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CHARACTERIZING NORTHERN SAW-WHET OWL (*AEGOLIUS ACADICUS*) WINTER HABITATS IN SOUTH-CENTRAL INDIANA

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ABSTRACT. Northern Saw-whet Owl (*Aegolius acadicus*) winter habitat in south-central Indiana was assessed during two winters (2003/2004 & 2004/2005). Differences between locally occupied and unoccupied habitat were examined, and occupied habitat in Indiana was compared to occupied habitat in other regions. Using audio surveys and active voice detection, 40 locations were sampled in the first winter, 45 in the second winter, 35 in both winters and 50 total. The presence of Northern Saw-whet Owls was strongly related to the understory transparency, agreeing with previous studies in Maryland and Michigan showing a correlation with dense vertical structure. However, there was no evidence of a strong correlation between the presence of Northern Saw-whet Owls and either evergreen canopy cover, evergreen stem density or mid-canopy gap, contradicting results from other studies in Minnesota, Maryland and Michigan, though there was a minimum 40% evergreen canopy cover in occupied sites. The lack of consistency among studies indicates regional variability in the habitat structure of sites occupied by Northern Saw-whet Owls, but a dependable reliance on dense cover.

Keywords: Northern Saw-whet Owl, winter habitat, understory density

Historic records show that Northern Saw-whet Owls (*Aegolius acadicus*) occasionally breed in northern Indiana, and migrant populations spend the winter across the state (Cannings 1993). Christmas Bird Count records have also consistently (since 1985) documented the presence of Northern Saw-whet Owls wintering in south-central Indiana. Between fall and spring migration events, potential south-central Indiana forest sites were surveyed for Northern Saw-whet Owls to characterize occupied habitats in the winters of 2003/2004 and 2004/2005.

Northern Saw-whet Owls undergo an annual fall movement from their primary breeding range in boreal forests along the U.S.-Canada border to points as far south as the Gulf Coast (Weir et al. 1980; Cannings 1993; Swengel & Swengel 1997). This partial migration has a high degree of variability due to "irruptive" years when the number of migrating Northern Saw-whet Owls can be ten times higher than the longterm average (Weir et al. 1980; Whalen & Watts 2002).

Breeding Northern Saw-whet Owls are usually found in coniferous or mixed coniferous-deciduous forests with a well-developed middle canopy of coniferous trees (Cannings 1993). Wintering and migrating Northern Saw-whet Owls appear to rely on dense vegetation for roosting, generally with a large component of evergreen trees (Mumford & Zusi 1958; Forbes & Warner 1974; Cannings 1993; Churchill et al. 2000, 2002). Past studies have shown variable vegetation structure in occupied saw-whet habitats of Michigan and Maryland, but these habitats were generally composed of thick cover (Mumford & Zusi 1958; Churchill et al. 2000).

The purpose of this study was to assess occupied wintering Northern Saw-whet Owl habitat in south-central Indiana forests based on the results of a presence-absence survey of potential roosting locations, and to determine if occupied wintering Northern Saw-whet Owl habitat in Indiana differs from occupied habitat in other regions.

METHODS

Owl surveys.—Once per winter, sample locations, primarily in Monroe, Brown, Lawrence and Jackson Counties (Figure 1 and Table 1), were surveyed for the presence of Northern Saw-whet Owls, using active voice detection during a period beginning two weeks after fall migration ended (~December 15th) until approximately two weeks before the beginning of spring migration (~February 15th) during the winters of 2003/2004 (Year 1) and 2004/2005 (Year 2). To allow for better

