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Techniques for Monitoring Pileated Woodpeckers

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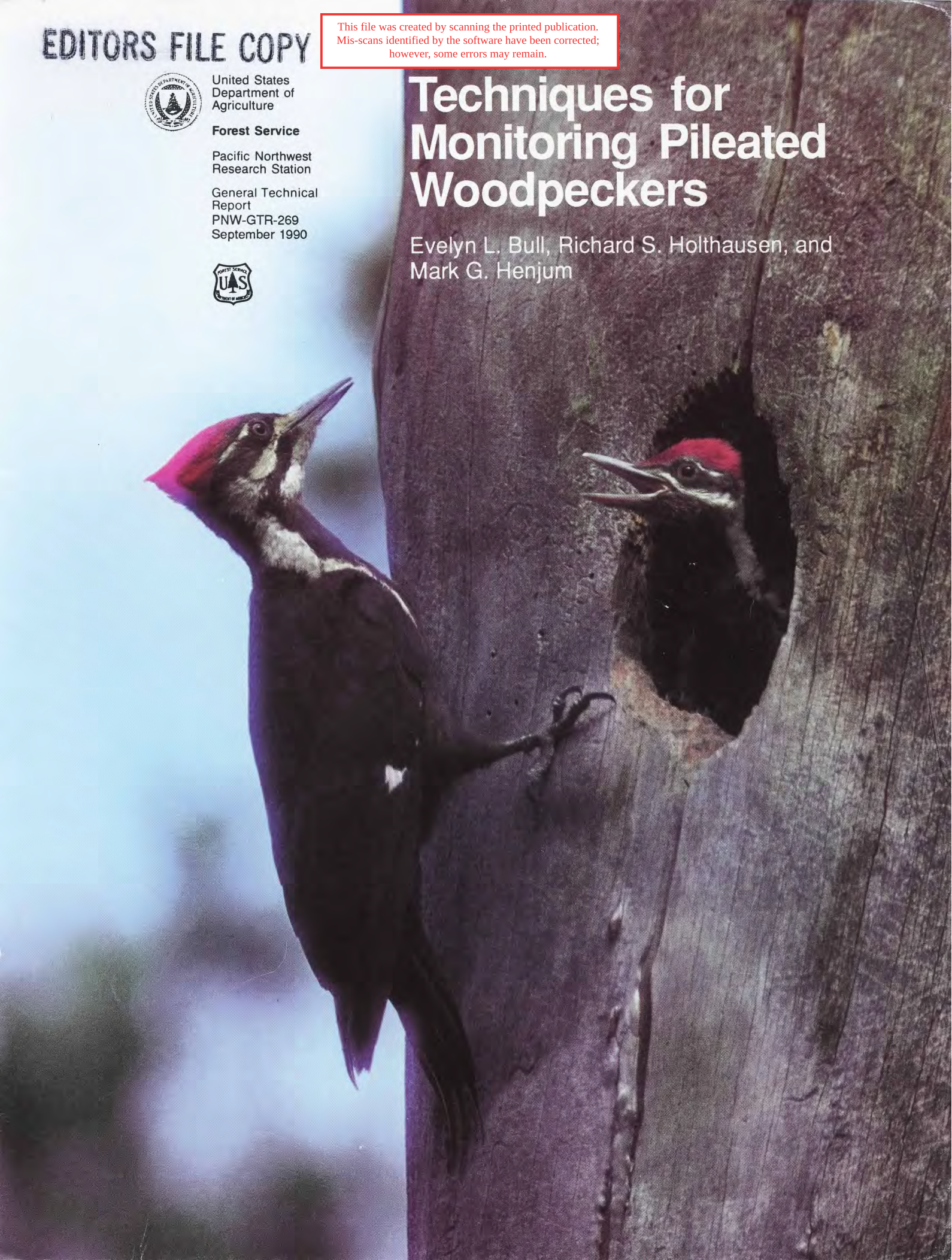

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Abstract

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Methods of locating pileated woodpeckers *(Dryocopus pileatus)* are described, including imitating pileated woodpecker vocalizations, identifying nest and roost trees, and finding foraging signs. Populations of pileated woodpeckers can be monitored by using (1) density of breeding pairs, (2) reproduction, and (3) presence or absence of birds. The size of area being monitored, the amount of resources available for the work, and the amount of information desired determine which monitoring method is appropriate.

