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An Assessment of Barred Owl (*Strix varia*) Habitat Suitability in Ocean Township, New Jersey, USA

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Abstract: Barred owls are distributed widely in Eastern North America and utilize various habitats. Owls were reported in a local habitat area in Ocean Township, NJ. However, several factors, at least superficially, seemed to point to the patch's unsuitability for the species. Hence, I performed a habitat suitability assessment on the area using various transect and detection methods. No owls were directly detected by sight or sound. However, the habitat was suitable for 2 of 3 main habitat suitability requirements. Any owls are utilizing the patch for foraging and/or nesting would be considered tolerant of high levels of human activity.

Key words: Barred owl, habitat suitability, playback calls, New Jersey

INTRODUCTION

The Barred Owl (*Strix varia*, Barton) is distributed widely in Eastern North America and is generally thought to reside in many types of habitat including a range of altitudinal and physiognomical habitat characteristics (Mazur and James, 2000). The limits of the species distribution seems to be on the increase throughout much of its range (Fyfe, 1976; Marks *et al*., 1984; Taylor and Forsman, 1976) however, in certain well-studied areas such as the maritime provinces plus Ontario and the Midwestern US, breeding populations seem to be negatively affected by forest clearing (Cadman *et al*., 1987; Erskine, 1992; Jackson, 1996; Mazur and James, 2000; Nicholson 1997; NJDEP, 2004) particularly in New Jersey (Bosakowski *et al*., 1987). This relatively recent decline in some areas, potentially, is the reason New Jersey lists the species as threatened with extinction. Hence, I report field data assessing the reproductive and non-reproductive habitat suitability for a specific wooded land area in Ocean Township, Ocean County, New Jersey, USA (39°46'30N, 74°12'36W).

The area has delineated wetland habitat (USFWS, 2006) and at least one barred owl has been reported to have been in the immediate area; hence, there exists a 150 ft preservation buffer instead of the normal 50 ft buffer zone. In New Jersey individual barred owls have been recorded in many habitats but primarily, these include sites containing mature hardwoods and/or cedar-dominated wetlands as well as upland mixed forests (Allen, 1987; Laidig and Dobkin, 1995; Sutton and Sutton, 1985). While there are several literature sources associating barred owls with wetland habitats (Bent, 1938; Soucy, 1976; Sutton and Sutton, 1985) data from other studies (Devereaux and Mosher, 1984; Fuller, 1979; Nicholls and Warner, 1972) fail to support this hypothesis. Devereaux and Mosher (1984) hypothesize that the association with water may be an artifact of reduced timber harvesting in moist woodlands. Regardless of the reason, larger diameter trees and canopy cover seem to be very important factors resulting in source populations of barred owls. Because the current site contains wetland habitat and potentially suitable woodland characteristics, I set out to 1) determine presence/absence of individual barred owls in the area and 2) assess the habitat suitability based upon breeding and feeding requirements of the species.

MATERIALS AND METHODS

The upland and wetland habitats of the block and the area immediately north of the block were sampled for habitat and sign of individuals using various methods. First, in order to sample the upland habitat, with minimal overlap from habitat influences of wetland, I sectioned off a 50×50 m grid to the southwestern side of the wetland. I then subdivided this area into 25 equal area (10×10 m) plots. Within each of these plots I recorded presence/absence and habitat information. The dominant cover type within each plot was categorized into coniferous, deciduous or mixed forest. Percent of canopy cover to the nearest 5% was determined with a hand-held forest densitometer from the center of each plot. The vegetation cover of the midstory and understory was categorized as either open or closed. I counted the number of trees with a diameter at breast height greater than or equal to 51 cm (dbh = 51 cm; recommended as suitable diameter for potential cavities by Evans and

Conner (1979) and Hamel *et al.* (1982) and the number of snags = 33 cm within each plot (although the number of snags is currently hypothesized as not required for barred owls (Apfelbaum and Seelbach, 1983; Allen, 1987; Elody, 1983; Mazur and James, 2000). I measured dbh on 2 canopy trees within each plot, one from the southern and northern corners. Additionally, I searched potential roosting sites within each plot sign of barred owl-feathers, regurgitated pellets and potential nesting cavities.