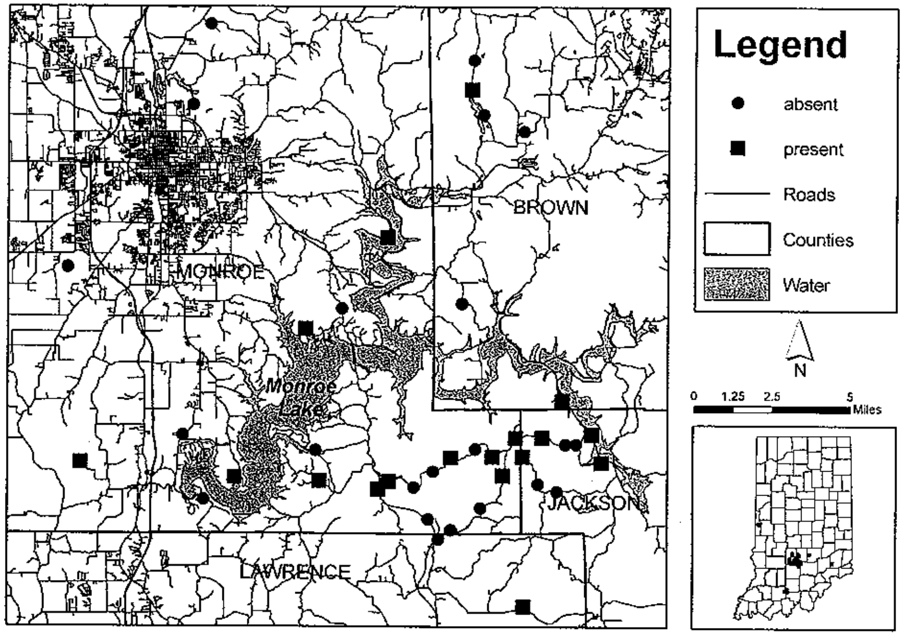

Figure 1.—Primary Northern Saw-whet Owl survey sites. Map showing the location of 40 of the Northern Saw-whet Owl survey sites in the Monroe County area and access roads.

detection, the advertising call of a male Northern Saw-whet Owl was played on nights with calm winds for 45 min or until a Northern Saw-whet Owl was detected. Surveys were stopped once a Northern Saw-whet Owl was detected. An audiolure of the type recommended by Project Owlnet was used to attract Northern Saw-whet Owls, but at ~60 dB instead of the suggested ~100 dB (Huy 2004). Detection consisted of either seeing a Northern Saw-whet Owl or hearing a distinctive vocalization. Once Northern Saw-whet Owls were heard, an attempt was made to spotlight the owl for verification (two were heard landing on a branch and spotlighted without vocalizing), but approximately half of the owls were in vegetation too dense to be spotlighted. In Year 1, forty locations were surveyed, 45 in Year 2, 35 in both years and 50 total, for a grand total of 85 survey events. The presence of other owl species that potentially prey on Northern Saw-whet Owls was also recorded.

Three years of experience at Northern Saw-whet Owl banding stations in Pennsylvania and Indiana had allowed the surveyor to become intimately familiar with their sounds. Vocalizations were generally (~90%) in the form of soft, "skew" call notes, not the "scree" or male toots commonly heard on commercially available recordings. One other, uncommon "twitter" response was also detected; it sounds like the twitter of an American Woodcock (*Scolopax minor*) or a higher-pitched version of a Belted Kingfisher (*Megaceryle alcyon*), lasting 1–3 sec (Brigham 1992). Based on ~30 events in which the twitter call was heard in response to being disturbed near mistnets at banding stations or in the hand, it is apparently a response to a surprise, close-proximity threat in the owl's environment.

Since Northern Saw-whet Owls are generally forest-dwelling (Cannings 1993), study sites were located in mostly forested habitat within 100 m of a road (paved or gravel) for easy access and were spaced at least 1.6 road km apart. Agricultural fields, urban and other developed landscapes were not included because Northern Saw-whet Owls have never been detected in these habitats during Christmas Bird Counts in the area. Sample sites were

located without regard to habitat structure, but were chosen on the ability to make a good survey without interference from background noise, such as dogs or traffic. Forty-six of the survey locations were on public land (Hoosier National Forest, Yellowwood State Forest, Big Oaks National Wildlife Refuge, Patoka Lake, and Newport Chemical Depot) and four were on private property.

Habitat characteristics.—Habitat within 50 m of each survey location was characterized using 11 variables: canopy height, understory height, mid-canopy gap between understory and canopy, estimated percent deciduous and evergreen canopy coverage using a densiometer, visually estimated deciduous and evergreen understory coverage to the nearest 5%. Stem density of deciduous, evergreen and sapling (<10 cm diameter at breast height) trees was also measured by counting the stems within 10 m of the survey site, transparency calculated by measuring the average distance (in meters) that a 12 inch diameter Secchi disk could be seen from a sample point at a height 2 m above the forest floor. The transparency measurement was taken four times at each location at 90° increments from a random starting bearing and averaged, giving a measure of understory thickness at the two-meter height that was more portable than the coverboard method (Nudds 1977).

