PNW
Pacific Northwest
Research Station

Science
FINDINGS

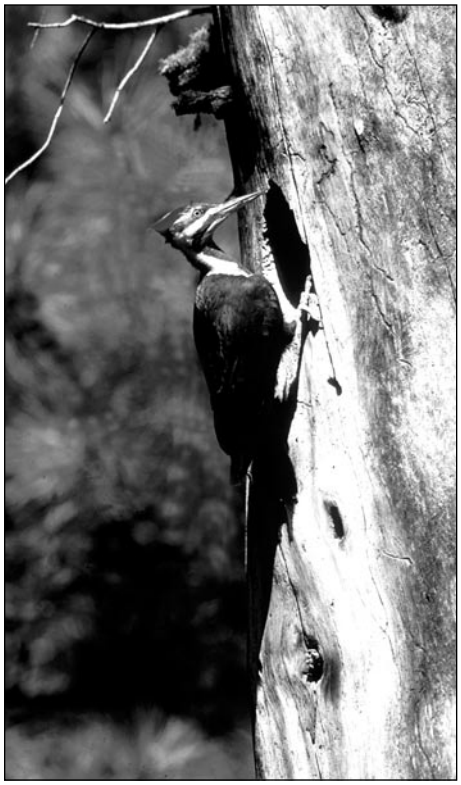
INSIDE

issue one hundred nine / january 2009

"Science affects the way we think together."
Lewis Thomas

LOOKING OUT FOR THE PILEATED WOODPECKER

Evelyn Bull



Pileated woodpeckers craft new nest cavities every year, sometimes trying out several sites before settling on their final choice.

"Nature is a language, and every new fact that we learn is a new word."
—Ralph Waldo Emerson

Venture into a forest almost anywhere across the country and you might hear the distinctive drumming of a woodpecker, 24 species of which live year-round in North America. If you stumble on trees peppered with rectangular feeding holes, or spot a crow-sized, black-and-white bird with a sinuous neck and pointy scarlet crest hammering away—that would be the pileated woodpecker, the biggest of the tribe. Its quirky looks and laughing call inspired that early star of animation, Woody the Woodpecker. However, in real life, this bird—whose Latin name, *Dryocopus pileatus*, means "tree cleaver"—is no cartoon character, but a major player in forest ecosystems. Its industrious tree excavating and foraging benefit as many as two dozen forest species and contribute generously to the recycling of forest nutrients. These and other services have earned pileateds the status of a "keystone" species.

Because the older forests inhabited by the pileated are diminishing, it also is considered a species of conservation concern. Guidelines for maintaining suitable habitat for the bird were issued following the National Forest Management Act of 1976. Those initial recommendations were derived from limited knowledge gleaned from birds of eastern deciduous woodlands. Subsequent studies led by Evelyn Bull, a wildlife biologist with the Pacific Northwest (PNW) Research Station in La Grande, Oregon, revealed that pileateds of the interior Pacific Northwest have somewhat different needs and habits. These findings have led to revised habitat-management recommendations.

Forests are dynamic, constantly evolving places, and in northeastern Oregon's Wallowa-Whitman National Forest, where Bull began her work in 1973, a series of events has radically altered sections of the forest over the last 30 years.

"The forests described in our earlier studies have changed from large, continuous areas

IN SUMMARY

The pileated woodpecker is a species of conservation concern and a keystone species in mature and old forests of the Pacific Northwest. In the Blue Mountains of northeast Oregon, researchers from the PNW Research Station in La Grande, Oregon, studied the effects of natural and human-caused disturbance on pileated populations and their habitat over a period spanning from 1973 to 2005. During this time, several pervasive insect outbreaks transformed the forest characterized by predominantly live conifers with dense canopy cover (prime pileated habitat) to one with increasing numbers of snags and downed wood. Logging for forest restoration and fuel reduction treatments also took place, further impacting habitat for the birds.

The researchers were able to compare the effects on pileated populations at various stages as their environment changed. They found, surprisingly, that despite heavy tree mortality, the number of nesting pairs, their reproductive success, and home range locations remained fairly consistent—provided that dead trees and logs remained abundant and extensive logging had not occurred. Conversely, nesting pair numbers and reproductive success decreased significantly where extensive regeneration cuts eliminated many nest and roost trees, as well as snags and downed wood where the birds forage for insects.

of mature and old conifers with more than 70-percent canopy cover to relatively open canopies and an increasing number of snags [standing dead wood] and logs, so we no longer have the conditions that our guidelines had been written for," Bull explains. "The effects of natural disturbances have not been described for most of our forest species," she adds. However, that changed for the pileated woodpecker with the recent publication of research spanning 30 years.

