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Researchers at The Ohio State University censused red-headed woodpeckers, evaluated their breeding success, and measured habitat characteristics on 100 randomly-selected golf courses in northern and central Ohio in 2002-2003 to evaluate whether golf courses can provide suitable breeding habitat for this species.

## PURPOSE

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# Conservation of Red-headed Woodpeckers on Midwestern Golf Courses

Amanda D. Rodewald, Paul G. Rodewald, and Melissa J. Santiago

## SUMMARY

Red-headed woodpeckers (*Melanerpes erythrocephalus*) were once among the most common breeding birds in parts of the Midwest and eastern North America, particularly in oak savannas, farmlands, and other open habitats with trees. However, populations of this charismatic species have declined due to alteration of habitat and loss of oak savannas. Researchers at The Ohio State University expected that golf courses might provide suitable breeding habitat for red-headed woodpeckers due to structural similarities between golf courses and other habitats used by the species. To examine this, they censused red-headed woodpeckers, evaluated their breeding success, and measured habitat characteristics on 100 randomly-selected golf courses in northern and central Ohio in 2002-2003. They found that:

- Red-headed woodpeckers were detected on over 26% of censused golf courses.
- Habitat characteristics apparently preferred by red-headed woodpeckers include large-diameter trees, hard mast trees (e.g., oak, hickory, beech), standing dead trees (snags), and dead limbs - all habitat features that can be actively managed or created on golf courses.
- Red-headed woodpeckers bred successfully on golf courses. Of 16 monitored nests, 75% successfully fledged young, and this was comparable to nesting success documented by a concurrent study in less managed off-course habitats (80% successful).
- As a whole, the findings suggest that golf courses have a potentially important role in the conservation of red-headed woodpecker and possibly other wildlife associated with open woodlands.

The red-headed woodpecker is a striking bird that was once common in oak-savannas, farmlands and woodlots of the central and eastern U.S. and southern Canada (4, 9). During the 1900s,

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however, populations dramatically declined due to a variety of factors such as maturation of forests in eastern North America, loss of oak-savannah habitat, and the switch to "cleaner" farming practices that included removal of standing dead trees and limbs (10). Red-headed woodpeckers are now a species of conservation concern, and they are listed as a National WatchList Species by the National Audubon Society and is a priority species of Partners in Flight (7, 10).

Conservation of red-headed woodpeckers holds promise because natural habitats used by these birds are similar to some anthropogenic habitats. Red-headed woodpeckers prefer areas with large trees, low tree density, open understory, and availability of dead limbs and/or snags, and the species is somewhat tolerant of human activity (5). Thus, the large and widely scattered shade trees and open lawn typical of golf courses may provide breeding habitat for red-headed woodpeckers throughout their range. We evaluated the



Golf course may attract red-headed woodpecker because golf courses typically have an open forest structure that is characterized by large scattered trees and an open understory free from dense shrub or sapling growth. Red-headed woodpeckers are less likely to use woodlands containing the thick understory vegetation typical of many Midwestern woodlots.

potential of golf courses in Ohio to support breeding red-headed woodpeckers and identified habitat features associated with their presence. We also described nesting substrates and nesting success of pairs breeding on golf courses.

## Methodology

### Study site selection

We studied red-headed woodpeckers in central and northern Ohio, which are relatively flat, formerly glaciated areas that have been heavily converted to agricultural and urban land. During May-August of 2002 and 2003, we visited 100 golf courses within Till Plain (50 courses), Lake Plain (25 courses), and Glaciated Plateau (25 courses) physiographic provinces of Ohio. We randomly selected golf courses (50-408 acres in size) under both public (ca. 60%) and private ownership in a variety of urban and rural landscapes.