Statistics.—Since the data record presence/absence of Northern Saw-whet Owls, binary logistic regression models were built in Statistical Analysis System (SAS) 9.0 using the presence/absence of other owl species and vegetation characteristics of each sample point as predictor variables (SAS 1996). One variable at a time was used as the predictor, and significant variables were grouped as multiple predictors to assess interactions. Models using multiple variables with a condition index <15 were considered safe from correlation in this study (Yaffee 2005). Models were built using survey results for all 50 survey sites combined. Reported values from the analysis include *P*-value (model significance), parameter estimate, percent concordance (measure of association between the model and data), Pearson test (goodness of fit), and the change in odds of Northern Saw-whet Owls occupying a site based on parameter estimates. After testing for normality and equal variances, appropriate univariate *t*-tests or Mann-Whitney tests were conducted between habitat characteristics of sites occupied by Northern Saw-whet Owls and unoccupied sites.

RESULTS

Wintering Northern Saw-whet Owls were detected at 17 locations in Year 1 (Table 1). The average response time in Year 1 was 13 min with a range of 2–35 min. Northern Saw-whet Owls responded at only seven locations in Year 2, with an average response time of 7 min (range 4–20 min). Overall, Northern Saw-whet Owls responded at 20 of 50 locations during the two-year study. Four locations had a Northern Saw-whet Owl in both years, 13 locations in Year 1 only, and three locations in Year 2 only. Of the three locations that had Northern Saw-whet Owls only in Year 2, two also had Barred Owls (*Strix varia*) vocalizing the year before.

Habitat characteristics for occupied Northern Saw-whet Owl sites were significantly different than unoccupied sites in understory height, transparency, percent deciduous understory and percent herbaceous cover (Fig. 2, Table 2). Unoccupied sites were approximately 6.1 m more transparent, had ~15% less herbaceous cover, had ~11% less deciduous understory cover and were ~1 m shorter in understory height than occupied sites (Fig. 3). All four of these characteristics described the lower strata of the forests. However, all four characteristics were also highly correlated with each other (Table 3). Percent deciduous understory had the most significant difference using a Mann-Whitney test ($P = 0.014$), and transparency had the most significant difference using *t*-tests assuming unequal variances ($P = 0.018$). Percent evergreen canopy cover and evergreen stem density were not significantly different between occupied and unoccupied sites ($P = 0.085$ and $P = 0.087$, respectively, $\alpha = 0.05$), but the *P*-values indicate there may have been a weak relationship between evergreens and the presence of Northern Saw-whet Owls in south-central Indiana (Fig. 4). Evergreen canopy percent cover ranged from 40% to 90% in sites occupied by Northern Saw-whet Owls, and 3% to 90% in unoccupied sites.

Logistic regression had significant results with percent deciduous understory, understory height and transparency (Table 4), but no multivariate models were significant. Each 1% increase in the deciduous understory cover increased the odds of detecting a Northern

Table 1.—Locations, dates and times of surveys, and survey results (yes/no) for wintering Northern Saw-whet Owls. (HNF = Hoosier National Forest, YSF = Yellowwood State Forest, SLT = Sycamore Land Trust property)

