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# Breeding Biology of the Pileated Woodpecker—Management Implications

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## Abstract

We located and studied 123 pileated woodpecker (*Dryocopus pileatus*) nests from 1973 to 1983 in northeastern Oregon. Pileated woodpeckers excavated nest cavities in late March and early April, incubated eggs as early as 13 May and as late as 15 June, and fledged young between 26 June and 13 July. These birds nested at 1 year of age, and some lived at least 9 years. Juvenile recruitment into the population was at least 8 percent. Mean annual adult survival was at least 64 percent, and mean annual adult mortality was at least 9 percent. This information is incorporated into management recommendations for monitoring populations of pileated woodpeckers over time.

Keywords: Pileated woodpecker, woodpecker, breeding biology, cavity nester, northeastern Oregon.

## Introduction

Since 1975, the pileated woodpecker has received increasing attention in the management of public lands because of the reduction of older forest stands and the loss of the large, dead trees that collectively comprise the habitat of this species. Many National Forests in the Pacific Northwest use the pileated woodpecker as an indicator species of habitat condition. The National Forest Management Act of 1976 (U. S. Laws, Statutes, etc., Public Law 94-588) mandates that indicator species be monitored to determine population changes as habitat conditions change. Our purpose is to provide information on the breeding biology of the pileated woodpecker that would be useful in monitoring their populations.

## Study Area and Methods

The study area was the 11,400-ha Starkey Experimental Forest 35 km southwest of La Grande, Union Co., Oregon. The area is characterized by mixed coniferous forests (75 percent) interspersed with grasslands (25 percent) (Strickler 1965). The topography is undulating uplands dissected by moderate to steeply walled drainages; elevations range from 1070 to 1525 m.

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Each year from 1973 through 1983, we located pileated woodpecker nests from April to July by riding horseback or hiking parallel lines no more than 0.5 km apart across the study area while listening for birds and looking for recently excavated cavities and large chips beneath trees. Calls of pileated woodpeckers (a series of 10-15 cuks) were imitated every 0.2 km. If a bird responded, we tried to follow it and find a nest. Only nests that contained nestlings or an incubating adult were considered active.

The stage of nesting (excavation, incubation, or nestling) was noted, and nests were checked every 1 to 2 weeks to determine nesting activity and when the young fledged. Each year we recorded the earliest and latest dates for excavation, incubation, and presence of nestlings.

We banded 26 adults and 95 nestlings with combinations of two colored leg bands by climbing to the nest cavity. Adults were captured at nest cavities (Bull and Pedersen 1978), and nestlings were banded at nests when 10-25 days old (usually within a week of fledging), when sex could be determined. Observations of color-banded birds provided information on juvenile recruitment, longevity, and movements.

Time-lapse movie cameras with clocks were used at three nests to determine when incubation exchanges and feedings occurred. A frame was automatically taken every 8-12 seconds. Nests filmed were less than 10 m off the ground because of the camera's limited range. Times that adults entered or left the nest were obtained from the film record. Data were summarized as frequency of feedings and changes of parents during incubation.

## **Results and Discussion**

We located 123 pileated woodpecker nests between 1973 and 1983. Pileated woodpeckers were actively calling in March and April and responded to our vocal imitations of their vocalizations by calling back or flying toward the caller. Both unsolicited and solicited vocalizations were less frequent after incubation started.

### **Excavation**

Pileated woodpeckers started to excavate nest cavities in late March and early April and took 3-6 weeks to complete them. Although both sexes participated, males did 2-5 times more excavating than females. In 29 actual observations, males were excavating at 19 nests, females at 7, and both sexes alternately at 3. At 12 nests, we observed males excavating for 369 minutes and females for 70 minutes. Hoyt (1957) and Kilham (1979) also report that male pileated woodpeckers excavated more than females.

In the spring, some pairs started excavation of several cavities but completed only one. Partially completed cavities were sometimes completed in later years and used as nests. Hoyt (1957) also observed that pileated woodpeckers make several false starts at nests.

### **Incubation**

Clutch size was determined at three nests: one nest contained one nestling and three addled eggs; one abandoned nest contained two addled eggs; and one nest had three recently hatched young and one egg.



Birds were observed incubating as early as 13 May and as late as 15 June. Incubation was assumed to be 18 days (Hoyt 1957). The male and female incubated the eggs alternately during the day, and the male incubated at night. During 44 hours of observation at three nests, the female arrived 22-35 minutes after sunrise, and the birds changed an average of once every  $145 \pm 57.94$  minutes (range of 43 to 259 minutes,  $n = 14$ ). The incubating bird remained in the cavity until its mate flew to the nest, passed its head across the entrance hole, and moved aside to let the incubating bird out. The eggs were attended 99 percent of the time.

