from June 15th to August 15th, 2022, the approximate period when the young have left the nest but before they have left the territory (Bierregaard, 2018; Leder & Walters, 1980). Calling was conducted for two months to find Barred Owls while reducing the disturbance to the success of the owls. Surveys were spaced by at least a week before the location was surveyed again. Surveying methods were similar to other suburban owl studies (Clement, 2020; McGarigal & Fraser, 1985). The data was collected using ArcGIS Field Maps and analyzed using ArcGIS Pro.

Survey Sites

Potential survey locations were identified using ArcGIS Pro and Field Maps to find forested areas with vehicle access. The size or composition of the forested area was not as important as proximity and/or access to the patch. Some potential habitats were surveyed from a variety of locations to ensure maximum coverage. While surveying, those responses that could not be confirmed were called closer to the possible location of the source to validate the response. Some locations with no further potential responses were only called once. As the survey progressed, locations were selected that expanded the total area covered until the entire West Olympia Peninsula was surveyed.

The survey form was created using ArcGIS Pro and Field Maps (Figure 2). A point was created in Field Maps for each location data was collected. The data recorded was surveyor

name, date, weather, wind, start time, owl species, sex, response time, response type, call type, notes, end time and pictures/video taken during the survey (See Appendix - Weekly Results). The results were stored into an ArcGIS Online Map that could be accessed and adjusted during the survey.

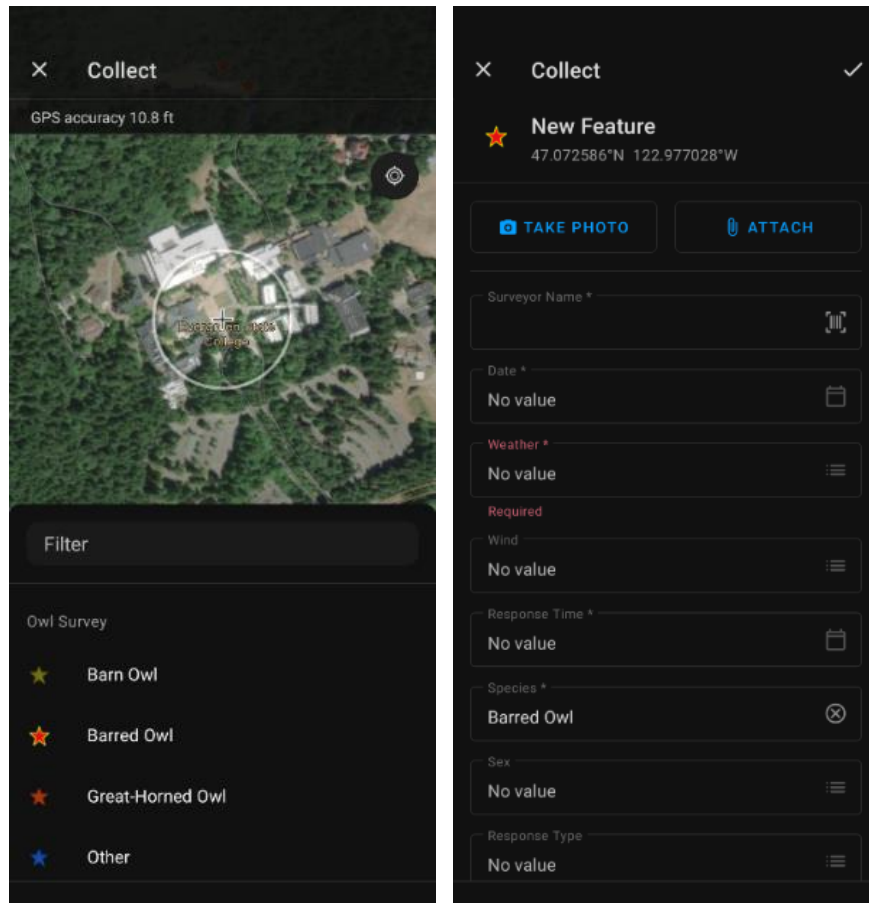


Figure 2. Screenshots of the Field Maps Phone App used to collect data during the survey.

Calling

Audio playback surveys use recorded conspecific calls to attract or elicit a response from a target species. Barred Owls are often successfully surveyed using this technique (McGarigal &

Fraser, 1985). Starting half an hour before sunset each station was surveyed until owls were detected. The standard procedure was to play a call, then allow a two-minute listening period before continuing the survey. The order of the owl call recordings progressed in complexity and territorial status. The calls began with an individual male and female calling and at the end of the audio the owls were duetting and caterwauling together. The survey lasted 14 minutes to ensure the owls have time to respond and to help overcome any suburban noises that make surveying difficult. All owl species that responded during the survey were recorded. However, if a Great-Horned Owl responded, the survey was stopped to minimize predation risk to any Barred Owls. The volume of the survey was also adjusted to minimize disturbing residents. Surveying was adjusted to later start times to reduce urban noises such as traffic, people, and pets. To maximize effectiveness, surveys were not conducted on Friday or Saturday nights when more traffic and urban noises were present. Near Highway 101 the noise of cars was a constant disturbance and only the early hours of the morning had the least amount of traffic. Wind and weather were factors that could impact audio broadcast surveying. When there is wind and rain, surveying is difficult because it is harder to hear responses. Surveying during the summer months minimizes the chances of rain during the survey period. The northern point of the west Olympia Peninsula can be impacted by ocean breezes because it narrows to less than a mile. This and other coastal areas tended to have higher winds, potentially impacting the ability to hear owls calling.

Responses

Surveys produce a variety of common Barred Owl response types including calling from a distance, flying in and calling loudly, flying in and not calling, as well as young begging. If a Barred Owl flies in but does not call it is impossible to determine the sex of the owl. Male and

female Barred Owls can be identified by the octave of their calls (Odom & Mennill, 2010). Males tend to be lower and end their 8-note calls abruptly. The female Barred Owls are higher pitched and often elongate the final notes more than the males. Young can be identified by the high pitch begging call they repeat. A location was considered completed when young were detected and to prevent further impacts on the family it was not surveyed again. The weekly result maps are found in the Appendix. After the first week it became clear that surveys would need to start later at night to reduce the urban background noise. The third week expanded the survey areas as well as rechecking locations. Week 4 was the first time young Barred Owls were calling with the adults. During week 5 the surveying expanded and resulted in more young owls being discovered. Surveying during week 6 expanded into the northern peninsula and continued into the urban gradient to the south. Weeks 7 and 8 were spent expanding the survey locations and coverage. Weeks 9 and 10 repeated the survey at as many locations as possible as well as surveys at locations that produced single or pair responses in a final attempt to find young owls

Mapping

Field Maps was used on my cell phone to record the results of each survey. The data was stored and could be accessed in ArcGIS Online. This data was divided into increments of one week and is displayed in the Appendix. When the survey was completed, the data was imported into ArcGIS Pro. The data was summarized into results and locations layers. The total dataset had overlapping information that needed to be summarized. The owl responses were classified as Single, Pair, or Family based on the maximum number of owls detected (Figure 4). Survey Locations were also summarized into single spots because some of the calling was adjusted to improve the chances of detection (Figure 3). Land classification data (USANLCD) was imported

from ArcGIS Portal and used to compile habitat information. A circular buffer with a radius of 500m was created surrounding the location point of owls on the Results Map. These buffers were combined with the land classification data to characterize and analyze the habitat. The total area for each classification found within the buffer was divided by the total area to create Land Class percentages (See Figures 5,6,7, and Appendix: Table of Habitat Percentages Within 500m Radius) These percentages are not without bias, since individual owls may have traveled in towards the recorded calls before responding.

Results

Barred Owls were successfully located throughout the West Olympia Peninsula during the eight-week survey period. Surveying a total of 170 times at 91 locations (Figure 3), 38 detections of owls were recorded. A total of 31 adults and 11 young Barred Owls were found (Figure 4). Owl families were located in neighborhoods, next to shopping centers, as well as in forested areas of the northern peninsula. Survey results were summarized based on the maximum number of owls recorded in one visit. All the results from the survey are mapped and available in a Web map using ArcGIS Online (<https://arcg.is/1PPHaG>).

Survey Locations

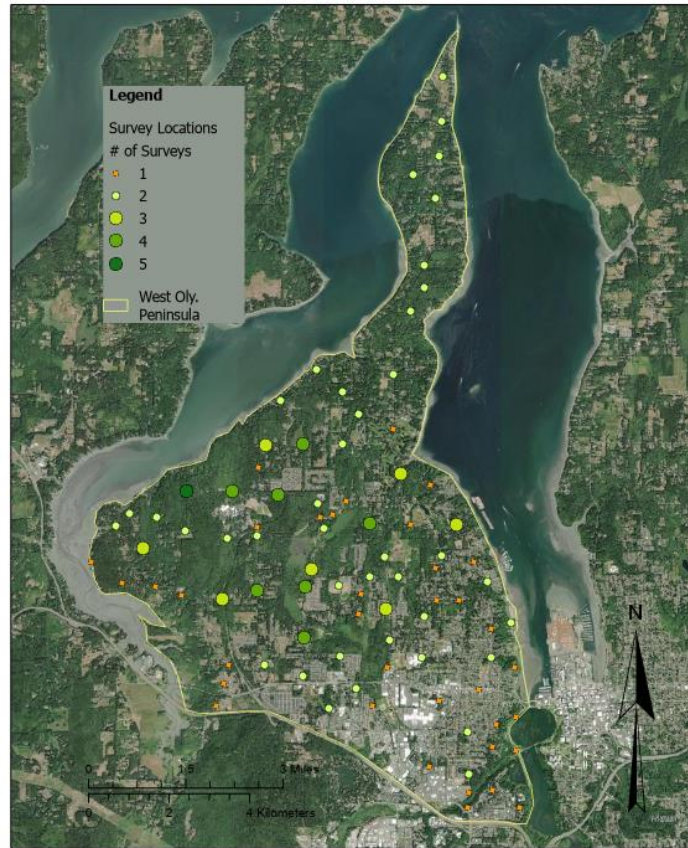


Figure 3. Map showing Survey Locations and the number of times surveyed.

Survey

Figure 3 shows the summarized survey locations and the number of times that each was surveyed. A major goal of this study was to survey as many locations as possible to maximize the Barred Owls recorded on the West Olympia Peninsula. Of the 91 total locations 55 were surveyed at least twice. Of the 36 locations that were surveyed once, 3 locations had families responding and were therefore considered completed. Other locations were not repeated due to traffic/urban noise, proximity to Barred Owl family response, and proximity to Great Horned

Owl presence. Locations were summarized into points based on distance to other surveys, size of the stand or area, and environmental impacts such as traffic noise or ocean winds. At locations where Barred Owl individuals or pairs responded the survey was repeated to confirm the occupancy and attempt to find young. The results of each survey, divided into 7-day increments, can be found in the Appendix.

In total, 42 individual Barred Owls were detected during the survey period (Figure 4). Of the total number found, 11 young were recorded. Six places were classified as having a family because of the presence of young at those locations. There were three places where a pair of Barred Owls was responding but no young ever recorded. At the remaining 19 locations a Barred Owl was recorded but only one individual at a time. The west Olympia Peninsula, 15.77 mi², contained on average 2.66 Barred Owls per square mile. While Barred Owls were the target species for the survey any owl that responded was recorded as a response. Great Horned Owls were recorded at three locations and one Barn Owl was observed. Great Horned Owls negatively impact Barred Owl responses and have been known to kill Barred Owls so when a Great Horned Owl was found that location and surrounding areas were not surveyed further to reduce the potential negative impacts on Barred Owls.

This study located Barred Owls in a wide variety of areas in and around Olympia, Washington. The habitats where they were found varied from larger tracts of Douglas Fir to small stands of hardwoods around drainages. These variations highlight the adaptability of Barred Owls. The Table of Habitat Percentages Within 500m Radius found in the Appendix details the habitats where responses were recorded. It is important to note that these points and the surrounding buffer area are inherently biased because surveying can result in owls traveling outside of their core habitat areas to respond. The descriptive data of habitat percentages can still

provide important information about the areas Barred Owls are occupying in Olympia. Every buffer area contained at least Low Intensity Development and Developed Open Space while 10 contained some High Intensity Development (maximum of 1.85%). All buffer areas also contained Deciduous Forest (min .74%, max 34.32%, Evergreen Forest (min 1.77%, max 40.79%), and Mixed Forest (min .03%, max 39.20%).

Based on the results, Barred Owls have found ample habitat options in Olympia. However, the presence of many single responses indicates that there may be more Barred Owls than were located. These individuals may be part of a pair or family that was not found during the surveys. Further study of the suburban resident Barred Owls is necessary to better understand the total population, territory sizes, and impacts they may be having on surrounding areas.