			Year 1				Year 2			
Site	County	Location	mm-dd	Time	Yes/no	Min	mm-dd	Time	Yes/no	Min
1	Monroe	HNF: County Line Road	1-20	19:00	Yes	7	1-30	18:45	No	
2	Jackson	Maumee Bottoms: Robertson Cemetery	1-18	20:05	No		12-18	18:30	Yes	5
3	Jackson	Maumee Bottoms	1-18	21:03	Yes	12	12-18	18:45	Yes	5
4	Monroe	HNF: Hardin Ridge Recreation Site	2-14	20:05	Yes	17	12-18	19:00	No	
5	Brown	Deckard Ridge	2-15	20:15	No		1-23	18:45	No	
6	Bartholomew	SLT: Touch the Earth	1-05	18:50	No					
7	Brown	YSF: Yellowwood Lake Road	1-06	18:50	Yes	6	1-23	19:35	No	
8	Brown	YSF: Yellowwood Lake Road					1-23	20:25	No	
9	Brown	YSF: Yellowwood Lake Road					1-23	21:15	No	
10	Brown	Green Valley					1-23	22:05	No	
11	Monroe	Paynetown SRA	12-17	19:20	Yes	11	12-18	19:50	Yes	4
12	Lawrence	HNF: Norman, IN	12-17	21:05	Yes	4				
13	Monroe	HNF: Allens Creek SRA	2-15	21:10	No		12-18	20:05	No	
14	Monroe	HNF: Dutch Ridge	2-14	20:55	No		12-18	20:55	Yes	4
15	Monroe	SR 446 and Hunter Creek Road	1-19	18:55	No		1-16	18:30	No	
16	Lawrence	Hunter Creek Road	1-19	19:45	No		1-16	19:20	No	
17	Monroe	Hunter Creek Road	1-19	20:40	No		1-16	20:10	No	
18	Monroe	HNF: Hunter Creek Road	1-19	21:30	Yes	35	1-16	21:00	No	
19	Monroe	Hunter Creek Road	1-19	22:20	No		1-16	21:50	No	
20	Jackson	HNF: County Line Road	1-20	19:25	No		1-30	19:35	No	
21	Monroe	HNF: County Line Road	1-20	20:20	No		1-16	22:40	No	
22	Vermillion	Newport Chemical Depot					1-06	18:20	No	
23	Vermillion	Newport Chemical Depot					1-06	19:20	No	
24	Vermillion	Newport Chemical Depot					1-06	20:20	No	
25	Monroe	Griffy Lake	1-02	18:50	No		1-30	20:25	No	
26	Monroe	Old Meyers Road	12-31	18:40	No					
27	Monroe	Leonard Springs	12-24	18:55	No		1-30	21:15	No	
28	Monroe	Cedar Bluff	2-14	21:45	No		1-05	19:00	No	
29	Monroe	SLT: The Cedars	12-30	19:05	Yes	15	1-30	22:05	No	
30	Monroe	Monroe Lake Dam	2-14	22:40	No		1-05	19:50	No	
31	Monroe	Fairfax SRA	2-01	19:05	Yes	12	1-05	20:40	No	
32	Monroe	HNF: SR 446 and Paynetown Office	2-15	22:05	No		12-18	21:15	No	
33	Orange	Jackson SRA	12-21	18:05	Yes	9	1-28	18:15	Yes	5
34	DuBois	Lick Fork SRA					1-28	18:35	No	
35	Orange	Newton-Stewart SRA					1-28	19:25	No	

Table 1.—Continued.

			Year 1				Year 2			
Site	County	Location	mm-dd	Time	Yes/no	Min	mm-dd	Time	Yes/no	Min
36	Orange	Newton-Stewart SRA					1-28	20:15	No	
37	DuBois	Newton-Stewart SRA					1-28	21:05	No	
38	Monroe	Friendship Road	2-15	23:00	No		12-28	18:35	Yes	9
39	Monroe	HNF: Tower Ridge Road Blackwell Cabin	1-13	18:50	Yes	25	12-18	22:05	Yes	5
40	Monroe	HNF: Tower Ridge Road	1-13	19:35	No		12-18	22:30	No	
41	Monroe	HNF: Tower Ridge Road	1-13	20:25	No		1-30	22:55	No	
42	Monroe	HNF: Tower Ridge Road	1-15	19:20	Yes	20	12-18	23:20	No	
43	Monroe	HNF: Tower Ridge Road	1-15	20:05	No		1-16	23:20	No	
44	Monroe	HNF: Tower Ridge Road	1-15	21:00	Yes	18	1-17	00:10	No	
45	Monroe	HNF: Tower Ridge Road fire tower	12-17	22:00	Yes	8	12-19	00:10	No	
46	Jackson	HNF: Tower Ridge Road	1-20	21:07	Yes	7	1-30	23:45	No	
47	Jackson	HNF: Tower Ridge Road	1-18	21:45	No		1-31	00:35	No	
48	Jackson	HNF: Tower Ridge Road	1-18	22:35	No		12-19	01:00	No	
49	Brown	Maumee Bottoms	1-20	21:35	Yes	2				
50	Ripley	Big Oaks National Wildlife Refuge	12-16	18:30	Yes	18				

Saw-whet Owl by 2.8%, each 1 m increase in the understory height increased the odds of detecting a Northern Saw-whet Owl by 64.7%, and each 1 m increase in transparency decreased the odds of detecting a Northern Saw-whet Owl by 8.5%. Transparency also had the highest Percent Concordance (69.2%) and lowest P-value (0.013).