## **Nestlings**

Nestlings were heard or observed from 26 May to 13 July. Young in the same nest hatch asynchronously (Hoyt 1944). A nest tree we found after it fell contained three young, noticeably different in size. During 187 hours of observations at 11 nests, we observed that nestlings were fed an average of every  $52 \pm 40.11$  minutes (range of 2 to 240 minutes,  $n = 202$ ). Females arrived in the morning 18-50 minutes after sunrise. Males returned to the cavity 1-149 minutes before sunset to brood the young for the night. We saw males feed young 36 times and females 38 times during 60 hours of observation at 17 nests; sex could not be determined on the movie film, thus the smaller sample of hours. Kilham (1979) also reported that both sexes fed the young equally; however, Conway (1957) found that the female fed the young more often.

When nestlings were less than 7-10 days old, parents went completely into the cavity to feed them and frequently (especially the male) remained to brood the young. As the nestlings grew, the adult fed with its tail sticking out of the cavity, and young were rarely brooded during the day. Nestlings at least 15-18 days old waited for the adults at the cavity entrance. Nestlings fledged when 24-28 days old, between 26 June and 13 July. Young were capable of sustained flight when they left the nest, but they remained in the vicinity of the nest for several days.

Pileated woodpeckers reportedly renest if the first nesting effort fails (Truslow 1966). We observed one pair excavating a nest on 9 June and assumed, because of the late date, that it was a renesting attempt. The pair was incubating on 22 June and had nestlings on 12 July. A second pair failed in their first nesting attempt, and the male was discovered excavating a new cavity on 17 June.

Of 81 nests, 83 percent were successful (at least one young fledged) (table 1). Brood size within a week on fledging ranged from one to three birds and averaged  $2.26 \pm 0.66$  ( $n = 42$  nests). Five pairs fledged one juvenile, 21 fledged two, and 16 fledged three. Of 95 juveniles examined, 49 were females and 46 were males. Tanner (1942) reports that pileated woodpeckers in Louisiana averaged 2.14 per brood, and McClelland (1977) reports that pairs in western Montana averaged 2.0 per brood.

Handling the adults while removing them from traps and banding them did not cause any mortality or nest abandonment. Several adults escaped from the trap at the nest and returned to attempt to feed the nestlings with the trap still in place.



**Table 1—Percentage of pileated woodpecker nests with fledged young, sex ratio, and brood size in northeastern Oregon, 1973-1983**

Year	Nests		Nestlings	
	Successful Percent	Number	Sex ratio ♀ / ♂ (full sample)	Brood size $\bar{x}$
1973	67	3	3/0	1.5
1974	60	8	9/5	2.3
1975	75	6	7/3	2.0
1976	91	10	10/13	2.3
1977	81	13	7/8	2.5
1978	100	7	4/2	3.0
1979	92	8	6/7	2.6
1980	73	11	3/6	1.8
1981	86	7	0/2	2.0
1982	67	6		
1983	100	2		
<b>Total</b>		<b>81</b>	<b>49/46</b>	
<b>Mean</b>	<b>83</b>			<b>2.26</b>

#### Breeding Age

Pileated woodpeckers bred as 1-year-old birds. All the 1-year-old birds that we located (3 females, 1 male) were nesting. Eight of 95 birds banded as nestlings were later found breeding, indicating juvenile recruitment into the breeding population of at least 8 percent. We did not search for pileated woodpeckers off the study area, however, and some fledglings probably established territories off the study area and were never encountered. No bands were returned.

Two banded pileated woodpeckers on the study area were at least 9 years old in 1983. A female banded as a nestling in 1974 was relocated nesting in 1981 and again in 1983. A male banded as an adult in June 1974 was located at a nest in 1982, when he was at least 9 years old. Three other pileated woodpeckers banded as adults were at least 7 years old when last seen. These ages are comparable to records of a wild bird dying at 9 years and captive birds living 9 and 10 years (Hoyt 1952).

#### Adult and Juvenile Survival

Predators killed two pileated woodpeckers. A northern goshawk (*Accipiter gentilis*) was found eating a nestling we believe had been snatched out of a nest cavity while it perched at the nest entrance. An adult male was found plucked, presumably by a northern goshawk, 10 m from its roost tree.

Adults were twice observed carrying dead nestlings away from the nest in their bills. If dead nestlings were small, the adults carried them away from the nest. Larger, dead young were dropped from the nest entrance or left in the cavity. One or two dead nestlings were found in 4 of 44 nests examined. Dead nestlings were found at the bases of five nest trees. The cause of dead nestlings was not determined, but starvation, ectoparasites, or abandonment were suspected. Ectoparasites (Wilson and Bull 1977) were occasionally found on the nestlings examined and may have reduced vigor. At one nest with young, the female disappeared and the male abandoned the nest several days later.