West Olympia Barred Owls

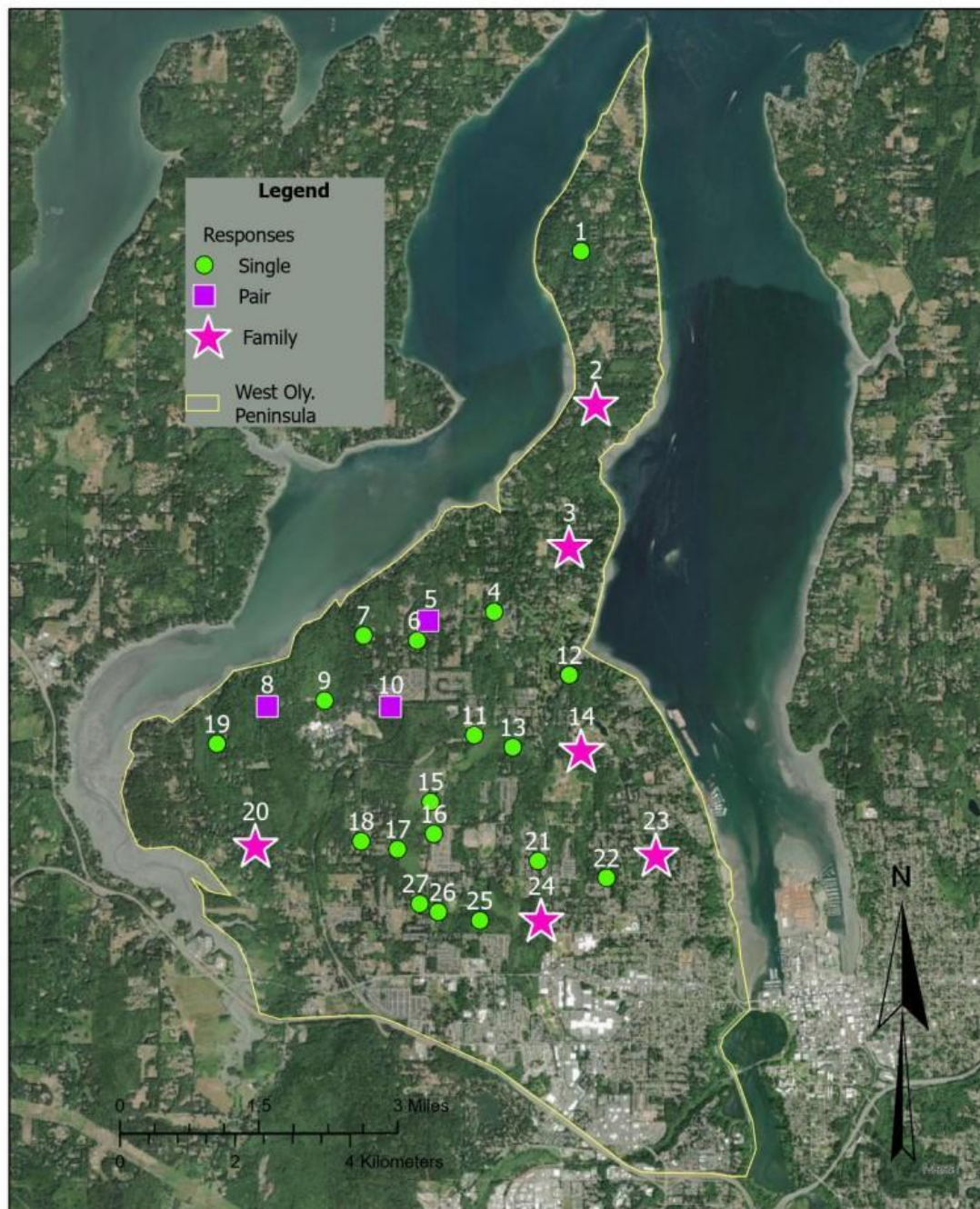


Figure 4. Map of Barred Owls classified by Individual, Pair, or Family based on the survey results.

Influencing Factors

Surveying in suburban environments is very different than surveying in the forested mountains. Initially, surveys were conducted following protocols similar to those conducted in the forest. However, within a week it became clear that I would not be able to start the surveys until much later in the evening after most people were asleep. The traffic noise along major roads and in the South and SE near Highway 101 resulted in calling from multiple locations searching for potential responses. Along with traffic noise, people influenced the survey in a variety of ways. Some locations were only called one time due to the presence of people either in the forested patches or in nearby houses and businesses. At three survey locations campus security or Olympia Police stopped to check on me. One OPD officer even admitted to hitting an owl with his car. Highway records confirm that Barred Owls are being killed along major roadways throughout the state and in other areas where they inhabit suburban areas (Croston, 2021; Gagné et al., 2015). People and traffic were considerations throughout the survey. While surveying in the SE and central suburban areas the goal was to find locations close to forested patches but not close to houses. While in neighborhoods calling volume was reduced to balance surveying the patch while minimizing impact on residents. Where possible, locations were chosen to maximize distance to surrounding houses. However, many times houses were very close to survey locations. Another aspect of suburban surveying were the dogs that would respond to the calls. Some locations were more difficult than others to hear owls because the dogs were so far away that they sounded very similar to a responding owl. Many times, when there was a suspicious response, it was a distant dog rather than an owl.

Discussion

This survey found that Barred Owls, located on the western peninsula of Olympia, Washington, are successfully reproducing. Within the two months of surveying eleven young were confirmed at six locations. The young indicate that a pair of Barred Owls have an established and suitable territory (Doyon et al., 2000). The suburban areas of western Olympia are a patchwork of developments, forest stands and open fields and grass. In fact, Barred Owls are known to thrive in mixed land class areas throughout their Eastern range (Clement et al., 2019). While surveying an area of 15.77 mi² (40.84 km²) a total of 42 Barred Owls were located. This results in a density of 2.66 owls/mi² on the West Olympia Peninsula.

To better understand the areas where Barred Owls were found a buffer of 500m radius was created around the response locations. Figure 5 is an example of an individual owl response. This location had responses on multiple surveys however, because only one owl was located during each survey this location was designated as a single owl point. This area is a good example of the more forested residential neighborhoods on the west Olympia Peninsula. Figure 6 highlights a pair designation where two adults were calling together on multiple occasions. Located very close to Evergreen State College, this pair occupied territory that was more forested. However, where these owls responded from was closer to the developments and campus recreational fields than the more heavily forested areas to the east. These owls were surveyed repeatedly to try to locate any young they may have produced. Unfortunately, no young were confirmed, so this location was recorded as a pair. The presence of a pair could indicate young not surveyed and at least increases the potential for young in the future.

The final example of response type and land class, Figure 7, shows a family response near the more-urban part of the peninsula (ID 24). This location was interesting because it was surveyed prior to finding the young. Those initial surveys were unable to locate any Barred Owls nearby. However, while driving I saw an adult fly over the road and so I stopped and surveyed. It was during this final survey the young were heard calling from the forest patch on the eastern side of Grass Lake Nature Reserve. This was one of the two families located within the neighborhoods of high and medium development. This location exemplifies the suburban environment: forest patch, surrounded by shopping centers, houses, a school, and busy roads. Response location 23 also contained a family of Barred Owls within a neighborhood. At the corner of Muirhead Ave. NW and Division St. NW the adults were frantically searching for the intruding owl while the young called from the backyards SE of the intersection. Locations 23 and 24 indicate that Barred Owls can successfully nest and reproduce within suburban environments of the PNW.

Response Location 18



Figure 5. Response Location 18 Land Class Buffer with satellite image and overall location inset.

Response Location 10



Figure 6. Response Location 10 Land Class Buffer with satellite image and overall location inset.

Response Location 24

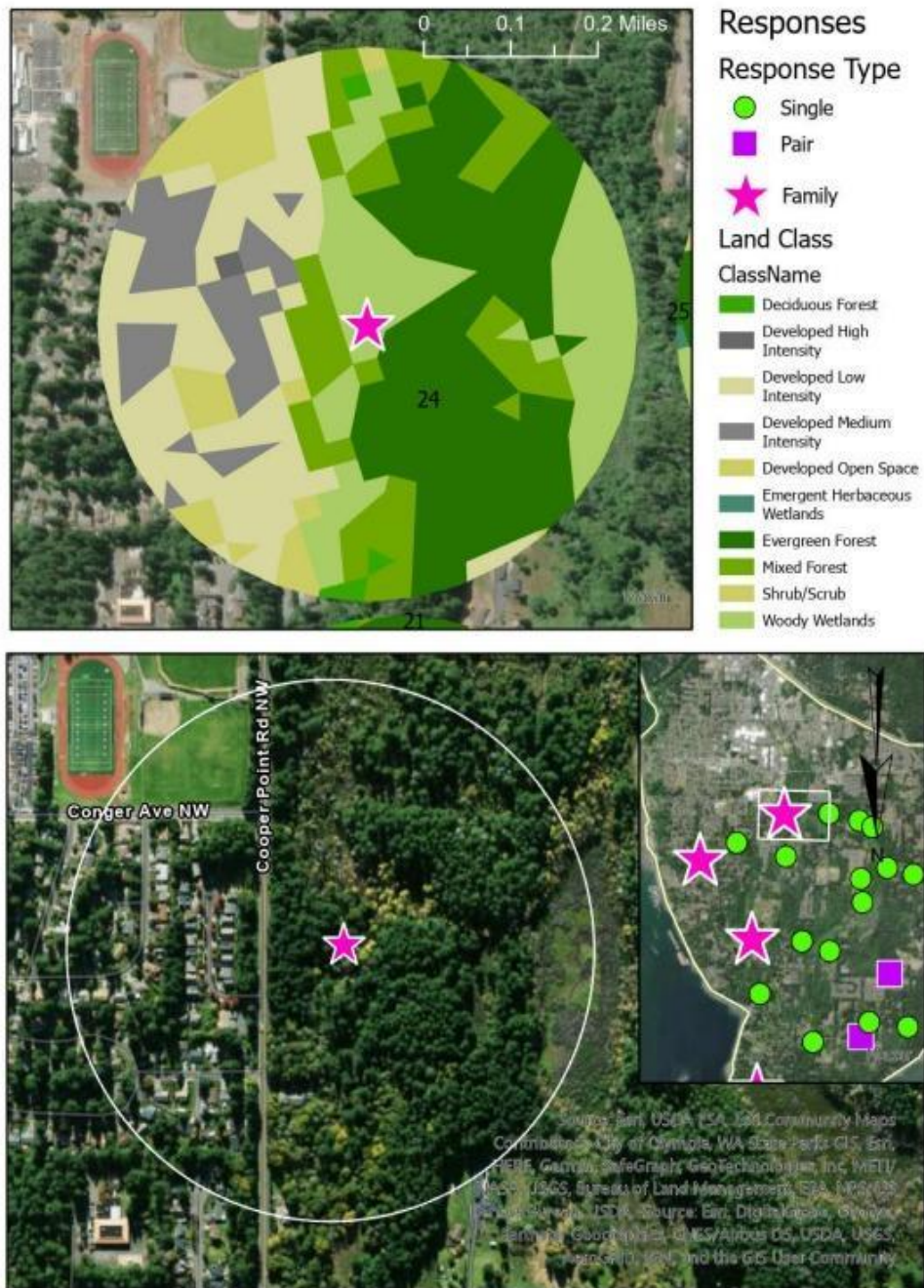


Figure 7. Response Location 24 Land Class Buffer with satellite image and overall location inset.

Until the individual owls and their territories are studied in more detail all land cover descriptions are based on the buffer around the approximate location of the recorded owls. The composition of the environment in each response buffer is found in the Appendix. It is important to note that the buffers are influenced by the survey locations because roads and driveways were used to survey. Despite roads increasing developed open spaces amounts (max 38.04%, min 7.02%) there were only 3 buffers that did not contain at least some medium intensity development. High intensity development was at most 1.85% (ID 9) and found in ten buffers. The primary cover type of the PNW is evergreen forests which had a maximum of 40.79% (ID 7) and a minimum of 1.77% (ID 23). Interestingly response location 23 only had 11.26% evergreen forest and 22.92% mixed forest. With a total tree cover at 35.95% this location had 43.61% low intensity development. What makes this location interesting is that it was a family response and had two young. In fact, the young were in someone's backyard responding while the adults flew around in defense. However, until the suburban Barred Owls are radio-tracked the exact composition and size of these suburban territories are unknown. These area values should not be interpreted to represent, average or calculate habitat utilized by Barred Owls but rather only that these are places where owls have been found.

