Characteristics of Woodpecker Nest Trees in Minnesota

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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 bird species for breeding, and 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. Questions have been raised recently about aspen rotation ages and the time it takes to grow aspen to appropriate sizes for woodpecker nesting. A 25-cm dbh has been identified as a threshold in the Pacific NW in which trees smaller than that are selected against for nesting by a suite of woodpecker species (Harestad and Keisker 1989); it is also the minimum dbh for pileated woodpeckers (e.g., Naylor et al. 1996), therefore it is an appropriate measure to use in forest habitat planning. Cooke and Hannon (2012), however, characterize the need for pileated and hairy woodpeckers and yellow-bellied sapsuckers as aspen >35-cm dbh, >25 m tall, and with ~20 conks of heartrot fungus). A recent timber harvest analysis in Minnesota established aspen rotation ages of 40 years on DNR timber production lands with a site index above 65, and 50 years with a site index below 65; and 60 years on DNR wildlife- and fisheries-managed lands.

Habitat Suitability Index models seem inadequate to assess local conditions, especially considering many regional aspen stands are on their third or fourth or possibly even fifth 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. Theoretically, woodpecker and cavity-dependent wildlife needs are at least partially accomplished through Minnesota Forest Resource Council guidelines, and monitoring (e.g., Rossman et al. 2016) suggests these are successful to some degree. Managed forests typically have fewer snags and fewer cavity-nesting species than do unmanaged forests (Raphael and White 1984, Zlonias 2012).

Woodpecker nests are extremely difficult to find except when young are begging for food. 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. The majority of these studies have been conducted in the boreal forests of Canada or the mountainous regions of the western U.S. Only Adkins Giese (1999) has studied woodpecker nest-site selection in Minnesota, in the southeastern counties of Fillmore and Houston, as well as La Crosse County, WI. In this poster I compile data on nest tree species, size (diameter at breast height [dbh]), and tree age or stand age collected from 1993-2021.

Methods

Woodpecker nests were found from under different scenarios, for different purposes, and by different methods from 1993—2021. In 1995, woodpecker nests were found in the Chippewa NF as part of an NRRI research project on least flycatchers and red-eyed vireos. From 2009-2013 woodpecker nests were found during the Minnesota Breeding Bird Atlas project. In 2016 I located a few woodpecker nests in a pilot project where whole stands were surveyed. In 2018 woodpecker nests were found by student interns and volunteers surveying transects laid out in DNR forest stands across northern and central Minnesota. Interns and volunteers measured the distances from nests to detection points using GPS devices. In 2021, I ran 2 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. During all years 1993-2021, data was also collected on nests found incidental to the efforts described above. Prior to 1996, tree diameters were estimated to the nearest inch, or if nests were inaccessible for measuring (e.g., on private property). Afterwards, diameters or circumferences were measured in English or metric units, depending on the equipment contributors had available. Data on nest height and tree height were also collected, but are not presented here. When possible, I cored trees to determine nest tree ages. Prior to 2021 I counted rings myself or asked DNR foresters to interpret difficult cores (e.g., aspen, birch). Beginning in 2021, some cores were submitted to Dr. Samantha Jones at Bemidji State University for tree ring analysis in a laboratory setting. In instances where tree cores were not obtained but nests were on State land, I used Forest Inventory Module (FIM) data to estimate stand age.

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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*

Results and Discussion

Aspen was the preferred nest tree for all species except black-backed and three-toed woodpeckers which used conifers, and red-headed woodpeckers which preferred harder deciduous species (Table 2). The results differ from Adkins Giese's results from southern Minnesota, where American elm was used extensively. Only yellow-bellied sapsuckers showed a strong preference for aspen in both studies. Hairy woodpeckers also showed a strong preference for aspen in this study. Downy woodpeckers, considered a weak excavator, surprisingly made extensive use of harder-wooded trees.