Second, a single-route transect (Bibby *et al.*, 1996) was walked along the northeastern side of a variable man-made ditch traveling through the northeastern most corner of the block and extending into the northern adjacent land area. Along this transect, I sampled points at 15 m intervals for data similar to the upland site with the following exceptions: Canopy trees within a three meter circular plot of point center were measured for dbh and the number of trees with a dbh = 51 cm and the number of snags = 33 cm within 20 m of plot center was recorded. In sequential plots, I ignored large trees that had already been counted.

The previous sampling areas were used for comparison with habitat suitability indices constructed by Allen (1987). Because Allen (1987) did not produce verified final Habitat Suitability Index (HSI) values (weighted or unweighted; Allen 1987) from empirical data, I used only the component values of "Percent Canopy Cover", "Mean dbh of sampled canopy trees" and "Number of canopy trees = 51 cm/0.4 ha" for comparison and final conclusions. Another more recent HSI is available (Olsen *et al.*, 1999) but is associated with western North American habitats (Alberta, Canada) where particular variables required for HSI calculation are unobtainable in the area.

Next, I employed select circular plots in the northeastern section of the block and a single-route transect (~150 m) along the eastern 1/3 of the block noting the presence of large trees, snags, potential roost sites and owl sign.

Availability of prey items may be a limiting factor for barred owls (Taylor and Forsman, 1976) and small mammals are an extremely important component of the Barred Owl diet (Bosakowski and Smith, 1992; Elderkin, 1987; Marks *et al.*, 1984; Takats, 1998; Snyder and Wiley, 1976). In order to determine if small mammal food resources were present to support barred owls in the area, I utilized modified mammal tracking tunnels (King and Edgar, 1977; Mirriam, 1990) which detect small-medium sized mammals attempting to eat a bait mixture of oats, peanut butter and paraffin by recording inked footprints on contact paper. Five tunnels were placed along a line-transect that included both upland and wetland habitats. The tunnels were deployed within two hours upon reaching the site, kept open during the entire two-day survey and retrieved and checked for mammal tracks upon leaving the area.

Because barred owls and owl signs are not conspicuous, I used a Johnny Stewart model 612 deluxe professional caller and loudspeaker to play barred owl calls and listen for live responses. Tape playbacks were made according to the 2nd Pennsylvania Breeding Bird Atlas Protocols (Lanzone and Mulvihill, 2006). Attempts to detect owls using this protocol were made at night and during daylight hours (Bent, 1938; Mosher *et al.*, 1990; Taylor, 1983). Furthermore, playbacks were made within the wetland habitat and at a wetland area in close proximity to the survey site (Fig. 1).

RESULTS AND DISCUSSION

Upland grid and wetland transect: The data collected in the upland and wetland sections of the plot are summarized in Table 1 and 2. Seven of 25 (28%) of the upland plots were dominated by deciduous forest canopy cover while 6 (24%) were dominated by coniferous vegetation. The remaining was a hardwood/conifer mixture. In the wetland transect, the plots were either dominated by deciduous or mixed deciduous/conifer canopy. In both upland and wetland sites, there was a relatively high percentage of canopy over (averages of 84 and 87%, respectively). Both sites had several instances of open mid-and understory although this aspect was not quantified in the wetland site. While there were no trees = 51 cm in the upland sampled grid, I detected 4 of these trees in the wetland site and one had a potential nesting cavity. Mean dbh of the upland and wetland sites were 18.4 and 18.7 cm, respectively. These three variables (No = 51 cm trees/0.4 ha, Mean dbh of Canopy Trees and Percent Canopy Cover) were used to determine reproductive habitat suitability index (Allen, 1987). Each of these variables was calculated from the data collected and plotted in association with optima produced by Allen (1987) (Fig. 2-4).

While the sampled upland habitat was devoid of trees = 51 cm dbh, the wetland habitat had an estimated 2.76 trees = 51 cm / 0.4 ha. These sites weighted by the total area sampled produced a "total" suitability for this variable close to one. Hence, while the upland vegetation (in the sampled area) is probably unsuitable for reproduction of barred owls, the wetland site and/or when the total area is considered, with respect to canopy tree diameter, the site produces an almost optimum suitability value (Fig. 2).