Although the target species for this survey was Barred Owls, three owl species were recorded during the two months. Great Horned Owls were recorded at multiple locations in West Olympia. If a Great Horned Owl was heard before the survey the location was not called to prevent threats to the Barred Owls. During one survey, what was later identified as a juvenile Great Horned Owl was located and the point surveyed because the species was not known at the time. The other nontarget owl that responded was a Barn Owl heard calling around the golf

course. The other owls recorded are common owls that thrive in suburban environments (Johnsgard, 2002).

Despite the limited amount of time Barred Owls have been present in the PNW their numbers in suburban areas are comparative to other suburban studies. Bierregaard (2018) found 1.1 pair/km² in the suburbs of Charlotte, North Carolina. Clement (2020) found 1.1 pairs of Barred Owls in adjacent territories per square kilometer in Clemson, South Carolina suburbs (Figure 8). They assumed, based on Johnsgard (2002), that each response represented a territory and indicated a pair. The adjacent territories they measured covered 27.27 km² of the Clemson suburbs. The Olympia Peninsula is 15.77 mi² or 40.84 km² and was found to contain 42 total owls resulting in 1.03 Barred Owls per square kilometer. This survey recorded the exact number of owls that responded and did not assume that a response indicated a pair. Also, locations with young recorded only the adult owls that responded and the number of young that could be individually identified (primarily by strength of calls and location). By only recording the owls that responded this survey most likely did not record every owl on the Olympia Peninsula. In fact, one location was found to have young in 2020 (personal observation, Figure 9) but only responded as a single owl during the survey. If each response was counted as a pair, there would have been approximately 54 adult owls. However, because Barred Owls exist as roaming single owls as well as territorial pairs a response was not assumed to be a pair. Further studies of the suburban Barred Owl populations are needed to fully understand their numbers, habitat usage and potential impacts.

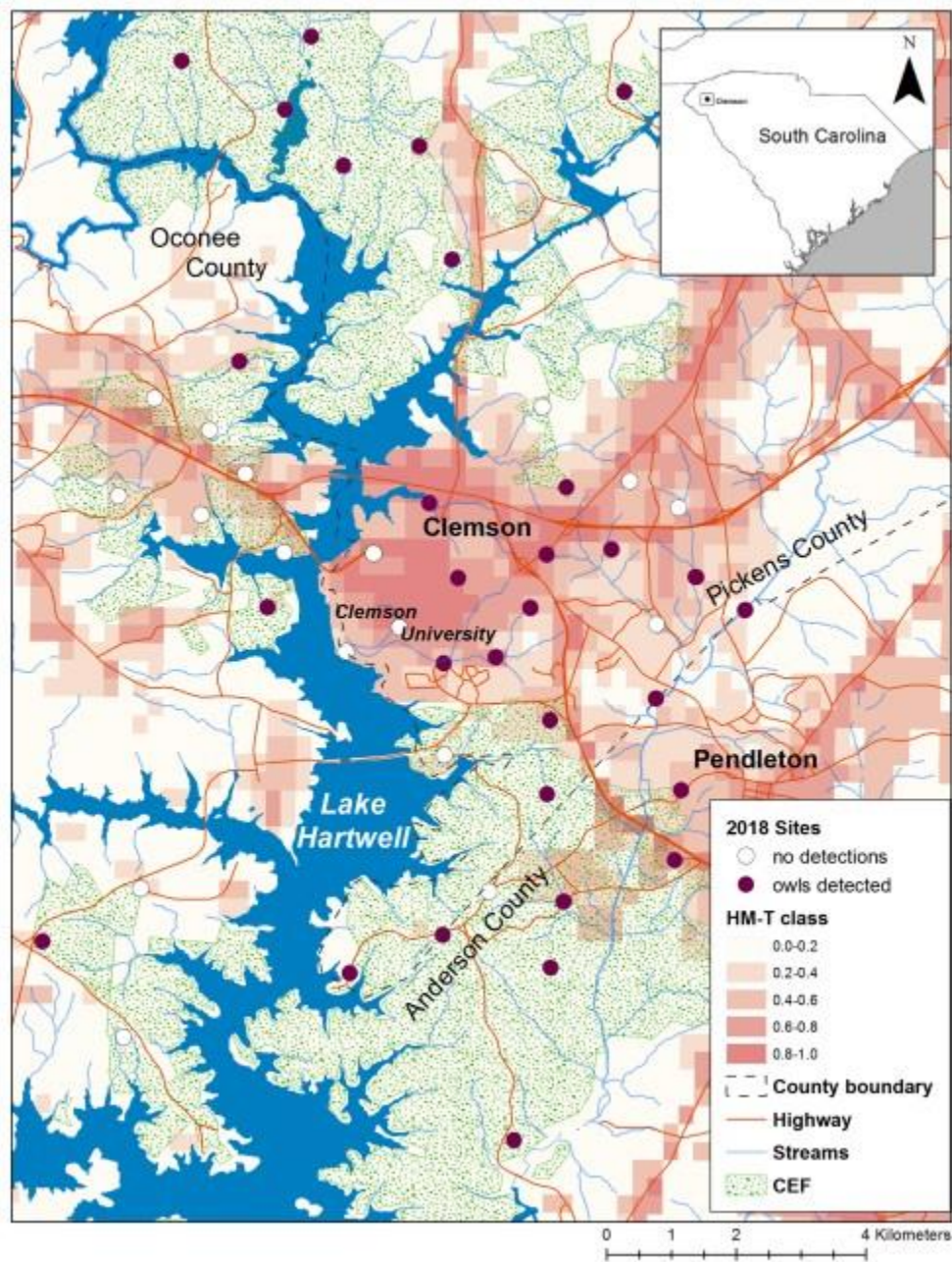


Figure 8. Map of survey results around Clemson, South Carolina. From Clement, M. A. (2020). *Habitat Features and Behavioral Plasticity Promote Barred Owl Presence in Developed Landscapes* [Diss., UNC Charlotte]. https://tigerprints.clemson.edu/all_theses

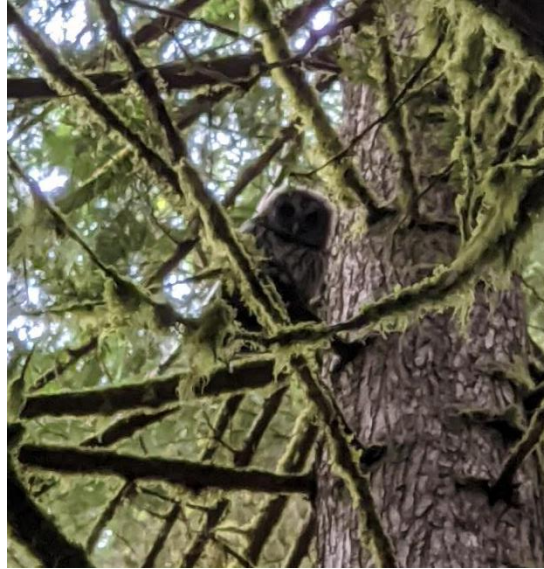


Figure 9. Juvenile Barred Owl photographed by Alex Seebeck in Olympia, Washington 7/1/20

One of the potential impacts of the residential suburban owl population is the dispersal of young into surrounding areas. Juvenile and non-territorial adults occupy less-desirable habitats until they can find their own territories (Johnsgard, 2002). Although the dispersal of suburban Barred Owls in the PNW has not been studied, other suburban owls have been found to travel 2.7km (Bierregaard, 2018). They also found that rural Barred Owls dispersed further than suburban residents at 4.2km. However, studies that track dispersal of Barred Owls on the California coast have recorded owls traveling up to 146km and almost 60% traveling over 50km (Watson, 2021). If the eleven young Olympia Barred Owls dispersed 50km they could reach Tacoma and at 75km the southeast corner of the Olympic National Forest. To better visualize these distances Figure 10 shows 25, 50 and 75 km dispersal rings as well as the maximum straight-line recorded dispersal. Until suburban juvenile Barred Owls in the PNW are tracked,

there is no way to determine how far or exactly where the young are dispersing. Further study is needed to fully understand how they are impacting the surrounding areas.

Suburban areas, like Olympia, Washington, can be found throughout the PNW. Further studies in suburban areas are likely to find more resident Barred Owls. IF the results of this survey are typical of other suburban Barred Owl's reproduction, they will continue to thrive even in areas where they were lethally removed. Initial results indicate that Barred Owls have found successful territories that are independent from the old-growth forests. More detailed study of the suburban Barred Owls in the PNW will help to better understand the full range and extent of this controversial owl.

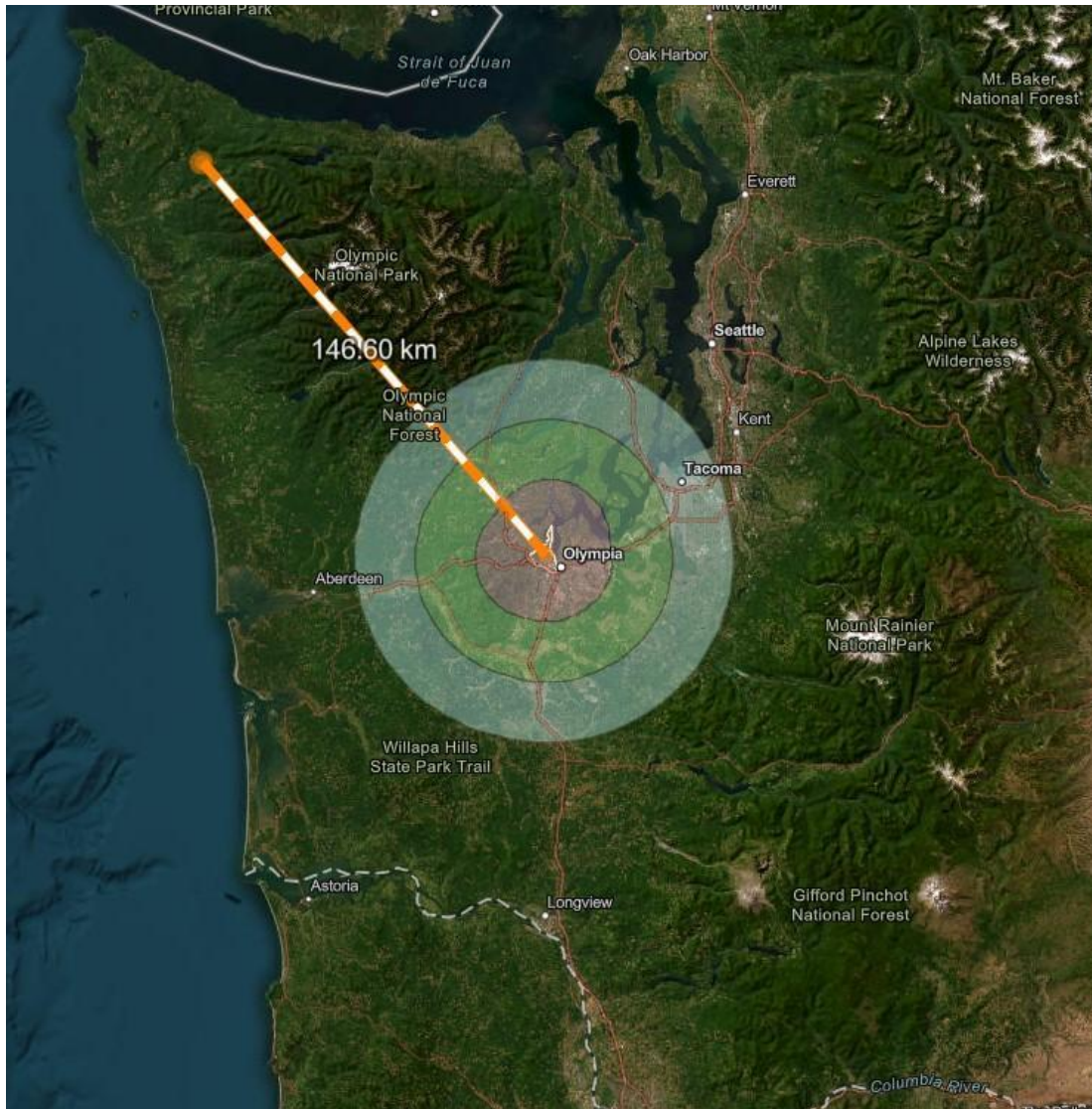


Figure 10. Potential 25, 50, & 75 km Dispersal Rings based on Watson (2021) Characterizing Barred Owl Dispersal at the Leading Edge of their Range Expansion. Line indicates farthest recorded dispersal distance.