Keywords: Pileated woodpecker, woodpecker, monitoring, cavity nester, Northwestern United States.

Contents

Introduction

The pileated woodpecker *(Dryocopus pileatus)* is the largest woodpecker in North America. It was selected as a management indicator species (MIS) for National Forests in the Pacific Northwest Region as part of the National Forest Management Act (NFMA) planning process. The pileated woodpecker was selected because its highest densities occur in old-growth conifer forests. Of the woodpeckers, the pileated seems most likely to be impacted by intensified timber management because of its large size and resultant need for large dead trees for nesting, large hollow trees for roosting, and dead woody material (standing and down) for foraging. These habitat components typically become more scarce as forest management intensifies and rotation ages decline. To provide for the continued existence of pileated woodpecker populations, the National Forests established requirements for pileated woodpecker management areas containing large amounts of standing and downed dead wood. Monitoring is needed to determine the effectiveness of these management areas. The NFMA requires that all MIS be monitored and the relation of their population change to habitat change be determined.

For pileated woodpeckers there are at least three population parameters that can be monitored: (1) density of breeding pairs, (2) reproduction, and (3) presence or absence. Monitoring density of breeding pairs is intended to reveal increases or decreases in the population. Monitoring reproduction indicates whether young are being raised. Birds inhabiting an area in low numbers and reproducing at a rate less than that required for replacement will not maintain a viable population. Monitoring presence or absence indicates only whether the birds are there or not.

Pileated woodpeckers inhabit coniferous forests in the Western United States and deciduous forests in the Eastern United States. They forage primarily on insects found in dead or live wood, with their primary diet in the Western United States consisting of carpenter ants (*Camponotus* spp.) (Beckwith and Bull 1985). Each pair excavates a nest cavity in the spring, usually in a dead tree. The birds roost year-round in cavities found most commonly in hollow trees or in old nest cavities.

Our objective was to provide a protocol for monitoring populations of pileated woodpeckers in the Western United States. Pileated woodpeckers can be monitored by direct observation, by counting birds that respond to vocalizations made by investigators, and by locating nest trees, roost trees, or foraging signs.

How To Identify Vocalizations

Pileated woodpeckers make several different vocalizations. The most common is the territorial call, a series of high-pitched "cuks" given in rapid sequence and lasting 5 to 10 seconds; they can be heard for 0.25 to 0.5 mile. This call is probably used for long-distance communication between members of a pair and as an advertisement to other pileateds that the territory is occupied. These same "cuks," when given more slowly, function as an alarm. This alarm call can continue for several minutes when the bird detects a potential predator. Lone birds occasionally give a series of slow, quiet "cuks." A soft vocalization, "woick, woick, woick," is exchanged at close range between pair members or between adults and juveniles. Nestlings in a cavity produce a "churring" sound similar to a hive of bees.

Pileated woodpeckers respond readily to good quality imitations of their calls—either tape recorded calls or a human imitation. The call of a northern flicker *(Colaptes auratus)* is very similar, however, so can easily be mistaken for a pileated. Pileated

calls are louder and change pitch and frequency during the call, whereas flicker calls keep the same pitch and frequency. Flickers also give a single-note, high-pitched call. A good recording of pileated and flicker calls with a description on how to distinguish them is available on tape (Walton and Lawson 1989).

Mechanical sounds produced by pileated woodpeckers include drumming, which is made by hammering the beak on a dead portion of a tree that resonates. Drumming is a burst of taps at regular intervals that lasts about 3 seconds and can be heard for up to 0.5 mile. Drumming is used to advertise a territory and to enhance pair bonding. The drumming of a pileated is louder and slightly slower than that of the flicker or hairy woodpecker *(Picoides villosus)*. The drum made by a Williamson's sapsucker *(Sphyrapicus varius)* exhibits an irregular pattern of long followed by short bursts.

How To Identify and Locate Nest Trees

Pileated woodpecker pairs usually excavate a nest cavity each year, typically in dead trees. Ponderosa pine (*Pinus ponderosa* Dougl. ex Laws) and western larch (*Larix occidentalis* Nutt) are most commonly used on the east side of the Cascade Range (Bull 1987); Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and red alder (*Alnus rubra* Bong.) are used on the west side of the Cascades (Mannan 1977, Mellen 1987); western larch is used in the Rocky Mountains in Montana (McClelland 1977); and cottonwood (*Populus* spp.), quaking aspen (*Populus tremuloides* Michx.), and grand fir (*Abies grandis* (Dougl. ex D. Don) Lindl.) are also used in the Northwest (color plates A-D). Nest trees are usually greater than 25 inches in diameter at breast height (d.b.h.), more than 30 feet tall, and often have a broken top. On the east side, typical nest trees have little bark remaining (Bull 1987); on the west side, nest trees retain most of their bark (Mellen 1987).