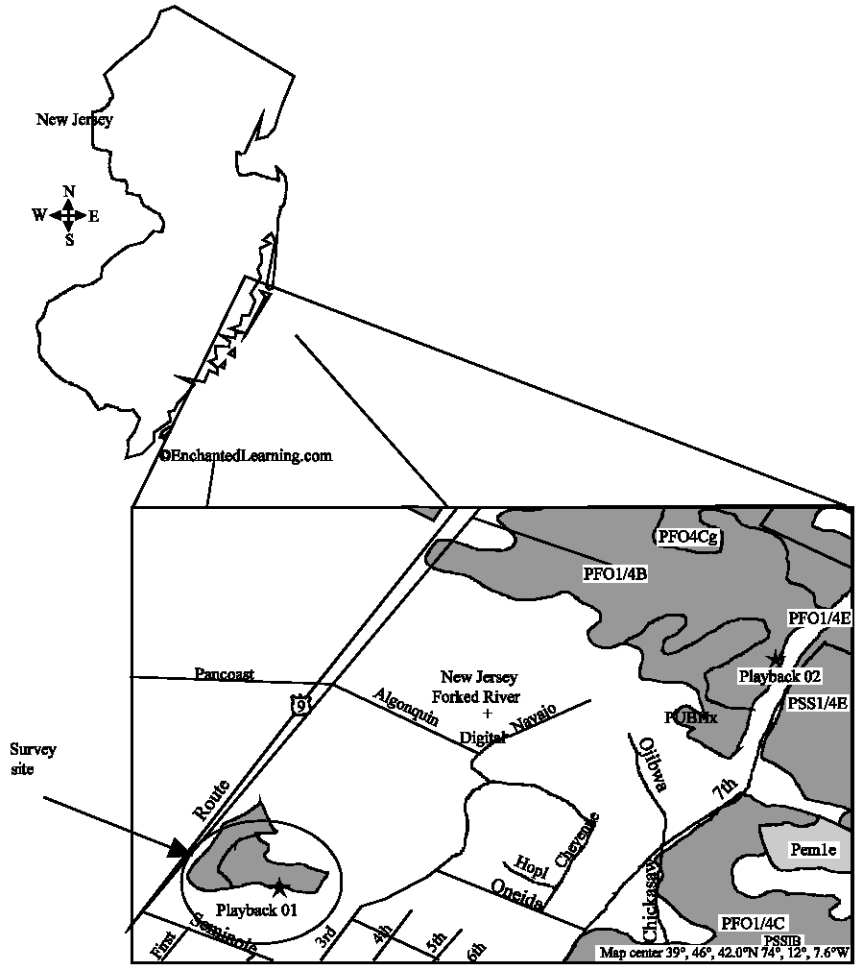

Fig. 1: The survey site with wetlands delineated as grey-shaded regions on map. Also, in this figure are the approximate positions of Barred Owl playbacks. Figure constructed using USFWS Wetlands Online Mapper (http://wetlandsfws.er.usgs.gov). Outline map of New Jersey from http://enchantedlearning.com

Table 1: Upland grid plots data

Upland grid plot	Dominant cover	Canopy (%)	Mid	Under	dbh1 (cm)	dbh2 (cm)
a_1	d	95	Open	Open	22.86	16.5
a_2	d	95	Open	Open	15.24	15.2
a_3	m	90	Closed	Open	25.4	24.1
a_4	m	90	Closed	Closed	22.86	26.7
a_5	c	75	Closed	Closed	10.16	19.1
b_5	m	50	Closed	Closed	12.7	22.9
b_4	m	95	Closed	Closed	27.94	17.8
b_3	m	90	Closed	Closed	10.16	20.3
b_2	d	95	Open	Open	20.32	15.2
b_1	d	95	Open	Open	13.97	15.2
c_1	d	98	Open	Open	15.24	25.4
c_2	m	80	Closed	Closed	29.21	16.5
c_3	c	85	Open	Closed	25.4	12.7
c_4	c	80	Closed	Closed	15.24	22.9
c_5	m	60	Closed	Closed	22.86	5.08
e_5	m	85	Closed	Open	11.43	15.2
d_5	c	95	Closed	Closed	22.86	17.8
d_4	m	75	Open	Open	25.4	12.7
e_4	c	40	Open	Closed	.	5.08
e_3	c	65	Open	Open	17.78	21.6
d_3	m	85	Open	Closed	24.13	15.2
d_2	m	85	Open	Closed	7.62	24.1
e_2	d	95	Closed	Closed	38.1	12.7
d_1	m	95	Open	Closed	17.78	22.9
e_1	d	95	Open	Closed	26.67	14
Averages		83.52			13.0666	18.4