Conclusion

This study has found that Barred Owls occupy a wide variety of habitats beyond large, forested tracts. Barred Owls have established themselves in suburban areas including Olympia, Washington. This population has found suitable habitats and is reproducing, creating juveniles to occupy more territories. Further study of the suburban owl population in the PNW is necessary to better understand the full coverage of Barred Owls. Spotted owl conservation must focus on the Spotted Owls and their preferred habitats rather than managing/removing Barred Owls. The Barred Owls have found ample habitats in the PNW including the backyards and fragmented forest patches of suburban areas.

Surveying in Olympia shows that Barred Owls are reproductive residents in suburban areas of Washington State. The focus of conservation in the NW has been how the Barred Owls impact the Spotted Owls. Unfortunately, the Barred Owls occupy more than just the forests of the PNW. Studies have attempted to remove Barred Owls to reduce competition for Spotted owls. However, they were unable to fully eradicate the Barred Owls. Barred Owls successfully reproducing in residential areas in Olympia indicates that no amount of removal in the forests can fully eradicate the Barred Owls from the PNW. The suburban owls have formed a stable population and thus any removal from the forests will only temporarily hinder Barred Owls but never eradicate them fully.

Despite extensive studies involving Barred Owls in the PNW, researchers are primarily focused on the relationship between the Barred and Spotted Owls. The endangered Spotted Owl has been drastically impacted by industrial logging and in recent decades competition with

Barred Owls. This project located reproducing Barred Owl in suburban areas of the PNW in densities comparable to studies in the SE. Until Barred Owls are recognized as both forest AND suburban species the total population in the PNW cannot be measured. As a prolific generalist Barred Owls are now permanent residents where they have expanded their range. Spotted Owl conservation will not be able to remove all Barred Owls in the PNW and must instead focus on habitat preservation as some researchers have suggested (Jones et al., 2018).

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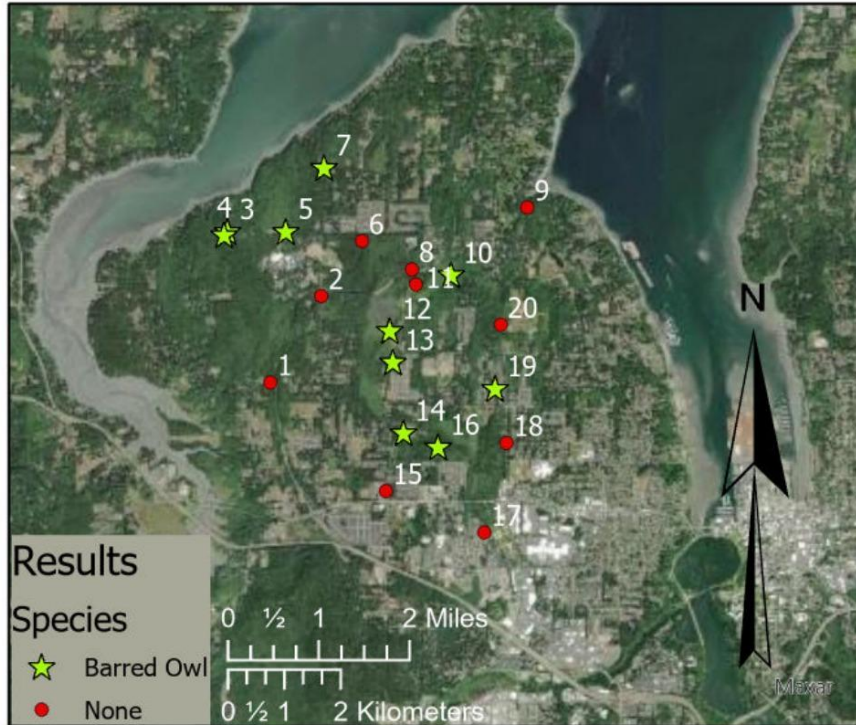
Wiens, J. D., Dugger, K. M., Higley, J. M., Lesmeister, D. B., Franklin, A. B., Hamm, K. A., White, G. C., Dilione, K. E., Simon, D. C., Bown, R. R., Carlson, P. C., Yackulic, C. B., Nichols, J. D., Hines, J. E., Davis, R. J., Lamphear, D. W., Mccafferty, C., Mcdonald, T. L., & Sovern, S. G. (2021a). Invader removal triggers competitive release in a threatened avian predator. *Proc Natl Acad Sci USA*, 118(31). <https://doi.org/10.1073/pnas.2102859118/-/DCSupplemental>

Wiens, J. D., Dugger, K. M., Higley, J. M., Lesmeister, D. B., Franklin, A. B., Hamm, K. A., White, G. C., Dilione, K. E., Simon, D. C., Bown, R. R., Carlson, P. C., Yackulic, C. B., Nichols, J. D., Hines, J. E., Davis, R. J., Lamphear, D. W., Mccafferty, C., Mcdonald, T. L., & Sovern, S. G. (2021b). Supplementary Information for Invader removal triggers competitive release in a threatened avian predator. *Proc Natl Acad Sci USA*, 118(31).

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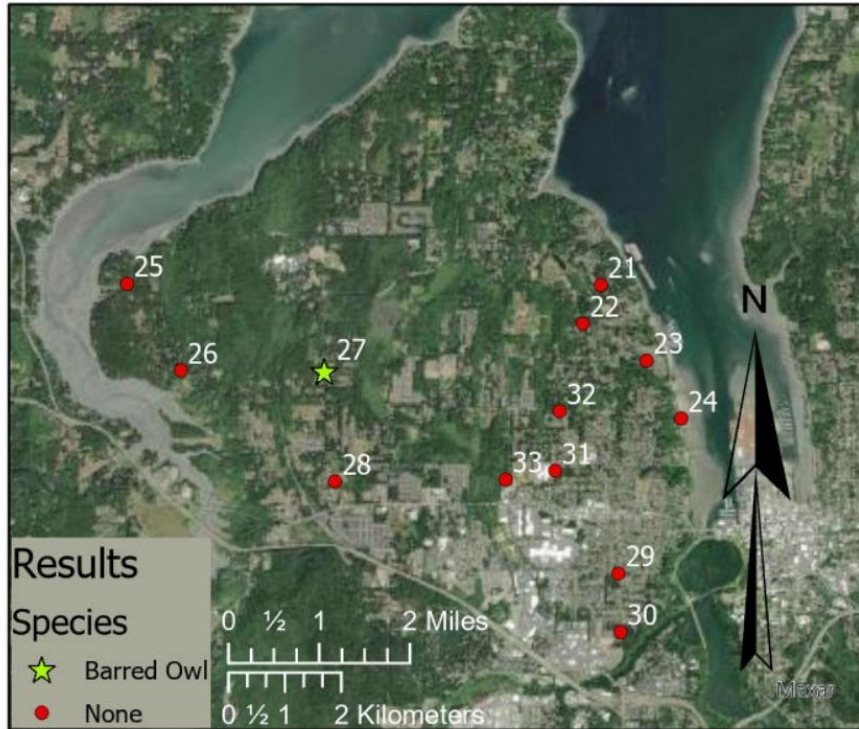
Appendix

Survey Results Week 1



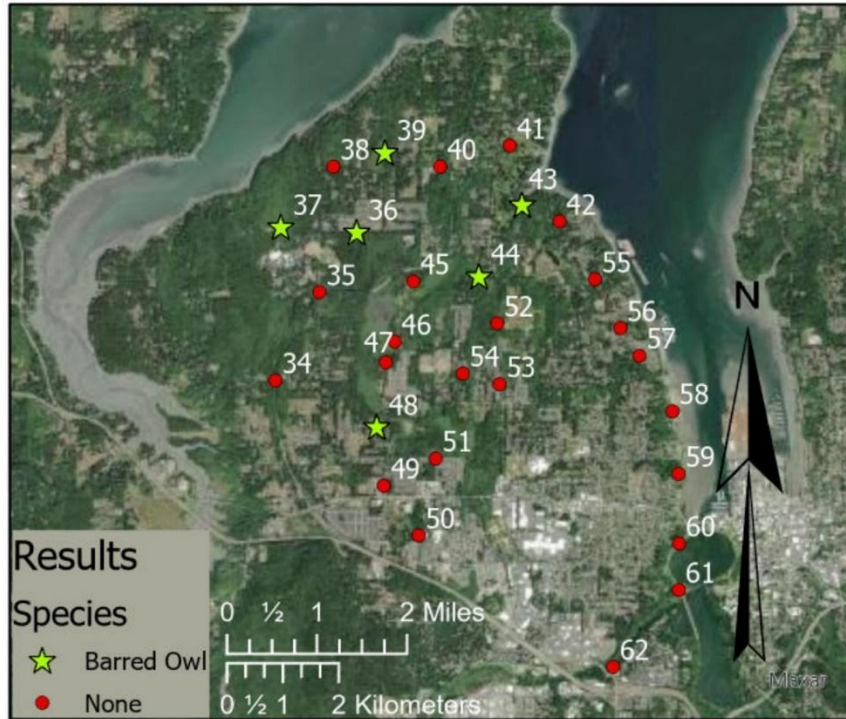
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1	Yes	6/15/2022 10:48:11 PM	Mostly Cloudy	No wind	6/15/2022 11:05:00 PM	None				6/15/2022 11:05:04 PM
2	Yes	6/15/2022 11:10:03 PM	Mostly Cloudy	No wind	6/15/2022 11:25:50 PM	None				6/15/2022 11:26:01 PM
3	Yes	6/15/2022 11:34:56 PM	Mostly Cloudy	No wind	6/15/2022 11:52:50 PM	Barred Owl	Male	Call and Approach	Caterwailing	6/15/2022 11:53:00 PM
4	Yes	6/15/2022 11:34:00 PM	Mostly Cloudy	No wind	6/15/2022 11:49:23 PM	Barred Owl	Female	Call and Approach	Caterwailing	6/15/2022 11:53:04 PM
5	Yes	6/15/2022 11:57:51 PM	Overcast	No wind	6/15/2022 11:58:01 PM	Barred Owl	Female	Call and Approach	Other	6/16/2022 12:17:14 AM
6	Yes	6/16/2022 12:21:20 AM	Overcast	No wind	6/16/2022 12:36:15 AM	None				6/16/2022 12:36:24 AM
7	Yes	6/16/2022 12:37:15 AM	Overcast	No wind	6/16/2022 12:37:33 AM	Barred Owl	Unknown	Call	Mourn	6/16/2022 12:49:59 AM
8	Yes	6/16/2022 12:54:00 AM	Mostly Cloudy	No wind	6/16/2022 1:10:10 AM	None				6/16/2022 1:10:28 AM
9	Yes	6/16/2022 1:15:39 AM	Partly Cloudy	No wind	6/16/2022 1:30:25 AM	None				6/16/2022 1:30:33 AM
10	Yes	6/16/2022 1:37:29 AM	Partly Cloudy	No wind	6/16/2022 1:37:47 AM	Barred Owl	Unknown	Call	8-Note	6/16/2022 1:54:15 AM
11	Yes	6/16/2022 11:09:50 PM	Mostly Cloudy	No wind	6/16/2022 11:25:20 PM	None				6/16/2022 11:25:29 PM
12	Yes	6/16/2022 11:27:38 PM	Mostly Cloudy	No wind	6/16/2022 11:38:26 PM	Barred Owl	Unknown	Call	Mourn	6/16/2022 11:42:48 PM
13	Yes	6/16/2022 11:45:15 PM	Mostly Cloudy	No wind	6/16/2022 11:50:25 PM	Barred Owl	Female	Call	Mourn	6/17/2022 12:00:59 AM
14	Yes	6/17/2022 12:07:46 AM	Mostly Cloudy	No wind	6/17/2022 12:11:19 AM	Barred Owl	Male	Call	Caterwailing	6/17/2022 12:23:20 AM
15	Yes	6/17/2022 12:26:19 AM	Mostly Cloudy	No wind	6/17/2022 12:41:30 AM	None				6/17/2022 12:41:31 AM
16	Yes	6/17/2022 12:48:45 AM	Mostly Cloudy	Light breeze	6/17/2022 12:53:17 AM	Barred Owl	Unknown	Call	Mourn	6/17/2022 1:02:40 AM
17	Yes	6/17/2022 1:08:35 AM	Overcast	No wind	6/17/2022 1:23:15 AM	None				6/17/2022 1:23:19 AM
18	Yes	6/17/2022 1:28:23 AM	Overcast	No wind	6/17/2022 1:43:20 AM	None				6/17/2022 1:43:24 AM
19	Yes	6/17/2022 1:45:26 AM	Overcast	No wind	6/17/2022 1:53:59 AM	Barred Owl	Male	Call	8-Note	6/17/2022 2:00:04 AM
20	Yes	6/17/2022 2:02:06 AM	Overcast	No wind	6/17/2022 2:16:54 AM	None				6/17/2022 2:16:57 AM