Nest cavities are excavated in sound or partially decayed wood. Nest cavities have a characteristic dome-shaped entrance 4 to 5 inches high and 3 to 4 inches wide (fig. 1). The cavity is 8 to 10 inches wide, about 24 inches deep, and usually 30 to 60 feet off the ground. Fresh wood chips are found at the base of an active nest and often are scattered in a 30-foot radius (color plate E). These chips are typically 1 to 3 inches in length and 0.25 to 0.5 inch wide.

Figure 1—Dome-shaped entrance to pileated woodpecker nest cavity; saw-whet owl looking out.

Active nests can be located from mid-April until late June. On the east side of the Cascades, cavities are excavated from late March until mid-May; incubation lasts from mid-May until early June (18 days) with young leaving the nest from mid-June to early July (Bull and Meslow 1988). Nesting may be 1 to 2 weeks earlier on the west side of the Cascades.

Birds can be located by listening for pileated vocalizations (territorial call or drum) in the mornings in March or April. Once the general area used by the birds is determined, one of several approaches may be taken. If possible, follow the birds, as they will eventually fly to the nest. Or use pileated calls to locate the nest; the young pileateds are quite vocal for several days before they leave the nest (usually in mid to late June).

Nests frequently can be located by inspecting all snags within a 1-mile radius of the bird's location for fresh wood chips under a dome-shaped cavity. Nest cavities are completed in 4 to 6 weeks, and chips will be more abundant as excavation proceeds and most abundant in May after cavities are finished.

Each pair may start excavating several nest cavities in different trees, but they will finish only one or two; therefore, an adult excavating at a cavity does not necessarily mean that particular cavity will be the nest site. On occasion, pileateds nest in a cavity excavated in a previous year. In such cases, nest location becomes more difficult to determine because few chips are on the ground. This is the exception, however.

A nest can be verified only after the birds start incubating and an adult is present in the cavity during the day or when adults are feeding young. Observing an adult or young pileated woodpecker in a nest is the only totally reliable verification, because other species nest in vacated pileated cavities and may sound like nestling pileateds churring. The adult often will look out of the cavity when the snag is struck or the bark is scratched.

How To Identify and Locate Roost Trees

Roosts are cavities in trees or hollow trees that pileated woodpeckers occupy at night. In northeastern Oregon, radio-tagged pileateds, which were followed year-round, roosted in cavities every night they were observed. Pileateds occasionally roost in old nest cavities in dead trees but more often roost in hollow trees. Roosts in hollow live trees in eastern Oregon are usually found in grand firs infected with Indian paint fungus (*Echinodontium tinctorium* (Ellis & Everh.); in fact, any live grand fir with Indian paint fungus conks having more than one pileated cavity has likely been used as a roost tree. Roosts in hollow dead trees are usually in grand fir, ponderosa pine, or western larch (color plates F-G, fig. 2). Many such roost trees have a broken top and one to eight entrance holes used by the bird to enter or exit. Such holes often are within a foot of each other and usually have been excavated by the birds. The hollow trees provide the birds with a large cavity (sometimes 10 to 30 feet deep) that does not require excavation. The hollow top and numerous entrance holes provide a variety of exits; this may aid in reducing predation.

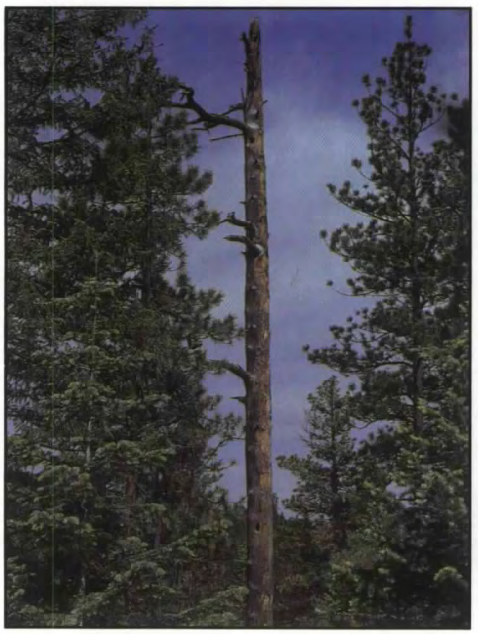
Figure 2—Roost holes and Indian paint fungus conks in dead grand fir.

