Exploring Detectability of Woodpecker Nests

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Introduction

Nine species of woodpeckers occur regularly in Minnesota (Table 1). Woodpeckers, as a guild, merit special consideration as ecological keystone species for two reasons. First, they are cavity-nesting birds that excavate their own nesting cavities. These cavities are later used by other birds, mammals, and herptiles for breeding and sheltering. Second, woodpeckers consume vast quantities of insects that damage or destroy trees, keeping these pest species in check and/or controlling outbreaks (Fayt et al. 2005 in Virkkala 2006). However, nesting activities of woodpeckers are inadequately studied broadly, probably because nests are hard to detect in sufficient quantities for meaningful statistical analyses in short-term graduate studies. Aspen is often harvested in the Great Lakes states at rotation ages that may not allow aspen to reach the size required for optimum cavity potential. Habitat Suitability Index models seem inadequate to assess local conditions, especially considering many regional aspen stands are on their third or fourth or more rotations. In addition, Minnesota DNR and some counties are mandated by an out-of-court settlement agreement to consider cavity-dependent wildlife needs and provide appropriate mitigation. Black-backed and/or three-toed woodpeckers have been designated as "regional forest sensitive species" in some national forests in the U.S. Forest Service's Eastern Region (Corace et al. 2001, Burdett and Niemi 2002), as sensitive species by the Bureau of Land Management, and as watch-list species by the U.S. Fish and Wildlife Service (Kelly et al. 2018). Theoretically, woodpecker and cavity-dependent wildlife needs are at least partially accomplished through "voluntary" best management guidelines, and monitoring (e.g., Rossman et al. 2016) suggests these are successful to some degree.

Woodpecker nests are extremely difficult to find except when young are begging for food (see Table 2, where 23 of 28 nests [82%] were found due to begging young). Because of this, most studies of woodpecker breeding have been based on the incremental accumulation of data into long-term data sets by governmental agencies. An exception is Tozer et al (2009) who found 418 nests in 3 years in Canada. Limited information is available on nest detectability. Russell et al. (2009) explored detectability of woodpecker nests in Oregon from transects spaced 200 m apart. They found that later stage nests were more detectable than early stage nests, that some species were more detectable than others, and that there were observer differences. They found the probability of finding a nest with a single survey was <50% in early nest stages but >90% in later nest stages. If 3 survey replicates were run, detectability approached >99% for later nest stages. Tozer et al. (2009) detected begging sapsucker young over a 13-day period out to 40 m. I further explore questions about detectability in this poster. Finding sufficient numbers of woodpecker nests is imperative for evaluating woodpecker responses to different forest management approaches.

I hypothesized that:

- there would be detection limits (Figure 1)
    - all vocal woodpeckers within some undefined distance would be detected
    - beyond that undefined distance, detectability would tail off linearly to a point of undetectability
- larger species would be detectable at greater distances than smaller species
- the window for detection of begging young would be fairly narrow, e.g., 5-7 or 7-10 days
- but even within that narrow window, detection distances would increase as young got older

Table 1. The woodpeckers of Minnesota.

Species	Scientific Name
Pileated Woodpecker	*Dryocopus pileatus*
Black-backed Woodpecker	*Picoides arcticus*
American Three-toed Woodpecker	*Picoides tridactylus*
Hairy Woodpecker	*Picoides villosus*
Downy Woodpecker	*Picoides pubescens*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Northern Flicker	*Colaptes auratus*

Methods

Woodpecker nests were found from 2018-2021 by different methods. In 2018 woodpecker nests were found by student interns and volunteers surveying transects laid out in DNR forest stands across the state. Interns and volunteers measured the distances from nests to detection points using GPS devices. In 2021, I ran 2 established transects in an old-forest management complex case study, and recorded data on woodpecker nest detection limits. From 2018 – 2021 additional nests were found incidentally by biologists and citizen-science contributors, and in 2021 during pilot research on black-backed and three-toed woodpecker habitat investigations. Distances to nests were either recorded by the nest finder, or by myself after the nest location was reported to me using GPS devices. In 2021, I made a concerted effort to follow multiple nests from initial detection through fledging.

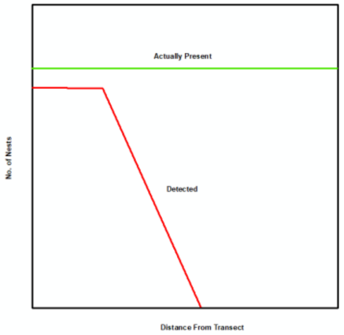

Figure 1. Theoretical detection limits. At some distance from a transect, nest detectability is steady, albeit not 100% due to some percentage of nests with silent young. Beyond the distance of steady detectability, detection drops off linearly to a point beyond which detection is not possible.