Survey Results Week 2



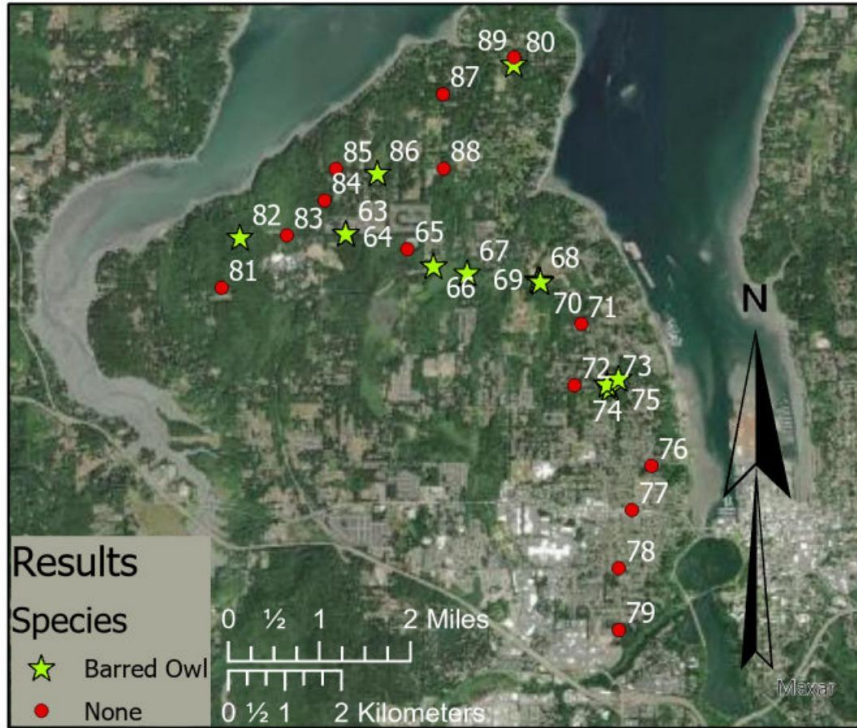
OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
21	Yes	6/20/2022 11:23:55 PM	Clear	Light breeze	6/20/2022 11:38:27 PM	None				6/20/2022 11:38:32 PM
22	Yes	6/20/2022 11:42:02 PM	Clear	No wind	6/20/2022 11:56:55 PM	None				6/20/2022 11:57:03 PM
23	Yes	6/21/2022 12:03:28 AM	Clear	Light breeze	6/21/2022 12:19:15 AM	None				6/21/2022 12:19:05 AM
24	Yes	6/21/2022 12:23:49 AM	Clear	No wind	6/21/2022 12:38:57 AM	None				6/21/2022 12:38:59 AM
25	Yes	6/22/2022 11:30:39 PM	Clear	No wind	6/22/2022 11:46:16 PM	None				6/22/2022 11:46:07 PM
26	Yes	6/22/2022 11:51:35 PM	Clear	Light breeze	6/23/2022 12:06:40 AM	None				6/23/2022 12:06:41 AM
27	Yes	6/23/2022 12:15:18 AM	Clear	Light breeze	6/23/2022 12:26:05 AM	Barred Owl	Male	Call	Monkey Call	6/23/2022 12:31:25 AM
28	Yes	6/23/2022 12:38:56 AM	Clear	No wind	6/23/2022 12:54:35 AM	None				6/23/2022 12:54:38 AM
29	Yes	6/23/2022 1:30:19 AM	Clear	No wind	6/23/2022 1:45:15 AM	None				6/23/2022 1:45:16 AM
30	Yes	6/23/2022 1:49:47 AM	Clear	No wind	6/23/2022 2:04:55 AM	None				6/23/2022 2:04:56 AM
31	Yes	6/23/2022 2:20:12 AM	Partly Cloudy	No wind	6/23/2022 2:35:14 AM	None				6/23/2022 2:35:15 AM
32	Yes	6/23/2022 2:44:35 AM	Partly Cloudy	No wind	6/23/2022 2:59:25 AM	None				6/23/2022 2:59:27 AM
33	Yes	6/23/2022 3:04:05 AM	Clear	No wind	6/23/2022 3:19:07 AM	None				6/23/2022 3:19:01 AM

Survey Results Week 3



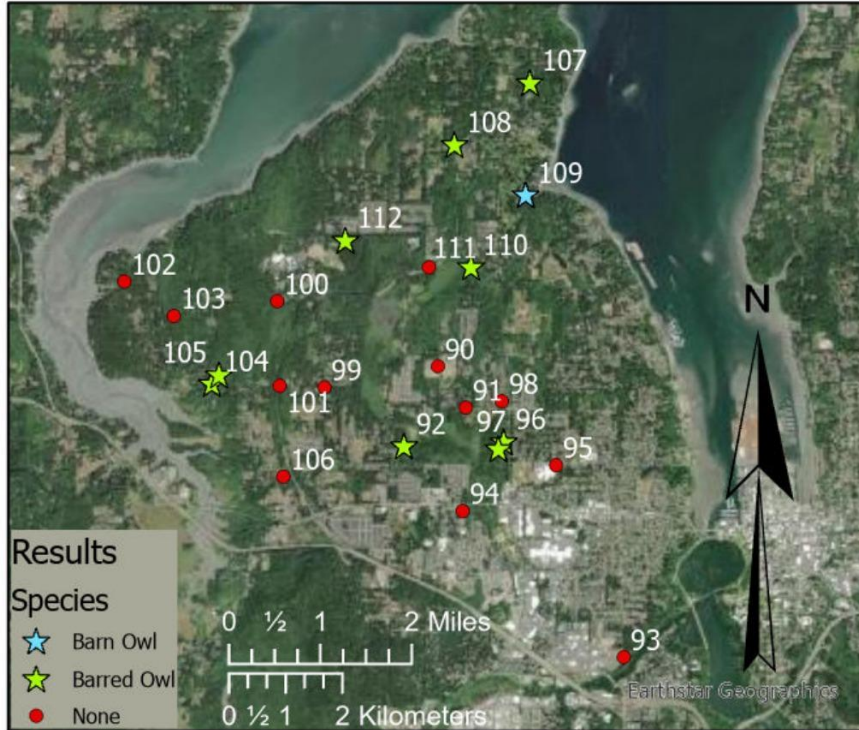
OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
34	Yes	6/26/2022 11:10:00 PM	Clear	No wind	6/26/2022 11:26:18 PM	None				6/26/2022 11:26:21 PM
35	Yes	6/26/2022 11:31:49 PM	Clear	No wind	6/26/2022 11:46:39 PM	None				6/26/2022 11:46:35 PM
36	Yes	6/26/2022 11:50:11 PM	Clear	No wind	6/27/2022 12:01:18 AM	Barred Owl	Male	Call	8-Note	6/27/2022 12:07:42 AM
37	Yes	6/27/2022 12:13:06 AM	Clear	No wind	6/27/2022 12:25:18 AM	Barred Owl	Male	Call	Monkey Call	6/27/2022 12:31:56 AM
38	Yes	6/27/2022 12:36:26 AM	Clear	No wind	6/27/2022 12:50:55 AM	None				6/27/2022 12:50:57 AM
39	Yes	6/27/2022 12:54:50 AM	Clear	No wind	6/27/2022 1:02:45 AM	Barred Owl	Male	Call	8-Note	6/27/2022 1:09:45 AM
40	Yes	6/27/2022 1:12:36 AM	Clear	No wind	6/27/2022 1:28:08 AM	None				6/27/2022 1:28:09 AM
41	Yes	6/27/2022 1:33:12 AM	Clear	Light breeze	6/27/2022 1:48:23 AM	None				6/27/2022 1:48:24 AM
42	Yes	6/27/2022 1:55:27 AM	Clear	No wind	6/27/2022 2:10:45 AM	None				6/27/2022 2:10:47 AM
43	Yes	6/27/2022 2:13:43 AM	Clear	No wind	6/27/2022 2:28:12 AM	Barred Owl	Male	Call	Monkey Call	6/27/2022 2:37:49 AM
44	Yes	6/27/2022 11:49:45 PM	Clear	No wind	6/28/2022 12:06:14 AM	Barred Owl	Male			6/28/2022 12:14:45 AM
45	Yes	6/28/2022 12:18:37 AM	Clear	No wind	6/28/2022 12:33:43 AM	None				6/28/2022 12:33:45 AM
46	Yes	6/28/2022 12:37:03 AM	Clear	Light breeze	6/28/2022 12:51:07 AM	None				6/28/2022 12:51:10 AM
47	Yes	6/28/2022 12:54:04 AM	Clear	Light breeze	6/28/2022 1:11:27 AM	None				6/28/2022 1:11:29 AM
48	Yes	6/28/2022 1:17:07 AM	Clear	No wind	6/28/2022 1:25:38 AM	Barred Owl	Male	Call	8-Note	6/28/2022 1:32:40 AM
49	Yes	6/28/2022 1:40:18 AM	Clear	No wind	6/28/2022 1:55:17 AM	None				6/28/2022 1:55:18 AM
50	Yes	6/28/2022 2:00:13 AM	Clear	No wind	6/28/2022 2:14:53 AM	None				6/28/2022 2:14:55 AM
51	Yes	6/28/2022 2:21:21 AM	Clear	No wind	6/28/2022 2:38:05 AM	None				6/28/2022 2:38:06 AM
52	Yes	6/29/2022 11:32:30 PM	Clear	No wind	6/29/2022 11:46:49 PM	None				6/29/2022 11:46:50 PM
53	Yes	6/29/2022 11:53:25 PM	Clear	No wind	6/30/2022 12:08:12 AM	None				6/30/2022 12:08:14 AM
54	Yes	6/30/2022 12:11:54 AM	Clear	Light breeze	6/30/2022 12:26:38 AM	None				6/30/2022 12:26:39 AM
55	Yes	6/30/2022 12:35:41 AM	Clear	Light breeze	6/30/2022 12:50:51 AM	None				6/30/2022 12:50:52 AM
56	Yes	6/30/2022 1:01:31 AM	Clear	Light breeze	6/30/2022 1:17:10 AM	None				6/30/2022 1:17:11 AM
57	Yes	6/30/2022 1:20:38 AM	Clear	Light breeze	6/30/2022 1:37:03 AM	None				6/30/2022 1:37:05 AM
58	Yes	6/30/2022 1:40:53 AM	Clear	No wind	6/30/2022 1:55:36 AM	None				6/30/2022 1:55:37 AM
59	Yes	6/30/2022 2:00:31 AM	Clear	No wind	6/30/2022 2:15:58 AM	None				6/30/2022 2:16:02 AM
60	Yes	6/30/2022 2:26:51 AM	Partly Cloudy	No wind	6/30/2022 2:41:42 AM	None				6/30/2022 2:41:43 AM
61	Yes	6/30/2022 2:45:22 AM	Partly Cloudy	No wind	6/30/2022 3:00:18 AM	None				6/30/2022 3:00:19 AM
62	Yes	6/30/2022 3:05:24 AM	Partly Cloudy	No wind	6/30/2022 3:20:22 AM	None				6/30/2022 3:20:25 AM