Roost trees are difficult to locate unless the birds using the roosts are radio-tagged; therefore, we do not recommend their use for monitoring. To locate a roost currently in use, find a bird in the early evening by imitating the territorial call and listening for a reply. Then, attempt to follow the bird to its roost. Pileateds usually call just before flying to a roost; however, a bird may fly a mile or more to a roost site. To confirm that a roost is being used, scratch a stick across the bark of the suspected roost tree just before dark, and the bird often will look out. Pileated scat may be present under the entrance to a roost cavity. If scat are found under a hole or a suspected roost is located, an observer can watch the cavity from 1.5 hours before sunset until dark to see if a bird uses it. Usually each bird has numerous roost trees used alternately throughout the year. Some pileateds demonstrate long-term fidelity to a roost site, while others change roosts every few weeks.

How To Identify and Locate Foraging Sites

Pileated woodpeckers forage for insects by (1) gleaning (picking off the surface) from foliage and from the trunk and branches of live trees, dead trees, and logs; (2) pecking in bark; and (3) excavating the interior wood of trees. Although other woodpeckers glean and peck, only the pileated woodpecker digs large excavations into the interior wood extensively—primarily in search of carpenter ants. Hairy woodpeckers *(Picoides villosus)* dig into the interior wood in search of wood-boring beetle larvae; however, their excavations are much smaller (less than 2 inches in diameter or depth) than those of pileateds. Because these large excavations (ranging from several inches to several feet) are exclusive to pileated woodpeckers, they can be used to identify pileated foraging.

A.



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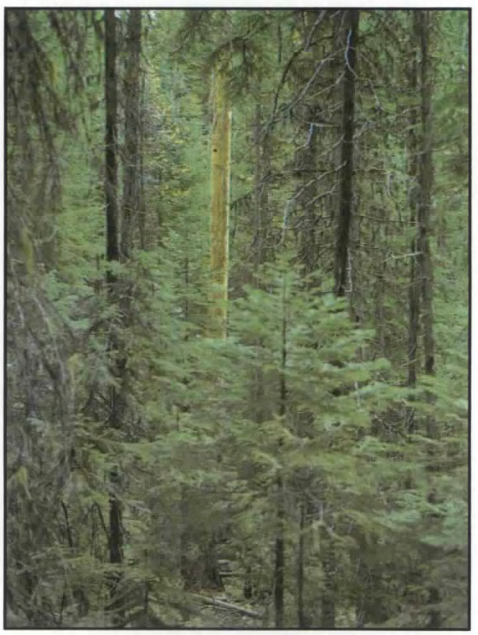


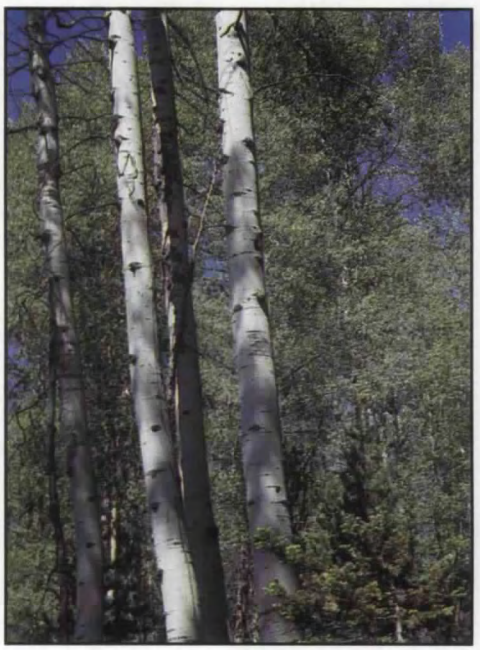
C.

Color plate A—Pileated nest in dead ponderosa pine.

Color plate B—Pileated nest in dead western larch.

Color plate C—Pileated nest in dead Douglas-fir.

D.