Reasonable sample sizes of nest tree diameters were obtained for yellow-bellied sapsuckers, hairy woodpeckers, and downy woodpeckers in both my study and Adkins Giese's study (Table 3). Mean DBH of cavity trees for these species ranged from 30-37 cm for all tree species combined. Northern flicker nest-tree diameters from my study also fell within this range. For aspen nest trees alone, mean dbh's ranged from 30-33 cm for yellow-bellied sapsuckers, hairy woodpeckers, and northern flickers, with ranges from 20-45 cm. Downy woodpeckers made use of smaller aspen, and larger non-aspen species, than did other woodpecker species. Based on growth rates in *Manager's Handbook for Aspen in the North Central States* (Perala 1977), aspen growing on the most favorable sites would take 50 years to average 20 cm dbh, 60 years to average 26 cm dbh, and 70 years to average 32 cm dbh.

Woodpeckers generally are nesting in aspen trees and/or aspen stands that exceed commercial rotation ages; 13 of 28 nests in aspen (46%) were in aspen or stands ≥60 years old, 20 (71%) were in aspen or stands ≥50 years old, and 23 (82%) were in aspen or stands ≥40 years old (Table 4). Nests in aspen of unknown age in oak stands were all in stands ≥74 years old, and nests in other hardwoods were all in trees or stands ≥77 years old. These ages correspond closely with predicted ages based on projected growth rates from Perala (1977) and nest tree diameters (Table 2).

Conclusions

Commercial aspen rotation ages of 40 years are unlikely to provide nesting sites to sustain a viable population of small-to-medium-sized nesting woodpeckers. Land managers and land owners should consider extending rotation ages and increasing reserve amounts in order to benefit cavity-dependent wildlife.

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Table 2. Percent composition of tree species used for nests by woodpeckers in northern Minnesota (this study), compared with Adkins Giese' study in southeastern Minnesota and Wisconsin. Numbers of nests are this study/Adkins Giese' study.

	This Study							From Adkins Giese (1999)					
Species (nests)	Populus	Quercus	Acer	Tilia	Betula	Other**	Conifer	Populus	Quercus	Ulmus	Tilia	Betula	Other**
NOFL (12/5)	75.0	8.3		8.3	8.3			0	0	80	0	0	20
YBSA (49/42)	95.9	4.1						88	5	7	0	0	0
HAWO (39/22)	79.5	12.8				7.7		27	14	36	0	9	14
DOWO (19/44)	57.9	21.1	21.1					11	23	48	2	2	14
BBWO (7 /0)							100	---	---	---	---	---	---
TTWO (2/0)							100	---	---	---	---	---	---
PIWO (7/4)	71.4						28.6*	50	0	50	0	0	0
RBWO (4/29)	50				50			20	14	34	21	10	0
RHWO (5/20)	20	60	20					20	5	70	0	0	5

*Dead conifers. **Other deciduous (e.g., black cherry, ash)

Table 3. Diameters (at breast height) of nest trees used by woodpeckers in northern Minnesota (this study), compared with Adkins Giese' study in southeastern Minnesota and Wisconsin.

Species	Mean dbh, all (cm)(N)		Range, all trees (cm)		Mean aspen dbh (cm)(N)	Range, aspen (cm)
	This Study	Adkins Giese	This Study	Adkins Giese	This Study	This Study
Northern Flicker	35.6 (8)	69 (4)	20-66	38-121	32.4 (6)	20-41.5
Yellow-bellied Sapsucker	30.3 (41)	30 (42)	21-45	19-42	30.3 (40)	21-45
Hairy Woodpecker	32.15 (27)	33 (22)	21-61	20-76	31.0 (22)	21-41
Downy Woodpecker	36.7 (15)	35 (44)	10-92	16-63	24.2 (9)	10-41
Black-backed Woodpecker	24.6 (7)		19-34			
Three-toed Woodpecker	23.0 (1)					
Pileated Woodpecker	41 (5)	69 (4)	35-46	42-127	39.75 (4)	35-43
Red-bellied Woodpecker	30.5 (2)	47 (29)	29-32	23-137		
Red-headed Woodpecker	45.4 (4)	54 (20)	23-60	28-168	43.5 (1)	

Table 4. Nest tree ages determined by tree coring and/or stand ages based on DNR Forest Inventory Module data, arranged by nest tree/stand species and tree or stand age.