Survey Results Week 4



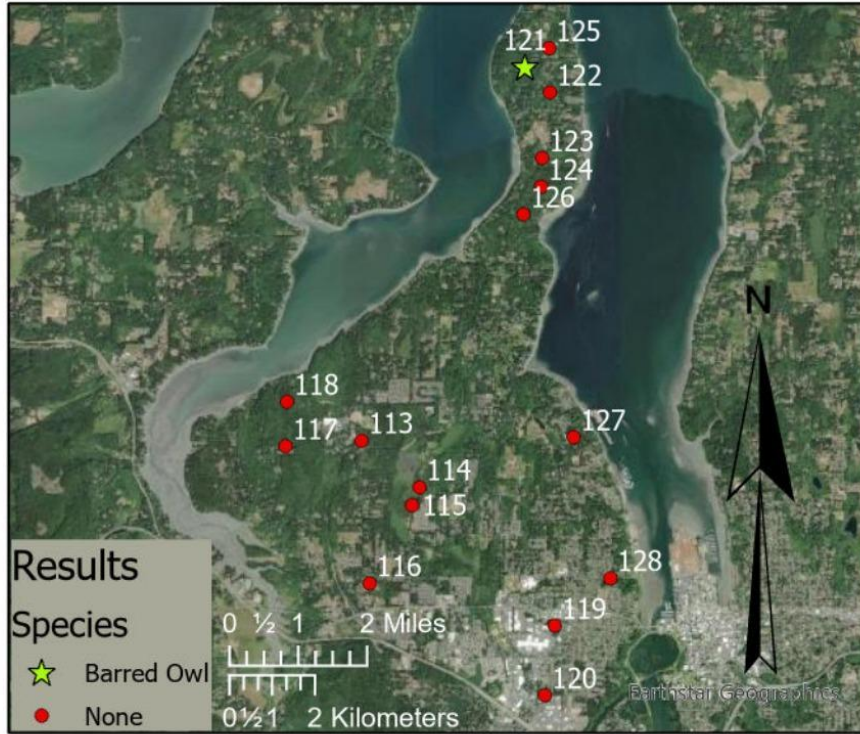
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63	No	7/4/2022 1:26:52 AM	Overcast	No wind	7/4/2022 1:27:02 AM	Barred Owl	Male	Call	Monkey Call	7/4/2022 1:28:00 AM
64	No	7/4/2022 1:26:00 AM	Clear	No wind	7/4/2022 1:28:04 AM	Barred Owl	Female	Call	Caterwailing	7/4/2022 1:28:53 AM
65	Yes	7/5/2022 11:41:59 PM	Mostly Cloudy	No wind	7/6/2022 12:00:14 AM	None				7/6/2022 12:00:08 AM
66	Yes	7/6/2022 12:05:17 AM	Partly Cloudy	No wind	7/6/2022 12:14:54 AM	Barred Owl	Male	Call	8-Note	7/6/2022 12:18:26 AM
67	Yes	7/6/2022 12:05:17 AM	Partly Cloudy	No wind	7/6/2022 12:18:49 AM	Barred Owl	Male	Call	8-Note	7/6/2022 12:20:08 AM
68	Yes	7/6/2022 12:32:32 AM	Mostly Cloudy	No wind	7/6/2022 12:42:46 AM	Barred Owl	Female	Approach	Monkey Call	7/6/2022 12:59:00 AM
69	Yes	7/6/2022 12:32:00 AM	Partly Cloudy	No wind	7/6/2022 12:55:39 AM	Barred Owl	Youth	Call and Approach	Other	7/6/2022 12:59:00 AM
70	Yes	7/6/2022 12:32:00 AM	Partly Cloudy	No wind	7/6/2022 12:56:27 AM	Barred Owl	Male	Call and Approach	Monkey Call	7/6/2022 12:59:40 AM
71	Yes	7/6/2022 1:07:05 AM	Mostly Cloudy	No wind	7/6/2022 1:21:50 AM	None				7/6/2022 1:21:53 AM
72	Yes	7/6/2022 1:29:23 AM	Mostly Cloudy	No wind	7/6/2022 1:48:20 AM	None				7/6/2022 1:48:21 AM
73	Yes	7/6/2022 1:51:13 AM	Overcast	No wind	7/6/2022 1:51:39 AM	Barred Owl	Youth	Call	Other	7/6/2022 2:22:00 AM
74	Yes	7/6/2022 1:51:00 AM	Overcast	No wind	7/6/2022 2:06:49 AM	Barred Owl	Female	Approach	8-Note	7/6/2022 2:22:00 AM
75	Yes	7/6/2022 1:51:00 AM	Overcast	No wind	7/6/2022 2:15:20 AM	Barred Owl	Male	Call	Caterwailing	7/6/2022 2:22:13 AM
76	Yes	7/6/2022 2:34:08 AM	Overcast	No wind	7/6/2022 2:51:51 AM	None				7/6/2022 2:51:52 AM
77	Yes	7/6/2022 3:00:05 AM	Overcast	No wind	7/6/2022 3:15:57 AM	None				7/6/2022 3:15:58 AM
78	Yes	7/6/2022 3:21:18 AM	Overcast	No wind	7/6/2022 3:36:30 AM	None				7/6/2022 3:36:31 AM
79	Yes	7/6/2022 3:40:11 AM	Overcast	No wind	7/6/2022 3:55:33 AM	None				7/6/2022 3:55:34 AM
80	No	7/7/2022 8:23:28 PM	Clear	No wind	7/7/2022 8:23:37 PM	Barred Owl	Unknown			7/7/2022 8:24:04 PM
81	Yes	7/8/2022 12:14:00 AM	Overcast	No wind	7/8/2022 12:28:34 AM	None				7/8/2022 12:28:35 AM
82	Yes	7/8/2022 12:34:35 AM	Overcast	No wind	7/8/2022 12:47:50 AM	Barred Owl	Male	Call	Monkey Call	7/8/2022 12:53:32 AM
83	Yes	7/8/2022 12:56:37 AM	Overcast	No wind	7/8/2022 1:12:42 AM	None				7/8/2022 1:12:43 AM
84	Yes	7/8/2022 1:18:02 AM	Overcast	No wind	7/8/2022 1:33:22 AM	None				7/8/2022 1:33:23 AM
85	Yes	7/8/2022 1:37:29 AM	Overcast	No wind	7/8/2022 1:52:40 AM	None				7/8/2022 1:52:42 AM
86	Yes	7/8/2022 1:56:44 AM	Overcast	No wind	7/8/2022 2:03:31 AM	Barred Owl	Female	Call	Caterwailing	7/8/2022 2:15:07 AM
87	Yes	7/8/2022 2:21:01 AM	Overcast	No wind	7/8/2022 2:36:11 AM	None				7/8/2022 2:36:13 AM
88	Yes	7/8/2022 2:39:46 AM	Overcast	No wind	7/8/2022 2:54:34 AM	None				7/8/2022 2:54:35 AM
89	Yes	7/8/2022 2:59:56 AM	Overcast	No wind	7/8/2022 3:15:13 AM	None				7/8/2022 3:15:14 AM

Survey Results Week 5



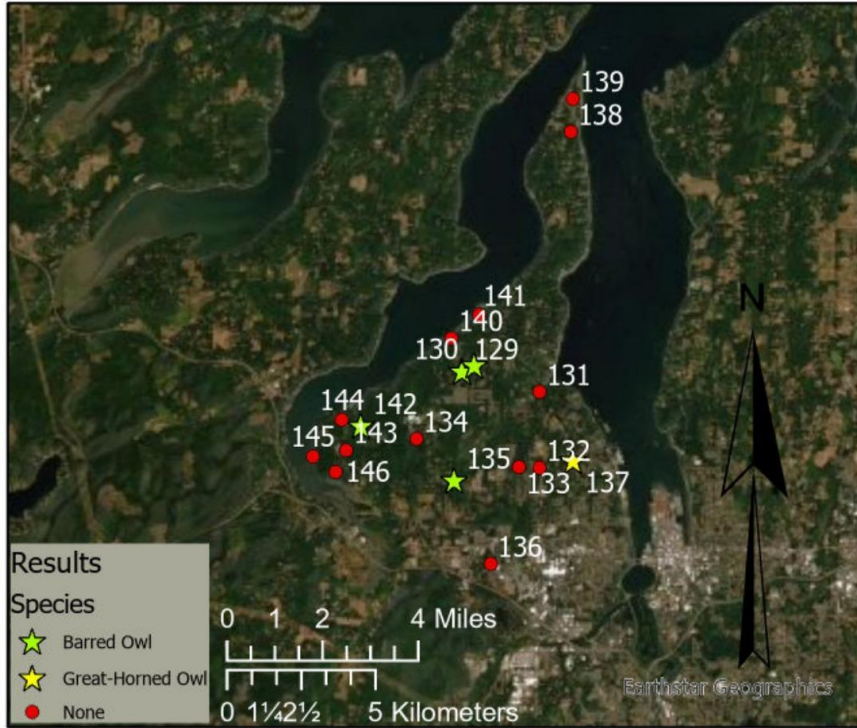
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90	Yes	7/12/2022 12:01:03 AM	Clear	No wind	7/12/2022 12:16:37 AM	None				7/12/2022 12:16:39 AM
91	Yes	7/12/2022 12:21:27 AM	Clear	No wind	7/12/2022 12:36:50 AM	None				7/12/2022 12:36:51 AM
92	Yes	7/12/2022 12:41:53 AM	Clear	No wind	7/12/2022 12:55:37 AM	Barred Owl	Unknown	Call	8-Note	7/12/2022 12:57:25 AM
93	Yes	7/12/2022 1:28:18 AM	Clear	No wind	7/12/2022 1:42:35 AM	None				7/12/2022 1:42:37 AM
94	Yes	7/12/2022 1:49:54 AM	Clear	No wind	7/12/2022 2:04:56 AM	None				7/12/2022 2:04:57 AM
95	Yes	7/12/2022 2:12:03 AM	Clear	No wind	7/12/2022 2:26:54 AM	None				7/12/2022 2:26:58 AM
96	Yes	7/12/2022 2:32:58 AM	Clear	No wind	7/12/2022 2:33:05 AM	Barred Owl	Male	Approach	Caterwauling	7/12/2022 2:59:00 AM
97	Yes	7/12/2022 2:32:00 AM	Clear	No wind	7/12/2022 2:50:45 AM	Barred Owl	Youth	Call	Other	7/12/2022 2:59:39 AM
98	Yes	7/12/2022 3:04:21 AM	Clear	No wind	7/12/2022 3:19:37 AM	None				7/12/2022 3:19:39 AM
99	Yes	7/12/2022 3:28:54 AM	Clear	No wind	7/12/2022 3:43:47 AM	None				7/12/2022 3:43:49 AM
100	Yes	7/12/2022 11:21:52 PM	Clear	No wind	7/12/2022 11:36:57 PM	None				7/12/2022 11:36:58 PM
101	Yes	7/12/2022 11:43:43 PM	Clear	No wind	7/12/2022 11:59:23 PM	None				7/12/2022 11:59:24 PM
102	Yes	7/13/2022 12:08:33 AM	Clear	Light breeze	7/13/2022 12:23:44 AM	None				7/13/2022 12:23:46 AM
103	Yes	7/13/2022 12:28:33 AM	Partly Cloudy	No wind	7/13/2022 12:45:39 AM	None				7/13/2022 12:45:41 AM
104	Yes	7/13/2022 12:52:23 AM	Mostly Cloudy	No wind	7/13/2022 12:52:31 AM	Barred Owl	Male	Call	8-Note	7/13/2022 1:16:21 AM
105	Yes	7/13/2022 12:52:00 AM	Mostly Cloudy	No wind	7/13/2022 12:55:00 AM	Barred Owl	Youth	Call and Approach	Other	7/13/2022 1:16:00 AM
106	Yes	7/13/2022 1:31:32 AM	Partly Cloudy	No wind	7/13/2022 1:47:18 AM	None				7/13/2022 1:47:19 AM
107	Yes	7/13/2022 11:41:39 PM	Clear	Light breeze	7/13/2022 11:44:52 PM	Barred Owl	Youth	Call	Other	7/13/2022 11:57:28 PM
108	Yes	7/14/2022 12:03:10 AM	Clear	No wind	7/14/2022 12:19:04 AM	Barred Owl	Male	Call	8-Note	7/14/2022 12:21:43 AM
109	Yes	7/14/2022 12:45:13 AM	Clear	No wind	7/14/2022 1:00:32 AM	Barn Owl				7/14/2022 1:02:08 AM
110	Yes	7/14/2022 1:08:08 AM	Clear	No wind	7/14/2022 1:16:38 AM	Barred Owl	Male	Call	8-Note	7/14/2022 1:23:30 AM
111	Yes	7/14/2022 1:28:35 AM	Clear	No wind	7/14/2022 1:45:12 AM	None				7/14/2022 1:45:01 AM
112	Yes	7/14/2022 1:46:00 AM	Clear	No wind	7/14/2022 1:54:00 AM	Barred Owl		Call	Caterwauling	7/14/2022 1:59:00 AM