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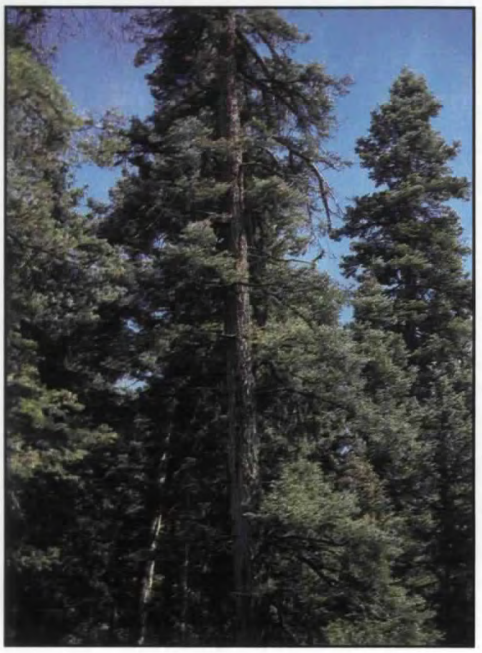
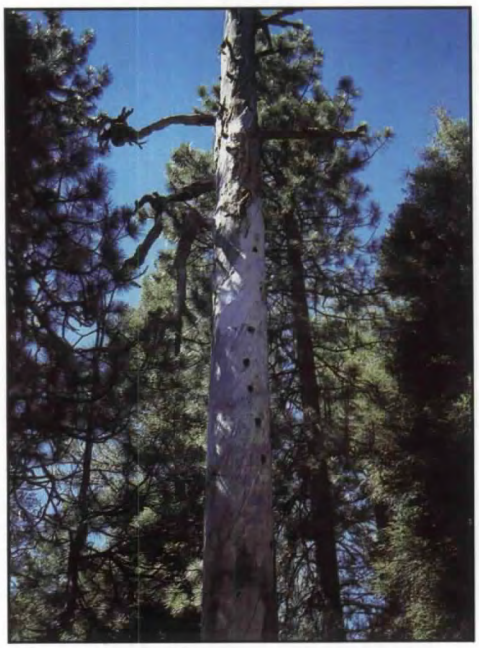


Color plate D—Pileated nest in live quaking aspen.

Color plate E—Excavated chips under nest tree.

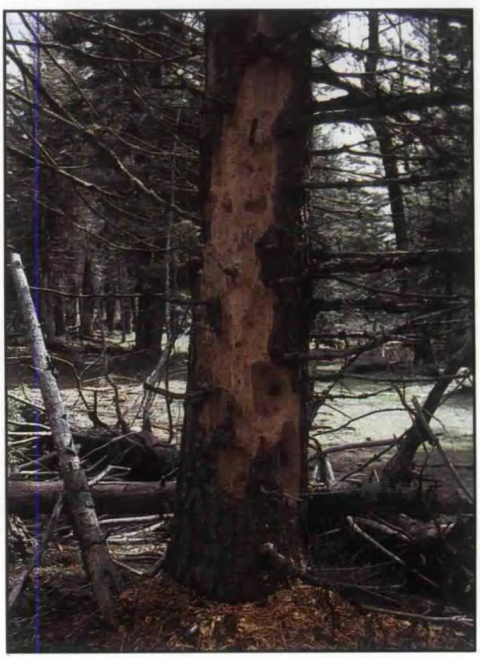
Color plate F—Pileated roost in live grand fir.

G.



H.

I.



Color plate G—Pileated roost in dead ponderosa pine.

Color plate H—Recent pileated foraging sign in log.

Color plate I—Recent pileated foraging sign in dead grand fir.

J.

K.

L.

Color plate J—Old pileated foraging sign.

Color plate K—Woodpecker foraging sign on snag—not done by a pileated.

Color plate L—Bear foraging sign in log.

On the east side of the Cascades, most foraging occurs in logs and dead trees at least 6 inches in diameter, although large-diameter (greater than 12 inches) dead wood is frequently used. On the west side of the Cascades, most foraging occurs in standing dead trees. Characteristics of foraging excavations include a square or rectangular cavity 2 to 8 inches deep (color plates H and I). The cavity can be 4 inches to several feet long, with the width depending on the diameter of the tree. Chips from pileated excavations are usually more than 0.25 inch wide and 1 to 3 inches long; chips from other woodpecker excavations are shorter (less than 1 inch) and thinner (less than 0.25 inch).