Since Northern Saw-whet Owls generally breed in boreal forests (Cannings 1993), the lack of a correlation between Northern Saw-whet Owls and evergreens required exploration. The average transparency values in sites with ≥70% evergreen cover (42 m) was significantly higher than those with <70% evergreen cover (37 m, t = 1.7716, df = 48, P = 0.041, one-tailed assuming equal variances), indicating a thinner understory in surveyed evergreen stands. Overall, there were 14 sites that had at least 70% evergreen canopy cover, seven of which were occupied by Northern Saw-whet Owls. Of the seven sites with ≥70% evergreen cover that were also occupied by Northern Saw-whet Owls, two sites were young pines <14 m tall, one site was a red cedar (*Juniperus virginiana*) stand that maintained a relatively dense lower canopy well into maturity, and the other four sites had abundant shade tolerant American beech (*Fagus grandifolia*) saplings. The seven occupied sites with ≥70% evergreen cover also had significantly lower transparency values than the seven unoccupied sites (38.6 m in occupied sites and 48.4 m in unoccupied sites, t = −2.6286, df = 7, P = 0.034, two-tailed assuming unequal variances).

Barred Owls and Great Horned Owls (*Bubo virginiana*), both potential predators for Northern Saw-whet Owls, were detected in 16 of the 85 surveying events. Only two Northern Saw-whet Owls were detected during an event when another species of owl was also detected, but there were no statistically significant correla-

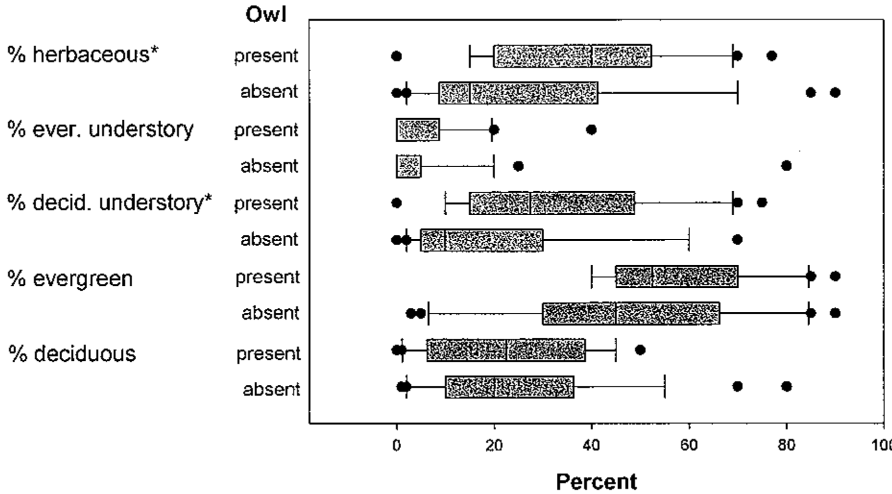

Figure 2.—Boxplots of percent habitat cover between survey sites with Northern Saw-whet Owls present vs. absent. See Table 2 for details of statistical tests. Significant differences indicated by asterick (P = <0.05).

tions between the presence of Northern Saw-whet Owls and other species of owls during the two-year study.

DISCUSSION

The ability of logistic regression to detect relationships between sites occupied by Northern Saw-whet Owls and habitat characteristics indicates that these owls exhibit fairly strong habitat selection (Brotons et al. 2004). The most significant variables explaining the presence of Northern Saw-whet Owls (transparency, percent deciduous understory cover, percent herbaceous cover, understory height) were measures of density and vertical structure in the lower strata of the forest. However, these variables were also highly correlated. The best predictor of the presence of Northern Saw-whet Owls was transparency. Each 1 m increase in the transparency of the understory at the 2 m height decreased the odds of detecting a Northern Saw-whet Owl by 8.5%. These results

Table 2.—Mean and standard error values of habitat characteristics for sites with Northern Saw-whet Owls present (n=20) or absent (n=30) during the two-year study, and P-values for test of differences. † = 2-sided t-tests assuming unequal variances. ‡ = Mann-Whitney test. * = statistically significant difference (P < 0.050)