Survey Results Week 6



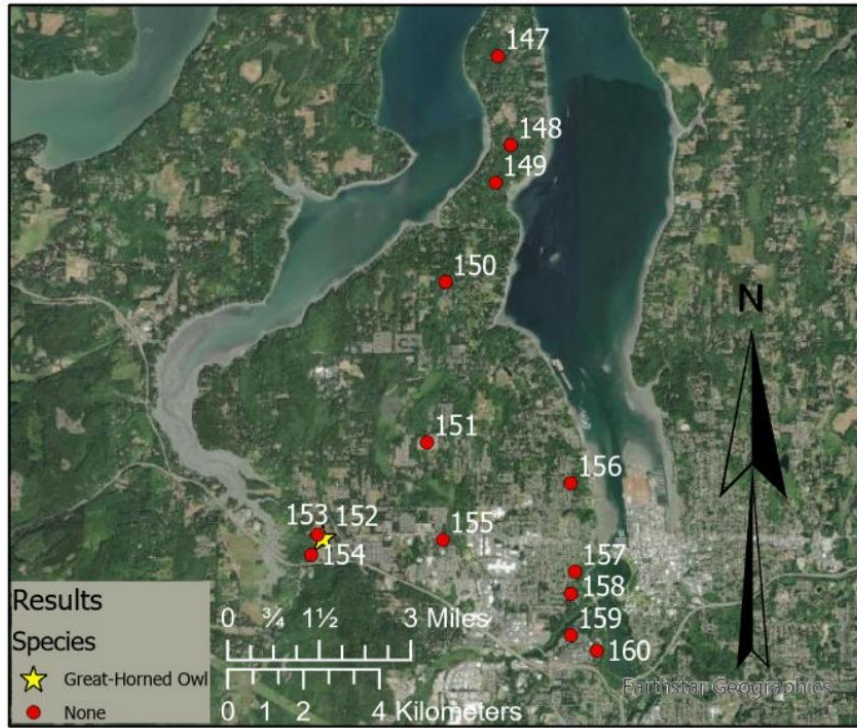
OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
113	Yes	7/19/2022 11:55:36 PM	Clear	No wind	7/20/2022 12:10:34 AM	None				7/20/2022 12:10:35 AM
114	Yes	7/20/2022 12:15:48 AM	Clear	No wind	7/20/2022 12:30:30 AM	None				7/20/2022 12:30:32 AM
115	Yes	7/20/2022 12:32:59 AM	Clear	Light breeze	7/20/2022 12:49:29 AM	None				7/20/2022 12:49:20 AM
116	Yes	7/20/2022 1:01:00 AM	Clear	No wind	7/20/2022 1:17:46 AM	None				7/20/2022 1:17:43 AM
117	Yes	7/20/2022 1:31:59 AM	Clear	No wind	7/20/2022 1:49:32 AM	None				7/20/2022 1:49:34 AM
118	Yes	7/20/2022 1:52:03 AM	Clear	No wind	7/20/2022 2:07:06 AM	None				7/20/2022 2:07:08 AM
119	Yes	7/20/2022 2:25:15 AM	Clear	No wind	7/20/2022 2:40:45 AM	None				7/20/2022 2:40:47 AM
120	Yes	7/20/2022 2:50:22 AM	Clear	No wind	7/20/2022 3:05:47 AM	None				7/20/2022 3:05:49 AM
121	Yes	7/20/2022 11:55:54 PM	Clear	Light breeze	7/21/2022 12:10:57 AM	Barred Owl	Female	Call and Approach	Monkey Call	7/21/2022 12:21:18 AM
122	Yes	7/21/2022 12:35:42 AM	Clear	Light breeze	7/21/2022 12:55:44 AM	None				7/21/2022 12:55:46 AM
123	Yes	7/21/2022 12:59:40 AM	Clear	Light breeze	7/21/2022 1:17:41 AM	None				7/21/2022 1:17:38 AM
124	Yes	7/21/2022 1:24:25 AM	Clear	Light breeze	7/21/2022 1:40:05 AM	None				7/21/2022 1:40:06 AM
125	Yes	7/21/2022 11:45:28 PM	Partly Cloudy	Light breeze	7/22/2022 12:00:35 AM	None				7/22/2022 12:00:36 AM
126	Yes	7/22/2022 12:07:52 AM	Clear	Light breeze	7/22/2022 12:23:14 AM	None				7/22/2022 12:23:16 AM
127	Yes	7/22/2022 12:39:57 AM	Clear	No wind	7/22/2022 12:55:41 AM	None				7/22/2022 12:55:42 AM
128	Yes	7/22/2022 1:08:31 AM	Clear	No wind	7/22/2022 1:23:20 AM	None				7/22/2022 1:23:21 AM

Survey Results Week 7



OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
129	Yes	7/24/2022 11:41:32 PM	Clear	No wind	7/24/2022 11:47:39 PM	Barred Owl	Unknown	Approach		7/24/2022 11:59:29 PM
130	Yes	7/24/2022 11:41:00 PM	Clear	No wind	7/24/2022 11:54:00 PM	Barred Owl		Call	8-Note	7/24/2022 11:59:00 PM
131	Yes	7/25/2022 12:24:34 AM	Clear	No wind	7/25/2022 12:39:42 AM	None				7/25/2022 12:39:43 AM
132	Yes	7/25/2022 12:48:36 AM	Clear	No wind	7/25/2022 1:03:22 AM	None				7/25/2022 1:03:24 AM
133	Yes	7/25/2022 1:09:02 AM	Clear	No wind	7/25/2022 1:23:45 AM	None				7/25/2022 1:23:47 AM
134	Yes	7/25/2022 1:32:33 AM	Clear	No wind	7/25/2022 1:48:22 AM	None				7/25/2022 1:48:24 AM
135	Yes	7/25/2022 1:56:01 AM	Clear	No wind	7/25/2022 2:07:58 AM	Barred Owl	Unknown	Call	Mourn	7/25/2022 2:11:17 AM
136	Yes	7/25/2022 2:20:29 AM	Clear	No wind	7/25/2022 2:35:16 AM	None				7/25/2022 2:35:18 AM
137	Yes	7/25/2022 11:42:23 PM	Clear	No wind	7/25/2022 11:43:56 PM	Great-Horned Owl		Call		7/25/2022 11:45:02 PM
138	Yes	7/25/2022 11:58:41 PM	Clear	No wind	7/26/2022 12:17:57 AM	None				7/26/2022 12:17:55 AM
139	Yes	7/26/2022 12:21:30 AM	Clear	No wind	7/26/2022 12:36:35 AM	None				7/26/2022 12:36:36 AM
140	Yes	7/26/2022 12:51:02 AM	Clear	No wind	7/26/2022 1:06:04 AM	None				7/26/2022 1:06:05 AM
141	Yes	7/26/2022 1:09:24 AM	Clear	No wind	7/26/2022 1:24:17 AM	None				7/26/2022 1:24:18 AM
142	Yes	7/26/2022 1:38:53 AM	Clear	Light breeze	7/26/2022 1:43:36 AM	Barred Owl	Male	Call	8-Note	7/26/2022 1:54:50 AM
143	Yes	7/26/2022 2:02:24 AM	Clear	No wind	7/26/2022 2:17:19 AM	None				7/26/2022 2:17:20 AM
144	Yes	7/26/2022 2:21:02 AM	Clear	No wind	7/26/2022 2:35:57 AM	None				7/26/2022 2:35:58 AM
145	Yes	7/26/2022 2:49:13 AM	Clear	No wind	7/26/2022 3:04:24 AM	None				7/26/2022 3:04:25 AM
146	Yes	7/26/2022 3:09:15 AM	Clear	No wind	7/26/2022 3:24:16 AM	None				7/26/2022 3:24:17 AM

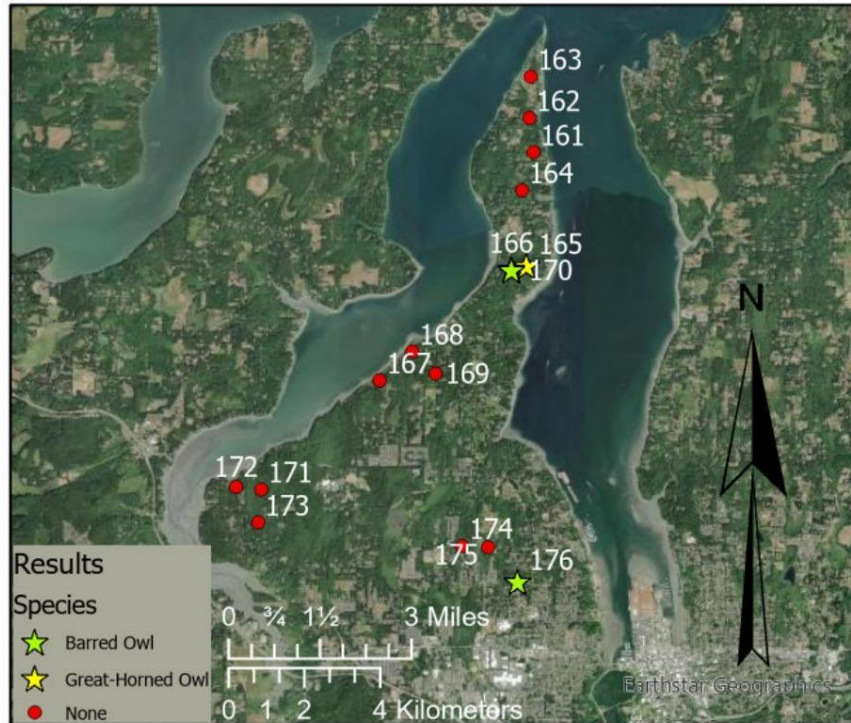
Survey Results Week 8



OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
147	Yes	8/1/2022 12:01:46 AM	Clear	No wind	8/1/2022 12:17:44 AM	None				8/1/2022 12:17:45 AM
148	Yes	8/1/2022 12:24:01 AM	Clear	Light breeze	8/1/2022 12:39:18 AM	None				8/1/2022 12:39:19 AM
149	Yes	8/1/2022 12:44:54 AM	Clear	Light breeze	8/1/2022 12:59:39 AM	None				8/1/2022 12:59:41 AM
150	Yes	8/1/2022 1:09:21 AM	Partly Cloudy	No wind	8/1/2022 1:24:11 AM	None				8/1/2022 1:24:13 AM
151	Yes	8/1/2022 1:33:40 AM	Overcast	Light breeze	8/1/2022 1:49:26 AM	None				8/1/2022 1:49:27 AM
152	Yes	8/1/2022 2:01:52 AM	Overcast	No wind	8/1/2022 2:02:00 AM	Great-Horned Owl	Youth	Approach		8/1/2022 2:17:06 AM
153	Yes	8/1/2022 2:01:52 AM	Overcast	No wind	8/1/2022 2:02:00 AM	None				8/1/2022 2:17:06 AM
154	Yes	8/1/2022 2:26:12 AM	Overcast	No wind	8/1/2022 2:40:54 AM	None				8/1/2022 2:40:58 AM
155	Yes	8/1/2022 11:51:38 PM	Clear	No wind	8/2/2022 12:06:37 AM	None				8/2/2022 12:06:38 AM
156	Yes	8/2/2022 12:18:18 AM	Clear	No wind	8/2/2022 12:33:26 AM	None				8/2/2022 12:33:28 AM
157	Yes	8/2/2022 12:43:24 AM	Clear	No wind	8/2/2022 12:59:16 AM	None				8/2/2022 12:59:17 AM
158	Yes	8/2/2022 1:04:26 AM	Clear	Light breeze	8/2/2022 1:19:35 AM	None				8/2/2022 1:19:37 AM
159	Yes	8/2/2022 1:28:24 AM	Clear	Light breeze	8/2/2022 1:42:56 AM	None				8/2/2022 1:42:57 AM
160	Yes	8/2/2022 1:46:23 AM	Clear	No wind	8/2/2022 2:01:06 AM	None				8/2/2022 2:01:07 AM