Recent foraging can be distinguished from that of previous years by the number and color of chips, the wood color, and the amount of debris in the cavity or on the chips. Chips from recent foraging and the wood in the excavation are brighter and lighter in color than older foraging signs. Chips will be on the ground with nothing over them (color plates H and I). Chips and excavations that are older are duller in color, the chips are settled into the ground, and debris covers the chips or is in the cavity (color plate J). Age of foraging may be more difficult to determine on the west side of the Cascades because of the greater precipitation received.

Although foraging signs can be observed all year, the ideal times on the east side are spring, just after the snow melts, and fall, just before the snow falls. Winter is less ideal because snow covers the telltale chips.

Several species of woodpeckers forage in bark (color plate K). The particular species cannot easily be distinguished, so we do not recommend attributing this foraging sign to pileateds. Bears also forage on insects in logs but tear off much larger chunks of bark and wood (color plate L).

How To Monitor Pileated Woodpeckers

Pileated numbers can be monitored at different levels of intensity. As monitoring intensity increases, the cost increases, but stronger inferences are possible. The intensity chosen for a monitoring program should reflect the level of concern for the species being monitored. At different levels of intensity, different population indicators or parameters can be monitored. We discuss three indicators here: (1) number of breeding pairs, (2) reproduction, and (3) presence or absence of birds.

Number of Breeding Pairs

The number of breeding pairs of pileateds can be determined by either (1) locating all the calling birds (using call counts) or (2) locating all the nests. Densities should be estimated in delineated areas of at least 3,000 acres. Trends in increasing or decreasing populations can be detected with call counts. A call count should be conducted between mid-March and late April when pileateds are most vocal. When incubation commences in early to mid-May, calling activity wanes. A call count is most productive in the morning from an hour after sunrise until noon, when most calling takes place. Pileateds do not leave their roosts until after sunrise. Call counts should not be conducted during rainy or windy conditions. To conduct a call count, walk a transect stopping every 0.25 mile for 5 minutes to listen for pileateds calling. If none are heard after 30 seconds, imitate a territorial call five times at 30-second intervals. If a bird responds, stop calling and do not imitate the call again for 0.5 mile.

If calls are not discontinued, pileateds may follow the caller making it difficult to tell if it is a new bird. To thoroughly cover an area, transects should be 0.5 mile apart and laid out so that the observer comes within 0.25 mile of all points on the area. If no birds are heard, the transects can be repeated 2 to 3 weeks later. During each call count the entire area should be covered in the same morning. Pileateds have large home ranges (from 659 to 2,608 acres; Mannan 1984, Mellen 1987) and can be found 1 to 2 miles away from their location on a previous day. This makes it difficult to determine if it is a different bird unless the entire area is covered each time. If an area is covered two times in the spring and no response is heard, it is unlikely that pileateds are nesting there.

A word of caution is needed here. The imitation of the territorial call must be a very good approximation of the real thing or the birds will not respond. In addition, some people have difficulty distinguishing a pileated call from that of the northern flicker. The best solution is to verify the call with a visual observation of the bird. This should be done until the observer can consistently identify which species is calling. It is essential that people doing these transects be trained on the visual and vocal identification of pileateds and be given a hearing test to assure accuracy.

The number of calling birds in spring seems to give a good approximation of the number of nesting pairs. To verify this, we conducted call counts and then located all active nests in nine areas of 3,400 to 4,000 acres (table 1). We calculated a correlation coefficient of 0.95 between the number of calling birds and the known number of nesting pairs. We used about 12 miles of transect in each area and covered each study area once between mid-March and mid-April; transects required about 1 hour per mile of transect. This information from call counts can be used to document changes in populations in the same areas over time or differences in populations among different areas.

Table 1—Number of pileated woodpeckers heard during call counts and number of nests located in each of 9 study areas in northeastern Oregon

Study area	Calling birds	Nests[a]
A	0	1
B	0	1
C	3	3
D	5	2
E	5	3
F	7	4
G	7	5
H	11	5
I	14	7

[a] One nest in study areas G and H was 0.25 mile outside the study area boundary, but the birds were heard and seen inside the study area regularly, so these nests were included in the sample.