	NSWOs present		NSWOs absent		
	Mean	SE	Mean	SE	P-value
Canopy height (m)	18.4	1.0	17.4	1.2	0.531†
Deciduous canopy % cover	22.7	3.7	26.1	3.8	0.698‡
Evergreen canopy % cover	58.3	3.7	46.8	4.3	0.085‡
Deciduous understory % cover	32.5	4.8	20.0	3.8	0.014‡*
Evergreen understory % cover	5.3	2.2	5.8	2.9	0.466‡
Herbaceous % cover	37.8	4.6	25.8	4.8	0.021‡*
Stem density deciduous trees (stems/m^2)	0.04	0.01	0.04	0.01	0.336‡
Stem density evergreen trees (stems/m^2)	0.14	0.02	0.10	0.01	0.087‡
Stem density saplings (stems/m^2)	0.32	0.04	0.26	0.05	0.065‡
Transparency (m)	34.9	2.0	41.0	1.4	0.018†*
Mid-canopy gap (m)	2.9	0.6	3.2	0.7	0.799‡
Understory height (m)	2.8	0.3	1.9	0.3	0.033‡*

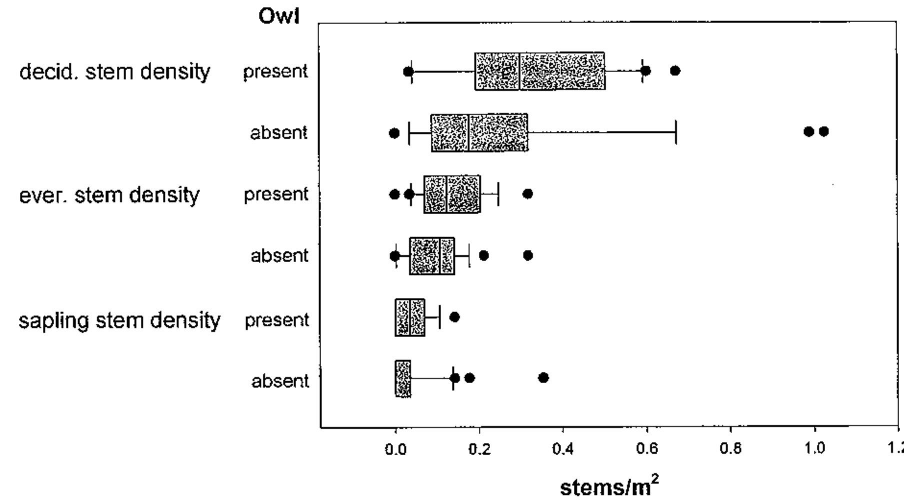

Figure 3.—Boxplots of stem densities between survey sites with Northern Saw-whet Owls present vs. absent. See Table 2 for details of statistical tests. Significant differences indicated by asterick (P = <0.05).

agree with previous studies in Michigan and Maryland indicating wintering Northern Saw-whet Owls select habitats of specific vertical structure with dense understory cover (Mumford & Zusi 1958; Churchill et al. 2000). Northern Saw-whet Owls may occupy these sites because their relatively small size gives them good maneuverability in dense forest thickets (Cannings 1993), allowing them to go where other owl species (their predators and competitors) cannot. Mumford and Zusi (1958) also found that a mid-canopy gap was important for roosting Northern Saw-whet Owls, but this study found no correlation between Northern Saw-whet Owls and the mid-canopy gap, indicating some regional variability in the structure of habitat occupied by Northern Saw-whet Owls.

The lack of strong significant relationships between evergreen canopy cover or stem density and Northern Saw-whet Owls is not consistent with other studies showing a correlation between Northern Saw-whet Owls and evergreens in Maryland, Michigan and Minnesota (Mumford & Zusi 1958; Forbes & Warner 1974; Cannings 1993; Churchill et al. 2002). However, results show there may have been a weak relationship between evergreens and Northern Saw-whet Owls with a minimum 40% evergreen canopy cover in occupied sites. Evergreen stands (≥70% evergreen cover) had moderately thinner understory structure than mixed or deciduous forests. Since the seven occupied sites with ≥70% evergreen cover had significantly lower transparency values than the seven unoccupied sites, it is apparent that the

Table 3.—Pearson correlation and P-value matrix for habitat characteristics that were significantly different between sites where Northern Saw-whet Owls were present and where they were absent.