Based on observations of 28 color-banded pileated woodpeckers (20 banded as adults, 8 as nestlings) at nest sites between 1975 and 1983, the mean annual adult survival was at least  $64 \pm 35.40$  percent. The mean annual adult mortality was at least  $9 \pm 8.24$  percent, assuming that a bird was dead if one member of a banded pair was mated with a different bird in the same territory in successive years. We never found a bird mated to another bird if its previous mate was alive.

Missing mates were replaced, and vacated territories were usually reoccupied within a year; for example, in one territory (fig. 1 A), a banded male nested with a banded female in 1976, a new female (banded as a nestling and 1 year old) in 1977, and a third female (banded as a nestling and 1 year old) from 1978 to 1980. The male was killed by a northern goshawk in February 1981, but the third female nested in the same territory with an unbanded male that year. In 1982, neither bird nesting in the territory was banded.

We observed three cases of intraspecific aggression, which suggested unmated birds were present. At one nest being excavated, a male intruder was driven off by a resident adult. In March, a resident female drove off an intruding female. In December, a male intruder was chased by a resident pair.

Of five color-banded pairs (four shown in fig. 1) we found nesting 4 or more years, two pairs nested in the same immediate vicinity for up to 7 years (fig. 1 A,B). Both territories had more than 20 suitable nest snags (60-90 cm in diameter, 15-30 m tall) in a 2-ha area. Three pairs (two shown in fig. 1C,D) excavated nests that were sometimes more than 1 km apart between years. Suitable nest trees were not concentrated but were scattered throughout these territories. Pairs tended to nest in the same vicinity (different trees), if suitable nest trees were available. If suitable nest trees were not available, pairs generally moved to a new, more distant nest site rather than excavate a second nest in the previous year's nest tree.





Figure 1—Nest locations of four pairs of pileated woodpeckers in northeastern Oregon, 1973-83. Circles designate nest location of the banded male of a pair. Squares designate nest location of the banded female of a pair. Different banded females mated with the male in different years designated by triangles and diamonds. Numbers designate year of nest.



## Management Implications

Several parameters can be used to monitor populations of pileated woodpeckers: (1) number of calling birds, (2) number of breeding pairs, (3) number of successful breeding pairs, and (4) number of young raised. The first is the easiest and cheapest parameter to obtain but the least meaningful because nothing is known of the reproductive status of the birds. The last is the most difficult and expensive to obtain but the most meaningful in terms of assessing reproductive success and population fluctuations over time. The level of monitoring will be determined by the objectives of and resources available to each management agency.

Pileated woodpeckers are most easily located in the spring by imitating their calls. The birds are most vocal when excavating cavities in March and April, before the onset of incubation. To locate birds, we recommend driving along roads in the morning (1-4 hours after sunrise), stopping every 0.2-0.4 km and imitating their call (a series of 10-15 cuks), listening for 30-60 seconds for a response, and repeating the procedure at least three times.

To determine if a bird is nesting, the bird can be followed until a nest is located. Determining if a pair nests successfully involves spending time at the nest to determine if nestlings fledge. Determining the number of young necessitates climbing the nest tree when the young are ready to fledge and examining the nest contents or spending days at the nest waiting for them to leave the nest.

Nestlings fledge in June and July, thus increasing the population of resident birds. Any monitoring done in the summer should consider the recruitment of juveniles. We do not recommend banding adults or nestlings as part of a monitoring program, because it is time consuming and often dangerous climbing to the nest.

Management of nest trees for pileated woodpeckers follows two general schemes: clustering potential nest trees in a small area or dispersing potential nest trees throughout each territory. Examples from this study support either approach (fig. 1, A and B versus C and D). In most situations, we recommend dispersing nest trees because it reduces the risk of loss to wind, fire, and wood cutters. Seldom will the manager have the luxury of knowing the history of nest site use; thus, dispersal of potential nest trees increases the probability of matching nest trees with other appropriate site characteristics.

Because missing mates were replaced and vacated territories were usually filled within a year, our general impression was that the study area was "fully stocked" with the density remaining remarkably constant from 1973 to 1983. Bull (1987) calculated the density on this study area as 1 pair per 220 ha. If this study had ended after 3 years, we would have concluded that the population was reproducing at a lower rate (more nest failures, smaller broods, more female nestlings) than actually occurred. Long-term studies, such as this one, provide an opportunity to evaluate the stability and changes in a population over time.

## English Equivalents

1 centimeter (cm) = 0.39 inch

1 meter (m) = 3.28 feet

1 kilometer (km) = 0.62 mile

1 hectare (ha) = 2.47 acres



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