Locating nests of breeding pairs provides additional information about the nesting status of the population, because some areas support birds that do not nest. Nests can be found by following birds in April and May—this is often quite difficult—or by intensively searching within a 1-mile radius of where birds are seen for snags with dome-shaped holes and fresh chips scattered beneath. Suspected nests can be verified by observing an incubating adult looking out of the cavity or by observing an adult feed young. Adults change incubation duties about every 3 hours and feed young every 1 to 3 hours. The best time to observe a nest is in the morning between 7:30 and 11:30, because an incubation change usually occurs then, and the young are fed frequently during this time.

Reproduction

Monitoring reproduction provides additional information on the productivity of pileated populations. Some habitat areas may support adults but not provide adequate resources for consistent, successful reproduction. These areas may serve as "sinks" for the species even though they are continually occupied. Monitoring reproduction can help identify such areas. To monitor reproduction, birds must first be located with call counts; second, nests must be located and verified; and third, nests must be checked every week after the young hatch to determine nest status and number of young.

Nest status can be determined by behavior of adults and young. During incubation an adult stays in the cavity for 2 to 4 hours while the mate is foraging. When the mate returns to the nest cavity, the incubating bird flies out and the other goes in. When the eggs hatch, the adults brood the young between feedings. The young can sometimes be heard churring when they are fed. After the young are about a week old, the adults do not brood them constantly but still go inside the cavity to feed them, and the young can often be heard churring. After about 2 weeks the adults feed the young from outside the cavity, and the young can be heard churring if the bark on the nest tree is scratched (mimicking an adult landing on the tree). After about 3 weeks, the young often perch at the entrance awaiting the arrival of an adult with food. The sex (identified by plumage) and number of offspring can sometimes be determined as two to three young can look out of the cavity at once. At this age the young often chur only when an adult arrives and do not always look out—so nest status can be difficult to determine and may require watching for several hours. After about 4 weeks, the young usually leave the nest. Disappearance of the young before this point would suggest a nest failure.

The best way to verify sex and number of offspring is to climb to the nest. Sex can be determined after nestlings are about 10 days old; however, some nestling mortality occurs before fledging, so it is best to check them a week before they leave the nest. Climbing the nest tree is recommended only if the tree is sound and will not fall. Most nests we have found are in dead trees unsafe for climbing.

Presence or Absence

In some situations, information on the presence or absence of pileateds in a particular stand may be all that is desired. To determine if pileateds occur in one particular area, use call counts or search for evidence that they have foraged there recently.

To search for foraging signs in northeastern Oregon, we walked a transect 0.25 mile long in grand fir stands having greater than 60 percent canopy closure in each of 10 home ranges of pairs of pileated woodpeckers. Recent foraging excavations into the interior of wood that could be seen from the transect were counted and verified by closer inspection. Foraging signs occurred primarily in logs and in standing dead trees within the first 15 feet above the ground. There was an average of 12 (range, 2 to 24) recent foraging sites on each 0.25 mile of transect.

We recommend two 0.25-mile transects in an area less than 300 acres for determining presence or absence of pileateds. One transect can be placed parallel to the slope and the other perpendicular to it. Transects should be placed in conifer forests having more than 60 percent canopy closure. These stands are the ones most likely to show evidence of foraging. There is no width restriction on the transect; any foraging that can be seen from the transect line is counted. Foraging on the east side of the Cascades is more visible and more easily distinguished as recent than is foraging on the west side.

Size of Area

The monitoring procedures presented here must be applied at an appropriate spatial scale. A common management unit used by USDA Forest Service Ranger Districts for pileateds is 300 acres. In units of this size, it would be appropriate to determine presence or absence each year (using call counts or foraging signs) or to determine reproduction. A 300-acre area is not large enough to determine density because pileated woodpeckers have large home ranges.

In larger units, such as a 3,000-acre watershed or inventory compartment, presence or absence, population density, or reproduction can be determined. Presence can be detected by using a call count or foraging sign search. Density can be calculated by locating nests; increasing or decreasing populations can be detected with call counts. On the east side of the Cascades, a 3,000-acre area (about 12 miles of transects) can be covered by three people in one morning. On the west side, transects may take twice as long unless they are located on roads; in addition, transects may have to be flagged before calling begins because of steep terrain and dense understory vegetation. Reproduction can be determined by locating nests and checking them weekly.

In larger areas, monitoring can be done on a subsample of the area. This could be a subsample of areas specifically managed for pileateds, a subsample of total suitable habitat, or a subsample of areas chosen at random. The type of monitoring done at this level and the intensity of the sampling design will be determined by the specific questions being asked and the desired reliability of the information.

Acknowledgments

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