	% Deciduous understory	% Herbaceous	Transparency
% Herbaceous	r = 0.836 P < 0.0005	–	–
Transparency	r = −0.482 P < 0.0005	r = −0.669 P < 0.0005	–
Understory height	r = 0.588 P < 0.0005	r = 0.493 P < 0.0005	r = −0.529 P < 0.0005

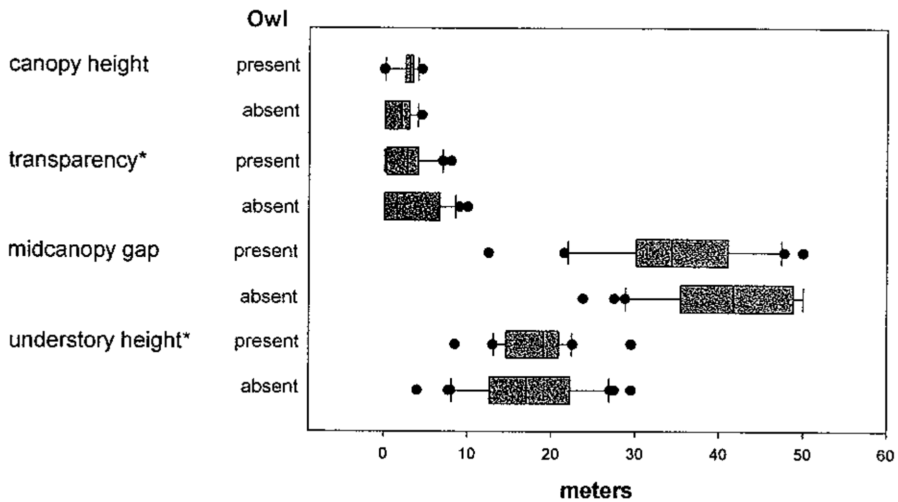

Figure 4.—Boxplots of habitat characteristics between survey sites with Northern Saw-whet Owls present vs. absent. See Table 2 for details of statistical tests. Significant differences indicated by asterick ($P = <0.05$).

density of the understory structure is more critical than the abundance of evergreens for wintering Northern Saw-whet Owls in south-central Indiana. Evergreen stands occupied by Northern Saw-whet Owls were dominated by young pines, red cedar, or had American beech in the understory, reducing transparency by maintaining more understory vegetation structure.

Northern Saw-whet Owls wintering in south-central Indiana may occupy these densely-structured mixed forest habitats because they provide excellent cover from predators, support higher densities of prey species, or both (Anderson et al. 2003). Northern Saw-whet Owls prey on white-footed mice (*Peromyscus leucopus*), and short-tailed shrews (*Blarina brevicauda*) in Indiana (Mumford & Whitaker 1982).

Studies indicate that annual variations in Northern Saw-whet Owl migration are driven by the quantity of fledglings (Cote et al. 2007), but local (territorial) movements of birds are more frequently driven by prey availability (Andersson 1980). Differences in the number of detected wintering Northern Saw-whet Owls between the two years of the study is more likely due to prey availability. Year 2 was "one of the worst in recent history" for tree mast production in local Indiana state forests, presumably due to damage from periodical cicadas (J. Allen pers. commun.). Given that *Peromyscus* populations are known to fluctuate with acorn abundance (Krohne et al. 1988; Elias et al. 2004), their populations were almost certainly below average in south-central Indiana deciduous forests in Year 2, supporting the likelihood of reduced wintering Northern Saw-whet Owl numbers due to low prey levels that year.

Northern Saw-whet Owls may depend on the presence of more than one habitat type for

Table 4.—Significant results of logistic regression using the presence/absence of Northern Saw-whet Owls as the dependent variable and field characteristics as the independent variable.

Predictive variable	*P*-value	Parameter estimate	Change in odds	df	Percent concordant	Pearson
% Deciduous understory	0.043	0.0278	2.8%/%	1	67.0	0.473
Understory height	0.023	0.4987	64.7%/m	1	58.7	0.809
Transparency	0.013	−0.0889	−8.5%/m	1	69.2	0.334

roosting and foraging (Cannings 1993). Since this was a nocturnal survey, the owls may have been moving between roosting and foraging habitats when detected, creating statistical noise in their distribution across the landscape.