### Bird censuses

From mid-May to early August 2002 and 2003, trained observers censused golf courses for red-headed woodpeckers between 6:00 a.m. and 11:00 a.m. EST. To census red-headed woodpeckers, we played pre-recorded calls and drums of the species (recordings provided by the Borror Laboratory of Bioacoustics, The Ohio State University) on a cassette player and an amplified field speaker. Because red-headed woodpeckers were very responsive to recordings, this technique improved our ability to detect the species even at great distances.

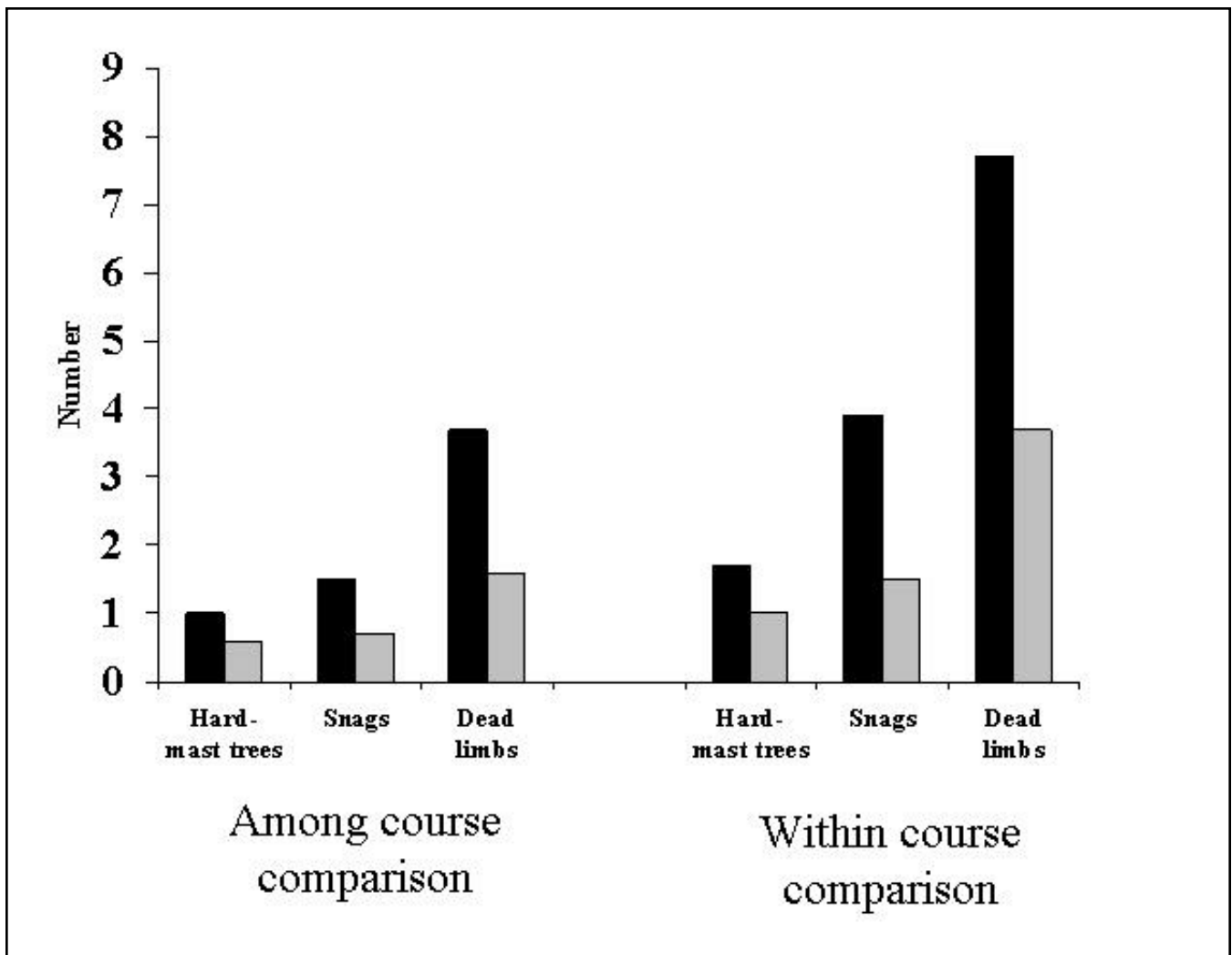
We used a grid layout of parallel transects each separated by 200 meters to census woodpeckers throughout each golf course. Along each transect, we broadcasted recordings at 200-meter intervals. Each census lasted eight minutes during which we recorded all red-headed woodpeckers seen or heard on the golf course. Each census began with two minutes of quiet observation, followed by three minutes of red-headed woodpecker calls interspersed with drumming, and ended with two minutes of quiet observation.