Species	Year	Nest Tree Species	Tree Age (Core)	Stand Cover Type	Stand Age (FIM)
Nests in aspen and/or aspen stands					
Hairy Woodpecker	2018	aspen		aspen	84
Pileated Woodpecker	2016	aspen	81	northern hardwoods	96
Yellow-bellied Sapsucker	2021	aspen	79	northern hardwoods	101
Northern Flicker	2021	aspen		aspen reserve	74
Pileated Woodpecker	2016	aspen	73	aspen	78
Hairy Woodpecker	2018	aspen		aspen	71
Northern Flicker	2016	aspen	69		
Downy Woodpecker	2016	aspen	68		
Yellow-bellied Sapsucker	2018	aspen	66	northern hardwoods	96
Hairy Woodpecker	2018	aspen		aspen	64
Hairy Woodpecker	2021	aspen	>63	northern hardwoods	101
Hairy Woodpecker	2021	aspen	63	black spruce	11
Yellow-bellied Sapsucker	2016	aspen	62		
Yellow-bellied Sapsucker	2017	aspen	>53		
Hairy Woodpecker	2021	aspen	>51		
Yellow-bellied Sapsucker	2017	balsam poplar	51		
Yellow-bellied Sapsucker	2019	aspen	50		
Pileated Woodpecker	2018	aspen		aspen	50
Yellow-bellied Sapsucker	2018	aspen		aspen	50
Hairy Woodpecker	2018	aspen		aspen	50
Hairy Woodpecker	2018	aspen		aspen	47
Hairy Woodpecker	2018	aspen		aspen	45
Yellow-bellied Sapsucker	2018	aspen		aspen	45
Yellow-bellied Sapsucker	2021	aspen		aspen	39
Yellow-bellied Sapsucker	2015	aspen	36		
Yellow-bellied Sapsucker	2020	aspen	33		
Yellow-bellied Sapsucker	2020	aspen	31		
Yellow-bellied Sapsucker	2018	aspen		aspen	23
Nests in aspen in oak or northern hardwoods stands					
Yellow-bellied Sapsucker	2018	aspen		oak	123
Downy Woodpecker	2018	aspen		oak	101
Hairy Woodpecker	2018	aspen		oak	100
Yellow-bellied Sapsucker	2018	aspen		oak	91
Yellow-bellied Sapsucker	2018	aspen		oak	74
Yellow-bellied Sapsucker	2021	aspen		northern hardwoods	94
Yellow-bellied Sapsucker	2021	aspen		northern hardwoods	94
Yellow-bellied Sapsucker	2021	aspen		northern hardwoods	96
Nests in hardwoods					
Hairy Woodpecker	2018	red oak	116		
Downy Woodpecker	2017	red oak	108		
Hairy Woodpecker	2018	ash	>100	lowland hardwoods	48
Yellow-bellied Sapsucker	2021	red oak	>89	northern hardwoods	101
Downy Woodpecker	2018	cottonwood		oak	94
Red-bellied Woodpecker	2021	paper birch	83		
Red-bellied Woodpecker	2021	paper birch	>79	northern hardwoods	101
Hairy Woodpecker	2018	black cherry		northern hardwoods	77
Nests in conifers					
Black-backed Woodpecker	2008	red pine		red pine	121
Three-toed Woodpecker	2021	black spruce		black spruce	116
Three-toed Woodpecker	2020	black spruce		black spruce	95
Black-backed Woodpecker	2016	jack pine	>65		
Black-backed Woodpecker	2016	jack pine		red pine plantation	56
Black-backed Woodpecker	2021	jack pine		red pine plantation	52
Black-backed Woodpecker	2021	jack pine		jack pine	52
Black-backed Woodpecker	2015	jack pine	>>44		