KEY FINDINGS

- Pileated woodpeckers occupy the same home ranges for up to 30 years and possibly for two to four generations.
- Density of pileated woodpeckers decreased 80 percent after extensive harvesting.
- Pileated reproductive success appears to be closely tied to the amount of unharvested, closed-canopy stands, and reproductive failure appears tied to the amount of harvested stands.
- High tree mortality is not detrimental to pileated woodpeckers if abundant large snags persist.

PROFILING THE PILEATEDS

Over two periods of early fieldwork (1973–83 and 1989–90), Bull and her collaborators compiled a detailed profile of pileateds and their habitat in the Blue Mountains in northeastern Oregon. Using aerial photos and ground survey data, they evaluated forest type, structural stage, and amount of canopy closure in seven study areas, totaling close to 30,000 acres of forest interspersed with grasslands.

The researchers used ground surveys, color-banding, and radio telemetry to track woodpecker whereabouts to help determine population densities, delineate home ranges, and characterize their nesting, foraging, and roosting habits. They learned that pileateds live at least 9 years, mate for life, and repeatedly occupy territories of roughly a thousand acres year-round.

"If one member of a nesting pair dies, the survivor stays within the same home range. When the pair dies, the territory is likely to be occupied by offspring or other dispersing birds," Bull explains. The birds also frequent the same nesting and roosting areas over time.

The studies underscored the importance of snags, logs, and dying trees to the pileated's lifestyle. "You need dead trees for many species to survive," Bull says, "though the question has long been how many."

Chiseling holes into dead trees, pileateds craft new nest cavities every year, along with an abundance of roosts, which the birds frequent at night and during inclement weather. Sometimes pileateds use living trees with hollow chambers created by decaying heartwood for roosts; these typically contain multiple entry holes to allow for escape from predators. "These cavities enable a range of other species to access tree hollows they would otherwise be excluded from," Bull explains. The secondary cavity nesters include numerous species of conservation concern including the fisher, American marten, bufflehead, flammulated owl, western bluebird, Vaux's swift, northern flying squirrel, and several bat species.

Likewise, by foraging for insects in decaying wood, pileateds accelerate the decomposition process. Bull's research team observed that the birds spent nearly 80 percent of their feeding efforts on downed logs and snags. To analyze pileated diets, they collected scat and ferreted out insect mouth parts to identify prey that included ants, beetles, and other invertebrates.

Evelyn Bull

Pileateds use snags such as this ponderosa pine for nesting.

"Pileateds are opportunistic feeders and also eat budworms, bark beetles, and other pests," says collaborator Jane Hayes, an entomologist with the PNW Research Station in La Grande, Oregon. "However, when environmental conditions allow pest populations to reach epidemic levels, they overwhelm their predators' capacities to substantially reduce the population," she notes.

Purpose of PNW Science Findings

To provide scientific information to people who make and influence decisions about managing land.

PNW Science Findings is published monthly by:

Pacific Northwest Research Station
USDA Forest Service
P.O. Box 3890
Portland, Oregon 97208

Send new subscriptions and change of address information to
pnw_pnwpubs@fs.fed.us

Rhonda Mazza, editor
rmazza@fs.fed.us

Keith Routman, layout
kroutman@fs.fed.us

USDA United States Department of Agriculture
Forest Service

WRITER'S PROFILE

Noreen Parks has written about science and the environment for more than 17 years. She currently resides in Port Townsend, Washington.

Evelyn Bull

To forage for insects, pileateds drill numerous holes in dead wood, accelerating decomposition in the process.

Evelyn Bull

Pileated woodpeckers find their primary prey, carpenter ants, by foraging on downed woody material.

A LANDSCAPE TRANSFORMED

It was a series of such insect outbreaks, beginning in the 1970s, that triggered a series of landscape changes in northeastern Oregon, affecting all the major tree species favored by pileateds. First, mountain pine beetles erupted to attack mature ponderosa and lodgepole pines. Then, during the 1980s and 1990s, western spruce budworms and Douglas-fir beetles swept through the forest. "The budworms' repeated defoliation of the trees was a painfully slow attack on the forest," Hayes recalls. Large numbers of mature trees eventually succumbed, although the full brunt of the devastation was not apparent until years later.

"Natural disturbance events such as insect activity, disease, wind, and fire are the primary mechanisms that insure a continuum of snags, downed dead wood, and live, decaying trees, which pileated woodpeckers depend on," Bull notes. Thus, the birds benefited to a degree. For example, ponderosa pines killed by beetles during the 1970s subsequently became nest sites.

Evelyn Bull

Although pileateds forage on snags all year, dead trees such as this grand fir are particularly important in the winter when logs are inaccessible because of deep snow.

But as the insect outbreaks continued, extensive logging for forest restoration was carried out in some areas. And, with the threat of wildfire looming ever larger, forest personnel carried out fuel reduction treatments to clear woody debris from sections of the forest.