Habitat characteristics, including the size and species of the nest tree, were measured in plots surrounding each woodpecker nest.

### Habitat measurements

We measured habitat characteristics both throughout golf courses (course habitat) and surrounding each woodpecker nest (nest habitat). For course habitat measurements, we sampled vegetation at the same locations used for playbacks (i.e., 200-meter intervals along transects). Using a modified nearest individual method (2) for spatially clumped tree distributions (1), we measured distances to the three nearest trees, diameter at breast height (dbh), and recorded tree species. Within 50 meters of each sampling point, we visually estimated percent ground cover by shrubs and saplings, forbs, grass, sand, pavement, and water, and mean height of saplings. We also counted all dead limbs (at least 30 cm long and at



**Figure 1.** Comparison of numbers of hard-mast trees, snags, and dead limbs (A) among golf courses with (black) and without (gray) red-headed woodpeckers and (B) between nest locations (black) and average values for courses with nests (gray).

least 16 cm in diameter) within a 50-meter radius, and snags (i.e., standing dead trees of at least 16 cm dbh and 2 meters tall) within a 100-meter radius.

Habitat immediately surrounding red-headed woodpecker nests on golf courses was measured within an 11.3-meter radius plot using modified methods of Martin et al. (6). We measured diameter at breast height (dbh) of the nest tree, and visually estimated nest tree height, nest cavity height, and canopy height. We assessed the health of each nest tree as either live, partly dead, or completely dead, and recorded whether or not the nest was located in a living or dead part of the tree. We recorded numbers of trees by species and size class (8-23, 23-38, and >38 cm dbh and snags >16 cm dbh). We then followed the same proto-

col as described for course habitat measurements above.

#### Data analysis

We compared habitat characteristics of golf courses with and without red-headed woodpeckers using multivariate analysis of variance (MANOVA), which controls experiment-wise error rate (11). Vegetation characteristics at golf course nests were compared to mean habitat values at golf courses with breeding red-headed woodpeckers using a MANOVA. We expected that mean habitat values would better reflect habitat available at courses than a random plot because of the patchiness of woody vegetation on golf courses.

## Results

We detected red-headed woodpeckers at 26% of golf courses sampled in Ohio with an average of 1.58 birds per course. Golf courses used by red-headed woodpeckers contained larger trees, greater numbers of hard mast trees (i.e., oak, hickory, and beech), snags, and dead limbs than courses lacking this species (Figure 1). Mean dbh of trees at courses containing red-headed woodpeckers was 40.4 cm compared to 35.3 cm on courses without the woodpeckers. For hard-mast species alone, the difference was more striking with a mean 48.6 cm dbh on courses with woodpeckers versus 36.4 cm mean dbh on courses without the woodpeckers.

In both years combined, we measured habitat surrounding 49 active nests of red-headed woodpeckers on 17 golf courses. Nests were usually located in dead limbs of live trees (67% of nests) rather than in dead trees, referred to as snags (33% of nests). Cavities were placed high (average 14.1 meters) in large trees (average 58.8 cm dbh) and in large limbs (average 20.7 cm diameter) (Table 1). Nests were found in at least 15 tree species, but most nests occurred in oaks (*Quercus spp.*; 22%) and maples (*Acer spp.*; 29%)

(Figure 2). In two years, we monitored the fate of 16 nests on 22 courses and found that overall nesting success was 75%.