Results and Discussion

Q: How far can you hear young?

Table 2 shows the distances at which 28 woodpecker nests were either first detected or detection distances were first measured. Twenty-three nests (82%) were discovered when begging young were heard and measured the nest location. In 5 instances, nests were first located due to adult behavior or visual discovery of fresh cavities. Data are also displayed in Figure 2. The top five lines in Figure 2 include 3 active nests with young in which young were never heard (2 RBWO, 1 HAWO), and 2 nests in which the young were audible only at the base of the nest tree (1 YBSA, 1 BBWO). The next 20 nests show a linear decline in detection between 36 and 158 feet from the nest. Three nests were detected at distances much greater than 158 feet (i.e., 250-590 feet). Overall, the nest detection pattern is best described as a reverse sigmoid pattern. An additional 3 nests (not included in Table 2) of yellow-bellied sapsuckers found by volunteers in Wild River State Park were estimated to be first heard from ca. 100 ft, 100-150 ft, and ≥300 ft in late June 2021. Once heard, begging young can be detected yet farther away during the same visit (Table 3). This implies that once an auditory signal is picked up, it can continue to be detected moving farther away. Tozer et al. detected begging sapsucker young up to 40 m (131 ft). My data suggest that black-backed and three-toed woodpeckers, in particular, may be detectable at greater distances than other woodpecker species (pileated woodpeckers excluded).

Figure 2 indicates that the percent of active nests in which young that have reached the begging stage but would not be detected on a single survey (as theorized in Figure 1) is about 18% (5 of 28).

Q: Do vegetation conditions affect the distance that nestlings can be heard?

It is unclear that vegetation conditions affect detection distances to any substantial degree. The 5 nests In Table 2 where young could not be heard beyond 1 m of the nest were all in forest edges abutting open areas. Of the 5 nests with greatest detection distances, 3 were in open forests (BBWO in Tables 2 and 3; TTWO in Tables 2 and 3; YBSA in Tables 2 and 4); 1 was in mature aspen (HAWO in Table 2), and 1 was near a forest edge (BBWO in Tables 3 and 4).

Q: How many days during the nestling period can you hear young?

In 2021, we documented 3 nests of 3 different species with begging young to be detectable for a minimum of 13 days (Table 4). Another nest of a fourth species (RBWO) was known to be active 15 days but young were quiet except for the first day detected. Onset of nestling begging may coincide with when nestlings first open their eyes (Backhouse 2005). Tozer et al. (2009) found nestlings were quiet their first 7 days while being brooded constantly, begged intermittently 3 days, then begged continuously for 11 days, then less frequently until fledging at about 27 days.

Q: Do young get more detectable (vocal/louder) as they get older?

The data is not definitive. There seems to be a general trend that young become more detectable as they get older (Table 4; HAWO#1, YBSA #4 and 5) but there are examples otherwise (YBSA #6). There also appears to be some indication that young become quieter near fledging (YBSA #7, RBWO #1). My findings agree with Tozer et al. (2009 that sapsucker young become quieter as they near fledging.

Summary Data in Table 4 can be used for predicting detection probabilities from parallel transects of various spacing distances. This potential would be enhanced with the collection of additional data.

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References

Backhouse, F. 2005. Woodpeckers of North America. Firefly Books.
Burdett, C.L., and G.J. Niemi. 2002. Conservation assessment for three-toed woodpecker (*Picoides tridactylus*). USDA Forest Service, Eastern Region.
Corace, R.G., N.W. Lapinski, and S.J. Sjogren. 2001. Conservation assessment for Black-backed woodpecker (*Picoides arcticus*). USDA Forest Service, Eastern Region.
Fayt, P., M.M. Machmer, and C. Steeger. 2005. Regulation of spruce bark beetles by woodpeckers - a literature review. Forest Ecology and Management 206:1-14.
Kelly, J.J., Q.S. Latif, V.A. Saab, and T.T. Veblen. 2018. Spruce beetle outbreaks guide American three-toed woodpecker *Picoides dorsalis* occupancy patterns in subalpine forests. Ibis 2018:1-12.
Rossman, R., J. Corcoran, and R. Slesak. 2016. Timber harvesting and forest management guidelines on public and private forest land in various watersheds in Minnesota. 2014 and 2015 monitoring implementation results. Minnesota Department of Natural Resources report to Minnesota Forest Resources Council.
Russell, R.E., V.A. Saab, J.J. Rotella, and J.G. Dudley. 2009. Detection probabilities of woodpecker nests in mixed conifer forests in Oregon. Wilson Journal of Ornithology 121:82-88.
Tozer, D.C., E. Nol, D.M. Burke, K.A. Elliott, and K.J. Falk. 2009. Predation by bear on woodpecker nests: are nestling begging and habitat choice risky business? Auk 126:300-309.
Virkkala, R. 2006. Why study woodpeckers? The significance of woodpeckers in forest ecosystems. Ann. Zool. Fennici 43: 82–85.