The overall outcome: a broad-scale transformation of the forest, and the rare opportunity to compare the consequences for a long-lived species of concern, compared to the earlier findings. So in 2003, armed with her data from more than a dozen previous studies, Bull, along with Hayes, Nicole Nielsen-Pincus—then a graduate student at the University of Idaho—and others returned to the research sites to investigate how the pileateds were faring.

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SURPRISING RESULTS

"The map of home ranges occupied by nesting pairs compiled between 1973 and 1983 indicated that the study area had reached its carrying capacity in terms of the number of nesting pairs it was supporting," notes Nicole Nielsen-Pincus, now a wildlife biologist, "and the population appeared stable during the 1989–90 period."

By 2003, however, tree density in many home ranges had greatly diminished. Fieldwork and geographic information system (GIS) studies showed that 75 percent of once lushly canopied grand fir stands had shrunk to less than 30-percent canopy closure.

"Going into the postdisturbance research, we expected to see that the birds had been most adversely affected by this loss. Instead, we found that even where mortality was high among grand fir and Douglas-fir, as long as extensive logging and fuel reduction treatments had not occurred and an abundance of large live or dead trees and logs remained, the pileateds were still there," Nielsen-Pincus says.

Specifically, "in six of the seven study areas, the number of nesting pairs remained the same or fluctuated by a single pair, and the same approximate home ranges were occupied," Bull explains. "In the seventh area, extensive regeneration harvests had taken place in 1991. We found that nesting pairs no longer occupied home ranges impacted by this logging activity, and the number of nesting pairs had decreased from the previous five, to one—a drop of 80 percent."

Similarly, a history of logging activity proved to be the major factor affecting pileated efforts in fledging young—a critical measure in how well the habitat is meeting their needs, as Bull points out. "The amount of unharvested area and forest with more than 60-percent canopy closure was considerably greater, and the amount of area harvested considerably less, in home ranges occupied by pairs that successfully raised young, compared to pairs that failed to," she explains. None of the other factors evaluated—forest type and structural stage (young, mature, or old-growth), differed between pairs that were successful in producing offspring, and those that were not.

Evelyn Bull

Pileateds use a number of different roosts where they take shelter at night and during inclement weather. Roosts typically contain multiple entry holes to allow for escape from predators—an advantage for secondary cavity-users as well.

FUEL REDUCTION VERSUS FORAGING NEEDS

In 2004, Bull and colleagues also evaluated the short-term effects of fuel reduction efforts on pileateds. Focusing on foraging opportunities for the birds, they tallied the numbers of logs, snags, and stumps in study plots where mechanical thinning and clearing had occurred—with and without followup broadcast burning—compared to control plots in mature forest. Then the researchers surveyed the areas for evidence of foraging pileateds and the presence of ants, their primary food. The data revealed that whereas thinning greatly reduced the abundance of all forms of dead wood, subsequent burning removed more than twice as many logs and stumps as mechanical treatment alone.

The contrasting effects on pileated foraging were substantial. "Both the control plots and those with mechanical removal treatments provided significantly more foraging habitat for pileateds, whereas the prescribed burn treatments provided significantly less," Bull explains. Not surprisingly, although evidence of foraging pileateds was most common in the control areas, they were roughly twice as numerous in the thinned-only plots as in the burned ones. "The lower occurrence of ants in the burned areas suggests that burning either directly eliminated the ants or rendered the habitat unsuitable for them," Bull says.

Other forest dwellers such as small mammals, amphibians, rubber boas, martens, and bears may experience diminished feeding opportunities in the short-term aftermath of burns as well. If maintaining biodiversity and wildlife habitat are objectives, it is important to understand the consequences of fuel reduction and restoration treatments on individual species—particularly those dependent on coarse woody debris that is removed during these treatments.

Evelyn Bull

A mature forest on the Starkey Experimental Forest in Oregon's Blue Mountains prior to insect infestations in the 1970s that killed conifers favored by pileateds for nesting and roosting.

TAKE-HOME LESSONS

The final leg of the pileated research rounded out a long-running documentation of a key, long-lived species of concern in its evolving habitat. "As researchers, we seldom have the opportunity for a multidecade study like this," says Hayes. "Mostly our studies provide snapshots of ecosystems. We often speculate on 'what would happen if?' and seldom get to find out. However, the temporal scope of this research has provided a unique opportunity to watch forest ecosystem processes in motion and played out on a wider screen by revealing more of the complex interactions among species as disturbance processes shape the forest they inhabit over time."

Nielsen-Pincus concurs. "We now have a better understanding of what the pileateds truly need. Thirty years ago, dense canopy cover in mature grand fir forests with old-growth structure was considered critical to suitable pileated habitat. We now know that canopy cover may not be as important, as long as enough large trees and downed logs are maintained."