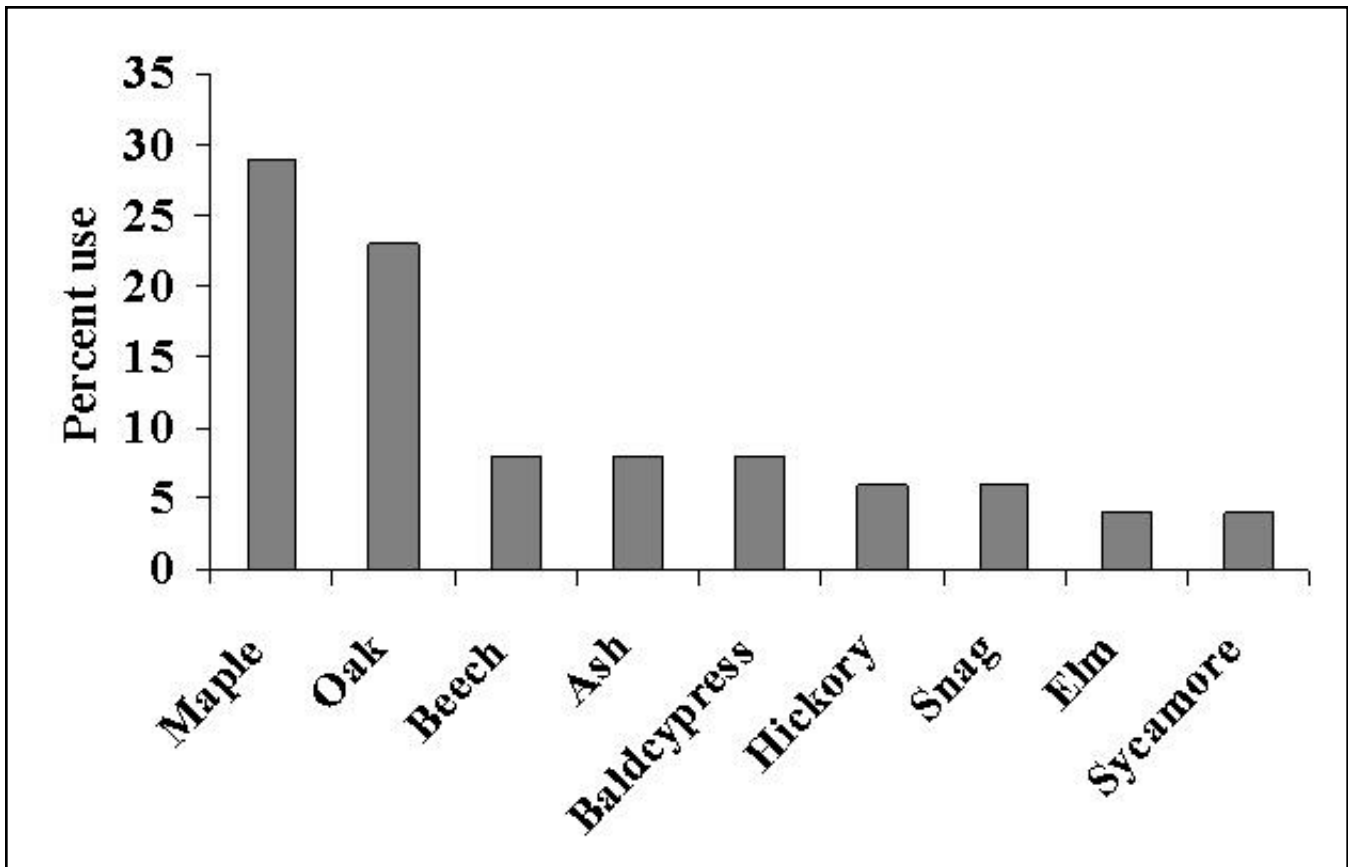
Habitat comparisons between course and nest patch plots showed that plots centered on red-headed woodpecker nests contained roughly twice as many hard mast trees, snags, and dead limbs as habitat plots over the entire course (Figure 1). In addition, nest patches had more closely spaced trees (average of 7 versus 18 meters) and less ground covered by turf (68% vs. 83%) than the habitat plots over the entire course.