Given the secretive nature of this species it was very likely that individual Northern Saw-whet Owls were occasionally undetected despite being present at a site. The detection of a Northern Saw-whet Owl was likely biased by the responsiveness of individuals to male advertising calls.

The average response times of 13 min in Year 1 and 7 min in Year 2 exceeded the normal listening time of most birdwatchers that conduct owl surveys. The typical responses of this secretive species also sound more like a soft "skew" or "nyeep," or more rarely a twittering response, rather than the vocalizations heard on commercially available recordings. Birders interested in accurately surveying for Northern Saw-whet Owls for Christmas Bird Counts and other surveys should listen for the call described above, and allow Northern Saw-whet Owls at least 15 min to respond. Adopting these owl survey techniques will help researchers conduct more accurate population surveys of Northern Saw-whet Owls in winter and migration.

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DAMIAN VINCENT SCHMELZ: DISTINGUISHED EDUCATOR, SCIENTIST, AND THEOLOGIAN

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It is indeed an honor to be asked to write in behalf of Dr. Damian V. Schmelz, OSB, for the Indiana Academy of Science's Biography Series. It is doubtful that any present member of the Academy enjoys greater respect, admiration, and affection than does Dr. Schmelz, or is more deserving of this recognition.

Damian and I first became acquainted in 1962 when he came to Purdue University's Department of Biological Sciences to pursue a Master of Science Degree in Plant Ecology under the direction of Dr. Alton A. Lindsey. At that time, six of us were working toward advanced degrees in Ecology with Dr. Lindsey. Later, Damian completed his Ph.D. in Plant Ecology (also with Lindsey) in 1969. Being about the same age, both having grown up on southern Indiana farms, and interested in the same area of graduate study, we soon became very good friends, as well as later becoming colleagues, relationships that have continued for more than 40 years.

ORIGINS, EARLY HISTORY, AND EDUCATION

The 50-acre farm where Damian grew up is located in Harrison County, Indiana, a few miles northeast from Corydon. In Damian's words, "in between Georgetown (post office), Crandall (telephone), and Lanesville (church and school)." He was born on May 7, 1932, the youngest of four brothers, all of whom still survive; the older three served in World War II or Korea. As Damian's stated, "We were of modest means, but we did not realize how much others had. We raised most of our own food – cows, hogs, chickens, garden, and fruit trees. Only I went to boarding high school (St. Meinrad) as a freshman; home two weeks at Christmas and summers. Mid-college, at age 20, I entered St. Meinrad Monastery".

His education included broad plus in-depth studies in Theology, Liberal Arts, Philosophy, Science, and Education, plus advanced degrees in Ecology and Natural Resources Management (sort of a Modern-day Renaissance Person). Dr. Schmelz graduated from St. Meinrad Seminary High School, St Meinrad, Indiana in May 1950, and from St. Meinrad College with a B.A. in Philosophy in May 1958. He also received the Theology S.T.B. from St. Meinrad School of Theology, and Catholic University of America, Washington, D.C. in June 1959.

During the early 1960s, he completed three NSF Summer Institutes at Purdue University. In the early 1970s, he completed an NSF Summer Institute in Systems Ecology at the University of Oklahoma, plus six NSF-AAAS Chautauqua Short Courses in various areas of Life Sciences at Miami University (Ohio). From 1962 thru 1969, he completed the M.S.

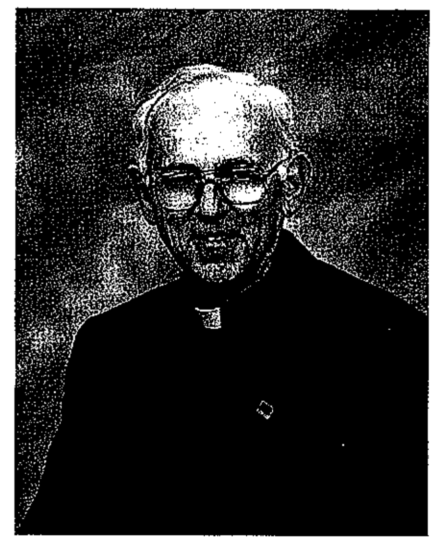

Figure 1.—Father Damian Schmelz in 2002.