With the fates of many other species tied to pileated woodpecker activity, lessons gleaned from the research extend beyond habitat requirements for the birds. For instance as seemingly dissimilar as black bears and western toads are, these species, like pileateds, feed primarily on ants found on dead wood during at least part of the year. Thus, an environment that supports healthy populations of pileateds also ensures the availability of shelter and forage for other, diverse wildlife.

Bull concludes, "While the future is hard to predict, one thing is certain: change is ongoing in dynamic forest ecosystems. With greater insight into the complex interactions taking place, managers will be better able to strategically design restoration treatments to enhance the resiliency of the landscape while also protecting and maintaining suitable habitats for numerous wildlife species relying on large trees, snags, and down wood."

Evelyn Bull

By the mid 1990s the majority of the grand fir and Douglas-fir had been killed by insects in some of the study areas.

LAND MANAGEMENT IMPLICATIONS

- Extensive tree harvesting rendered habitat unsuitable for nesting pileated woodpeckers.
- Retention of abundant large, dead trees and logs in mature and older stands with high tree mortality provided sustainable habitat for pileated woodpeckers.
- The same home ranges can be managed for pileated woodpeckers for decades, if large snags and logs exist or are retained.
- The home ranges of pileated woodpecker can be mapped and subsequently monitored with relative ease due to the high degree of fidelity.
- Protection of relatively easily identified nesting stands is important for the sustainability of this species.

"When we try to pick out anything by itself, we find it hitched to everything else in the universe."

—John Muir

FOR FURTHER READING

Bull, E.L.; Nielsen-Pincus, N.; Wales, B.W.; Hayes, J.L. 2007. *The influence of disturbance events on pileated woodpeckers in northeastern Oregon*. Forest Ecology and Management. 243: 320–329.

Bull, E.L.; Holthausen, R.S. 1993. *Habitat use and management of pileated woodpeckers in northeastern Oregon.* Journal of Wildlife Management. 57: 335–345.

Bull, E.L. 1987. *Ecology of the pileated woodpecker in northeastern Oregon.* Journal of Wildlife Management. 51: 472–481.

Bull, E.L.; Clark, A.A.; Shepherd, J.F. 2005. *Short-term effects of fuel reduction on pileated woodpeckers in northeastern Oregon—a pilot study.* Res. Pap. PNW-RP-564. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 17 p.

Bull, E.L.; Jackson, J.A. 1995. *Pileated woodpecker* (Dryocopus pileatus). In: Poole, A.; Gill, F., eds. The Birds of North America. Philadelphia, PA: Academy of National Sciences and American Ornithologists' Union. No. 148.

Nielsen-Pincus, N.; Garton. E.O. 2007. *Responses of cavity-nesting birds to changes in available habitat reveal underlying determinants of nest selection.* Northwestern Naturalist. 88: 135–146.

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U.S. Department of Agriculture
Pacific Northwest Research Station
333 SW First Avenue
P.O. Box 3890
Portland, OR 97208-3890

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SCIENTIST PROFILES

EVELYN L. BULL is a research wildlife biologist with the USDA Forest Service, Pacific Northwest Research Station. She received her Ph.D. in wildlife ecology at University of Idaho at Moscow. Her research focuses on the effects of natural and human disturbances on western toads and Columbia spotted frogs and on old-growth dependent species, including pileated woodpeckers and other cavity-nesting birds, great gray owls, Vaux's swifts, and American martens.

JANE L. HAYES is a research biological scientist with the USDA Forest Service, Pacific Northwest Research Station. She received her Ph.D. in entomology at University of Kansas. Her research examines arthropod biological and ecological interactions at the stand level and across forest landscapes. Her studies focus on the role of disturbances in ecosystems and how the desirable and undesirable effects might best be managed.

Bull and Hayes can be reached at:
USDA Forest Service/PNW Research Station
1401 Gekeler Lane
La Grande, OR 97850-3368

Bull:
Phone: (541) 962-6547
E-mail: ebull@fs.fed.us

Hayes:
Phone: (541) 962-6549
E-mail: jlhayes@fs.fed.us

NICOLE NIELSEN-PINCUS received her M.S. in wildlife resources from the University of Idaho. After completing a thesis on habitat selection in a suite of cavity-nesting birds in northeastern Oregon, including the pileated woodpecker, she continued to collaborate with scientists at the PNW Research Station in La Grande to further investigate the pileateds.

E-mail: nnielsenpincus@yahoo.com

COOPERATORS

Barb Wales, wildlife biologist, Pacific Northwest Research Station, La Grande, OR

La Grande Ranger District, Wallowa-Whitman National Forest

North Fork John Day Ranger District, Umatilla National Forest

Starkey Experimental Forest and Range, Pacific Northwest Research Station

Richard Holthausen (retired), National Wildlife Ecology Unit, U.S. Forest Service