Plot = 10×10 m designated sampling area in upland site, Dominant Cover = dominant forest cover type; c = coniferous, d = deciduous, m = mixed, Canopy % = percentage of cover as measured with a forest densitometer, Mid and Under = whether the midstory and understory were open or closed with vegetation, dbh1 and dbh2 = dbh of random tree in northern and southern (respectively) quadrant of plot. For upland plots, values were zero with respect to the number of snags >33 cm, the number of trees = 51 cm and the number of pellets or other sign of barred owl

In both upland and wetland cases, mean dbh values are relatively low and considered almost unsuitable for barred owl reproduction (Fig. 3) while canopy cover for both upland and wetland habitats are well above what is required for barred owl reproductive habitat (Fig. 4).

Table 2: Wetland transect data

Wetland transect plots	Dominant cover	Canopy tree dbhs w/in 3 m of center of plot No. 1	No. 2	No. 3	No. 4	No. 5	No. of as-of-yet uncounted trees with≥ 51 cm dbh within 20 m of plot center	Percent cover	No. of snags≥33 cm dbh	No. of trees≥33 cm dbh	Pellets or other sign of barred owl	Pertinent notes 1 tree w/ potential nest cavity
1	Mixed	27.9	15.2	39.4	11.4	30.5	2	90	1 Possible	1	1 Possible	
2	Mixed	8.9	16.5	20.3	5.1	22.9	0	95	0	0	0	
3	Deciduous	15.2	14.0	10.2	7.6	8.9	0	85	0	1	0	
4	Mixed	10.2	30.5	50.8	.	.	1	65	0	4	0	
5	Deciduous	8.9	10.2	20.3	30.5	29.2	0	95	0	2	0	
6	Deciduous	15.2	7.6	.	.	.	1	90	0	4	0	
	Average dbh =		18.6944						Average =	86.67		

Plot = 10×10 m designated sampling area in upland site, Dominant Cover = dominant forest cover type; c = coniferous, d = deciduous, m = mixed, Canopy % = percentage of cover as measured with a forest densitometer, Mid and Under = whether the midstory and understory were open or closed with vegetation, dbh1 and dbh2 = dbh of random tree in northern and southern (respectively) quadrant of plot. For upland plots, values were zero with respect to the number of snags >33 cm, the number of trees = 51 cm and the number of pellets or other sign of barred owl

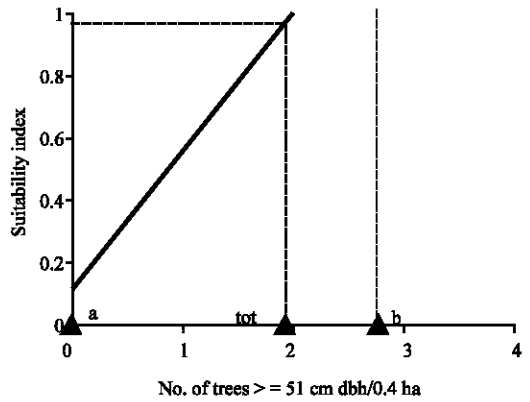

Fig. 2: Number of trees = 51 cm dbh / 0.4ha for upland ("a") and wetland ("b") sites. While the sampled upland habitat was devoid of these potential nesting and roosting sites, the wetland habitat had 2.76 trees/ 0.4ha. These sites weighted by the total area sampled produced a "total" suitability for this variable close to one. Hence while, the upland vegetation (in the sampled area) is probably unsuitable for reproduction of barred owls the wetland site and/or when the total area is considered, with respect to canopy tree diameter, the site produces an almost optimum suitability value. Suitability line from Allen (1987)

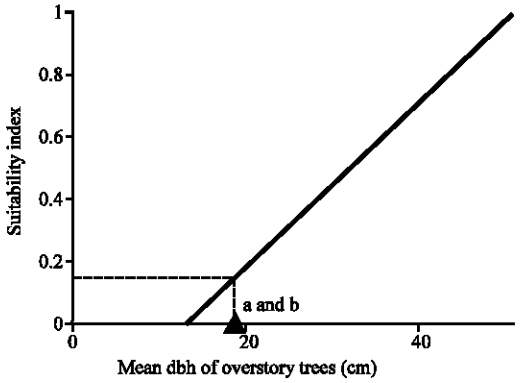

Fig. 3: Mean dbh of canopy trees for upland ("a") and wetland ("b") sampled areas. In both upland and wetland cases, with respect to mean dbh is relatively low and considered almost unsuitable for barred owl reproduction. Suitability line from Allen (1987)