Table 2. Distances at which nests were first detected, or subsequently first measured, arranged by species. Distances measured with GPS devices.

Species	Distance Young Heard (ft)			
	First Detection	Later Detection*	Habitat or Setting	Detector(s)
HAWO	88		mature aspen	BE and AB
HAWO	>70		road edge, forest	BE and AB
HAWO	590		mature aspen	BE and AB
HAWO	97		old growth maple-basswood	AC
HAWO	36		old growth maple-basswood	AC
HAWO	Young heard**	112	open park, small town	LM/MRN
HAWO	Young heard**	136	open floodplain, urban	LM/MRN
HAWO	Adult went to cavity	silent	forest edge	GM
HAWO	Young heard**	90	trailside, small town	LM/MRN
HAWO	56		closed forest	MRN
HAWO	Agitated male	154	road edge, forest	MRN
DOWO	76		Trailside, small town	MRN
YBSA	43		young aspen	BE and AB
YBSA	127		mature aspen	BE and AB
YBSA	140		partially open, lakeshore residential	MRN
YBSA	>45		road edge, forest	BE and AB
YBSA	Young heard**	48	forest edge	LM/MRN
YBSA	Young heard**	158	road edge, forest	LM/MRN
YBSA	Young heard**	1	road edge, rural residential	LM/MRN
YBSA	85		closed forest	MRN
YBSA	71		road edge, forest	MRN
YBSA	323		open forest	MRN
YBSA	Adult excavating	52	closed forest	MRN
BBWO	Young heard**	115/310***	thinned pine plantation	BS/MRN
BBWO	Cavities found	2	forest edge	JS/BS/MRN
TTWO	Young heard**	250	open forest	BH/ZDD
RBWO	Young heard**	silent	forest edge	LM/MRN
RBWO	Adult feeding young	silent	forest edge	MRN

*Indicates distance from nest at first effort to measure detection distance. **Distance from nest not recorded by initial finder. ***First distance heard by BS, second by MRN.

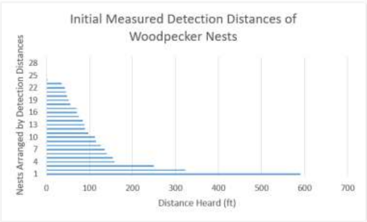

Figure 2. Initial measured detection distance of 28 woodpecker nests arranged from shortest to longest distance on y-axis.

Table 3. Detection distances after an auditory signal (begging calls) is detected and the observer moves farther away from the signal source (woodpecker nestlings).

Species	Distance first detected (ft)	Greatest distance detected (ft)	Habitat conditions	Observer
HAWO	60	91	closed forest	MRN
HAWO	ca. 80 – exiting vehicle	154	road edge	MRN
YBSA	118	155	closed forest	MRN
YBSA	77 - exiting vehicle	130*	road edge	MRN
YBSA	77 - exiting vehicle	161*	road edge	MRN
BBWO	115	310	thinned plantation	BS/MRN
BBWO	475	515**	forest edge	MRN
BBWO	239	456**	forest edge	MRN

*Same nest, different days. **Same nest, different days.

Table 4. Detection distances (ft) as a function of nestling age and proximity to fledging, 2021. Green shading shows minimum window of detectability of vocal young in nest.

Species	First heard	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
HAWO	19 May	unk									78	42		90		gone
HAWO	4 Jun	56				5		60							gone	
DOWO	12 Jun	ca 50		76	5	72	flgd									
YBSA	21 Jun	unk				48		yng			gone					
YBSA	22 Jun	unk			158		yng			yng	yng					
YBSA	22 Jun	unk			1		yng			gone						
YBSA	23 Jun	85		118				gone								
YBSA	25 Jun	71											130	161		
YBSA	29 Jun	≥300			yng					flgd						
YBSA	30 Jun	323	295	130	gone											
YBSA	30 Jun	52		qt/fl*												
BBWO	25 Jun	2											475	239		
TTWO	21 Jun	unk				250							unk			
RBWO	19 May	unk									quiet					quiet

*Some fledgling(s) out of nest, other silent young in nest being fed by adult. Other abbreviations/codes: unk=unknown, flgd=fledged, yng=young audible in nest but detection distance not recorded, quiet=silent young being fed in nest, gone=fledged or depredated