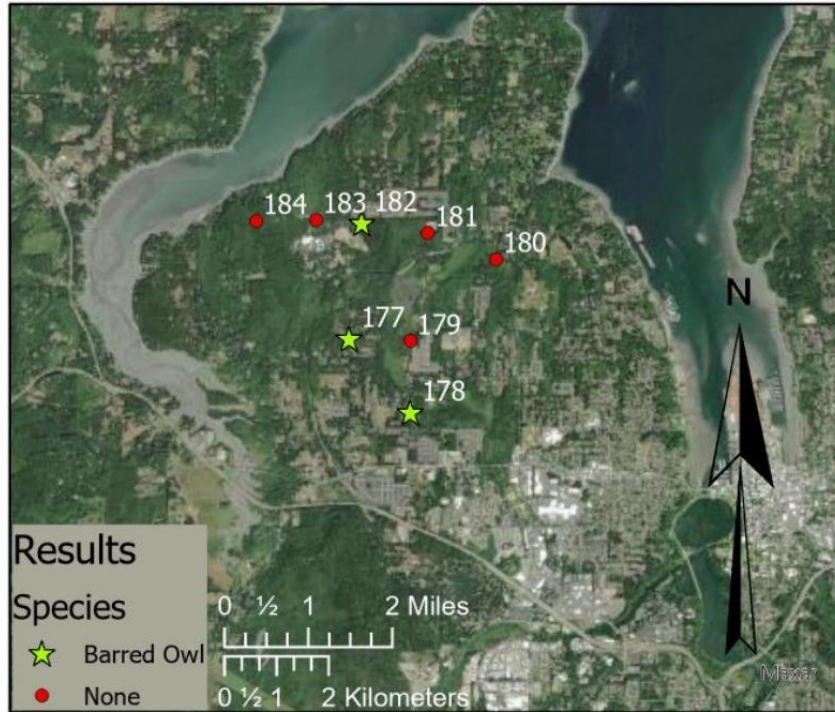
Survey Results

Week 9



OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
161	Yes	8/7/2022 11:57:13 PM	Clear	No wind	8/8/2022 12:13:09 AM	None				8/8/2022 12:13:10 AM
162	Yes	8/8/2022 12:16:18 AM	Clear	No wind	8/8/2022 12:31:33 AM	None				8/8/2022 12:31:34 AM
163	Yes	8/8/2022 12:37:00 AM	Clear	No wind	8/8/2022 12:53:02 AM	None				8/8/2022 12:53:03 AM
164	Yes	8/8/2022 1:01:30 AM	Clear	No wind	8/8/2022 1:16:32 AM	None				8/8/2022 1:16:33 AM
165	Yes	8/8/2022 1:21:51 AM	Clear	No wind	8/8/2022 1:31:08 AM	Great-Horned Owl				8/8/2022 1:43:00 AM
166	Yes	8/8/2022 1:21:00 AM	Clear	No wind	8/8/2022 1:35:00 AM	Barred Owl	Female	Call and Approach	Monkey Call	8/8/2022 1:43:29 AM
167	Yes	8/8/2022 2:04:53 AM	Clear	No wind	8/8/2022 2:19:38 AM	None				8/8/2022 2:19:40 AM
168	Yes	8/8/2022 2:22:23 AM	Clear	No wind	8/8/2022 2:36:52 AM	None				8/8/2022 2:36:53 AM
169	Yes	8/8/2022 2:40:30 AM	Clear	No wind	8/8/2022 2:55:41 AM	None				8/8/2022 2:55:44 AM
170	Yes	8/8/2022 1:21:00 AM	Clear	No wind	8/8/2022 1:37:00 AM	Barred Owl	Youth	Call	Other	8/8/2022 1:43:00 AM
171	Yes	8/10/2022 12:08:06 AM	Partly Cloudy	Light breeze	8/10/2022 12:23:15 AM	None				8/10/2022 12:23:17 AM
172	Yes	8/10/2022 12:31:52 AM	Partly Cloudy	Light breeze	8/10/2022 12:46:29 AM	None				8/10/2022 12:46:31 AM
173	Yes	8/10/2022 12:54:04 AM	Mostly Cloudy	Light breeze	8/10/2022 1:09:00 AM	None				8/10/2022 1:09:02 AM
174	Yes	8/10/2022 1:23:45 AM	Partly Cloudy	Light breeze	8/10/2022 1:39:06 AM	None				8/10/2022 1:39:12 AM
175	Yes	8/10/2022 1:43:06 AM	Partly Cloudy	Light breeze	8/10/2022 1:59:11 AM	None				8/10/2022 1:59:13 AM
176	Yes	8/10/2022 2:02:45 AM	Partly Cloudy	Light breeze	8/10/2022 2:13:00 AM	Barred Owl	Male	Call	8-Note	8/10/2022 2:21:06 AM

Survey Results Week 10



OBJECTID	Surveyed	Date	Weather	Wind	Response Time (if)	Species	Sex	Response Type	Call	End Time
177	Yes	8/14/2022 11:40:00 PM	Clear	No wind	8/14/2022 11:54:55 PM	Barred Owl	Female	Call	Mourn	8/14/2022 11:59:56 PM
178	Yes	8/15/2022 12:05:32 AM	Clear	No wind	8/15/2022 12:14:30 AM	Barred Owl	Unknown	Approach		8/15/2022 12:22:51 AM
179	Yes	8/15/2022 12:25:54 AM	Clear	No wind	8/15/2022 12:41:02 AM	None				8/15/2022 12:41:03 AM
180	Yes	8/15/2022 12:47:02 AM	Clear	No wind	8/15/2022 1:01:57 AM	None				8/15/2022 1:01:59 AM
181	Yes	8/15/2022 1:07:52 AM	Clear	No wind	8/15/2022 1:22:39 AM	None				8/15/2022 1:22:41 AM
182	Yes	8/15/2022 1:26:12 AM	Partly Cloudy	No wind	8/15/2022 1:34:15 AM	Barred Owl	Unknown	Approach		8/15/2022 1:42:30 AM
183	Yes	8/15/2022 1:45:51 AM	Clear	No wind	8/15/2022 2:01:13 AM	None				8/15/2022 2:01:14 AM
184	Yes	8/15/2022 2:04:21 AM	Clear	No wind	8/15/2022 2:19:14 AM	None				8/15/2022 2:19:15 AM

Tables

Indicates Family

Response Table

OBJECTID *	Response Type	# of Responses	Surveys	Number of Young	Total Owls
1	Single	1	2	0	1
2	Family	1	2	1	2
3	Family	1	2	2	2
4	Single	1	2	0	1
5	Pair	2	2	0	2
6	Single	2	2	0	1
7	Single	2	2	0	1
8	Pair	2	5	0	2
9	Single	2	4	0	1
10	Pair	4	5	0	2
11	Single	1	2	0	1
12	Single	1	3	0	1
13	Single	4	3	0	1
14	Family	1	1	1	3
15	Single	1	3	0	1
16	Single	1	4	0	1
17	Single	1	4	0	1
18	Single	2	4	0	1
19	Single	1	2	0	1
20	Family	1	1	2	3
21	Single	1	3	0	1
22	Single	1	2	0	1
23	Family	1	1	2	4
24	Family	1	2	3	4
25	Single	1	2	0	1
26	Single	3	3	0	1
27	Single	1	1	0	1

Survey Location Table

Survey Point	Surveys	Success	Adults	Young
1	3	0	0	0
2	2	0	0	0
3	5	2	3	0
4	4	2	2	0
5	4	3	4	0
6	3	1	1	0
7	1	0	0	0
8	3	1	1	0
9	4	3	3	0
10	2	0	0	0
11	3	1	1	0
12	4	1	1	0
13	4	4	4	0
14	2	0	0	0
15	2	1	1	0
16	1	0	0	0
17	2	1	2	3
18	3	1	1	0
19	2	0	0	0
20	3	0	0	0
21	2	0	0	0
22	2	0	0	0
23	2	0	0	0
24	2	0	0	0
25	1	0	0	0
26	4	3	3	0
27	2	0	0	0
28	2	0	0	0
29	2	0	0	0
30	2	0	0	0
31	2	1	1	0
32	1	0	0	0
33	4	4	5	0
34	2	0	0	0
35	1	0	0	0
36	1	0	0	0
37	2	0	0	0
38	1	0	0	0
39	1	0	0	0
40	1	0	0	0
41	1	0	0	0
42	1	0	0	0
43	1	0	0	0
44	2	0	0	0
45	1	1	2	0

Survey Point	Surveys	Success	Adults	Young
46	1	1	2	1
47	1	0	0	0
48	1	1	2	2
49	2	0	0	0
50	1	0	0	0
51	2	1	1	2
52	2	0	0	0
53	1	0	0	0
54	2	0	0	0
55	2	0	0	0
56	1	0	0	0
57	1	0	0	0
58	2	0	0	0
59	2	0	0	0
60	3	0	0	0
61	1	1	2	2
62	1	0	0	0
63	2	1	1	0
64	1	0	0	0
65	1	0	0	0
66	1	0	0	0
67	1	0	0	0
68	2	1	1	0
69	2	0	0	0
70	2	0	0	0
71	2	1	1	1
72	2	0	0	0
73	2	0	0	0
74	2	0	0	0
75	2	0	0	0
76	1	0	0	0
77	2	0	0	0
78	2	0	0	0
79	2	0	0	0
80	2	0	0	0
81	2	1	1	0
82	2	0	0	0
83	1	0	0	0
84	1	0	0	0
85	1	0	0	0
86	1	0	0	0
87	1	0	0	0
88	1	0	0	0
89	1	0	0	0
90	1	0	0	0
91	1	0	0	0

Table of Habitat Percentages Within 500m Radius

ORIG_FID	1	2	3	4	5	6	7	8	9	10
Barren Land										
Deciduous Forest	18.27%	10.62%	8.41%	8.73%	4.99%	3.75%	2.41%	7%	34.32%	0.87%
Developed High Intensity									1.85%	0.83%
Developed Medium Intensity	0.74%		1.72%	1.20%	3.48%	0.45%	0.20%		6.53%	19.91%
Developed Low Intensity	9.31%	3.69%	24.01%	26.64%	9.03%	13.58%	6.25%	0.82%	9.43%	16.25%
Developed Open Space	11.45%	26.37%	23.43%	38.04%	21.70%	27.91%	33.95%	18.95%	18.51%	21.80%
Emergent Herbaceous Wetlands			2.02%	1.54%	7.68%	6.98%	1.05%			
Evergreen Forest	21.04%	21.71%	21.24%	1.80%	20.52%	21.40%	40.79%	34.54%	17.60%	27.72%
Grassland/Herbaceous			0.74%			0.98%				
Mixed Forest	39.20%	32.78%	18.27%	19.33%	25.80%	18.23%	13.44%	38.69%	11.77%	9.62%
Open Water			0.16%							0.74%
Pasture/Hay		1.71%		1.39%		2.13%	0.51%			2.26%
Shrub/Scrub					4.31%	4.60%	1.39%			
Woody Wetlands		3.11%		1.32%	2.47%					

ORIG_FID	11	12	13	14	15	16	17	18	19	20
Barren Land		2.46%			1.03%	1.66%				
Deciduous Forest	8.87%	18.39 %	2.62%	2.60%	6.33%	6.66%	2.86%	1.23%	28.54 %	20.07 %
Developed High Intensity	0.09%			0.53%		0.56%				0.25%
Developed Medium Intensity	10.83%	2.06%		4.27%	1.24%	7.28%	2.08%	4.80%	0.45%	0.60%
Developed Low Intensity	17.03%	15.30 %	14.45 %	22.42 %	4.90%	17.64 %	14.12 %	23.16 %	0.81%	11.47 %
Developed Open Space	21.02%	38.51 %	24.95 %	35.22 %	22.02 %	19.45 %	21.04 %	30.48 %	10.01 %	21.25 %
Emergent Herbaceous Wetlands	3.71%	0.65%	0.89%		15.76 %	2.45%	3.45%			
Evergreen Forest	7.13%	12.47 %	11.69 %	18.08 %	5.31%	6.34%	23.64 %	28.77 %	35.47 %	25.74 %
Grassland/Herbaceous	0.53%	0.99%								0.02%
Mixed Forest	10.06%	7.87%	13.35 %	14.12 %	13.69 %	6.64%	10%	5.11%	20.41 %	18.05 %
Open Water		0.80%		0.53%						
Pasture/Hay	0.74%				0.05%	1.07%	0.01%	0.25%	0.25%	0.17%
Shrub/Scrub	1.31%	0.49%		1.48%			1.42%	6.08%	4.07%	
Woody Wetlands	18.67%		32.05 %	0.74%	29.68 %	30.25 %	21.37 %	0.13%		2.39%

ORIG_FID	21	22	23	24	25	26	27	West Oly.
Barren Land								0.17%
Deciduous Forest	4.54%	3.13%	11.26%	0.74%	2.36%	2.56%		8.59%
Developed High Intensity	0.84%	0.49%		0.25%	0.82%			0.26%
Developed Medium Intensity	12.85%	11.21%	3.45%	9%	9.95%	1.88%	2.80%	4.67%
Developed Low Intensity	53.72%	43.02%	43.61%	21.11%	7.29%	23.92%	33.59%	18.15%
Developed Open Space	24.55%	27.66%	16.99%	7.02%	8.63%	22.57%	27.18%	22.77%
Emergent Herbaceous Wetlands					3.66%	0.74%	0.34%	1.61%
Evergreen Forest	1.82%	7.34%	1.77%	29.42%	26.68%	24.05%	21.46%	19.37%
Grassland/Herbaceous					0.20%	0.74%	0.62%	0.19%
Mixed Forest	0.03%	6.86%	22.92%	13.89%	26.43%	17.25%	4.99%	16.70%
Open Water					0.29%	1.73%	0.05%	0.17%
Pasture/Hay	0.01%				1.34%	1.04%		0.47%
Shrub/Scrub					0.12%	1.42%	0.20%	0.97%
Woody Wetlands	1.65%	0.28%		18.58%	12.23%	2.12%	8.78%	5.91%