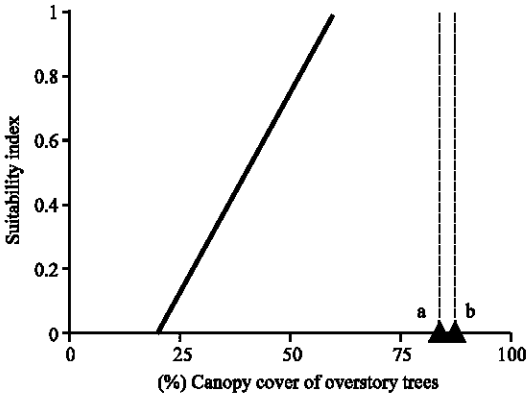

Fig. 4: Percent Canopy Cover for upland ("a") and wetland ("b") sampled areas. Canopy cover for both upland and wetland habitats seem to be well above what is required for barred owl reproductive habitat. Suitability line from Allen (1987)

Outside upland and wetland sample sites: While several trees = 51 cm (potential roosting and nesting sites) exist on the site as detected through grid, single route transect and select circular plots, no owl sign was detected nor were any owls seen or heard during the study and/or the tape playbacks. The fact that I had no owl responses to tape playbacks may be indicative of no owls in the area or relatively unsuitable habitat. However, this negative data should be used with caution as the owls are very cryptic and sampling time was well out of breeding season (February-April in New Jersey (Bent, 1938)) and in extreme

weather conditions (~37°C and humid). Additionally, I did not detect owls with playback at an off-site wet-woodland area (playback 02 in Fig. 1).

I detected several small mammals on the site through direct observation (Eastern Chipmunk (*Tamias striatus*) and Gray Squirrel (*Sciurus carolinensis*) as well as with tracking tunnels (including Cricetid rodents-a major component of barred owl diet). Hence, the mammal community is composed of species which are commonly found in the diets of eastern forest barred owls (Bosakowski and Smith, 1992). Additionally, I found the remnants of one mammal carcass northeast of the block which looked to have been taken by either medium-large mammal or large predatory bird.

CONCLUSION

The *upland habitat* when considered alone, particularly toward the southwestern corner of the block, is unsuitable for barred owls except possibly for foraging. However, when the wetland habitat is taken into account, a majority of the data suggest suitable habitat for barred owls-even with a lack of direct detection of owls or owl sign. This can be explained by the influence of the larger diameter trees and the closed canopy of the wetland area toward the northeast. Allen (1987) states that "…optimum reproductive habitat for barred owls can be characterized as a forest stand that has = 2, 51 cm dbh trees/0.4 ha, a mean overstory tree dbh of = 51 cm and an overstory canopy cover = 60%." This site is suitable for 2 of 3 of those conditions giving the site a relatively high overall value for barred owl habitat suitability. In fact, the two values for which the data satisfy the HSI model actually exceed the suitability requirements. Because human encroachment is very apparent (strip malls and housing developments) and because mean dbh is low (the forest is relatively immature), I suspect that if barred owls are using the area it may not be very productive. Breeding may occur (as a nest was reportedly observed in the vicinity within the past several years), but more likely, the area may be used as a component of a larger homerange. Use may be limited to potential foraging and/or territorial defense.

If owls have been in or are currently using the area for nesting habitat then, given the close proximity to Highway 9, a strip mall and local housing, those owls are fairly tolerant of human activity. If the human activity is increased, it is my opinion that owl suitability of the habitat can only decrease. An alternate HSI (Olsen *et al*., 1999) include human proximity (within 50 m is considered unsuitable) as a factor but also include a smaller mean diameter for suitable nesting habitat. The former would exclude much of the site under consideration here. However the latter would tend to have a positive effect on the overall HSI. If an ornithologist were to return to the site during the breeding season (late February through April), detection via tape playbacks and/or sightings would add confidence in a decision as to the current utility of the site by nesting Barred Owls.

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