## Discussion

Golf courses in Ohio provided habitat and breeding opportunities to red-headed woodpeckers, a widely declining species of high conservation importance. The presence of breeding red-headed woodpeckers on golf courses was positively associated with large hard mast trees (oak, hickory, and beech), dead limbs, and snags. Fortunately, these habitat features can be promoted through long-term planting and pruning strategies on golf courses. Of particular interest to golf course managers, we found that snag retention,

Habitat Variable	Mean	Standard Error
Canopy height (m)	21.0	0.4
Nest tree height (m)	18.3	0.6
Nest tree dbh (cm)	58.8	10.1
Nest cavity height (m)	14.1	0.6
Diameter of limb with cavity (cm)	20.7	1.2
Percent canopy cover	19.7	4.4
Number of trees 8-23 cm dbh	1.6	0.4
Number of trees 23.1-38 cm dbh	2.1	0.3
Number of trees > 38 cm dbh	2.4	0.3
Number of snags >16 cm dbh	1.1	0.3

**Table 1.** Mean and SE of nest placement variables associated with 49 red-headed woodpecker nests on Ohio golf courses, May-August 2002-2003.



**Figure 2.** Frequency and percent use of tree species for nest placement (n = 49 nests) by red-headed woodpeckers on golf courses in Ohio, May-August 2002-2003. Most nests were found in maple (*Acer spp.*) and oaks (*Quercus spp.*).

which is usually a critical piece of woodpecker conservation efforts, may not be required to improve habitat conditions for red-headed woodpeckers.

Live trees that held dead limbs (20 cm diameter on average) were frequently used by nesting woodpeckers. This is important because snags are often removed from courses either because of aesthetic concerns or perceived threats to safety. However, dead limbs and snags that are located in out-of-play areas or deemed to be of low risk to golfers may be easily retained and may often go unnoticed by golfers. Overall, our study shows that a highly modified habitat, widely regarded as having low value for wildlife conservation, may have a role in the conservation of some strongly declining species - in this case, the red-headed woodpecker.

These findings also are encouraging because red-headed woodpeckers were largely successful in their breeding efforts on golf courses,

though we had limited sample size. Most nests monitored on courses successfully fledged young (75%), and this rate of nesting success was similar to the 80% success documented by a concurrent study in nearby park and savanna habitats (8, 9). However, because we were unable to obtain reliable estimates of numbers of young fledged per nest, there is still a need to determine whether differences in productivity (i.e., number of young successfully raised by a pair) may exist between golf course and non-course habitats.

In addition, there is a need to investigate whether the use of pesticides on some courses may negatively affect survival and reproduction. For example, roughly one-third of foraging maneuvers red-headed woodpeckers were directed at invertebrate prey on turfgrass (9), and this behavior could result in increased exposure to chemicals used in turf maintenance.

Although local habitat features certainly play an important role in the management of golf

courses for red-headed woodpeckers, we believe that large-scale or landscape features also deserve attention in future studies. One interesting pattern observed was that golf courses in northern Ohio contained the greatest number of woodpeckers. Because parts of this region historically contained oak-savanna habitat, we suggest that historic breeding range of the red-headed woodpecker may influence the potential of any given golf course to support breeding woodpeckers.

We also noted that courses within rural areas (landscapes dominated by agricultural land and scattered woodlands) were twice as likely to contain red-headed woodpeckers as courses in highly urbanized landscapes (i.e., within town or city limits) (8). Thus, managers of rural golf courses may have better outcomes from their habitat management efforts to promote breeding by red-headed woodpeckers.

### **Recommendations to Enhance Red-headed Woodpecker Habitat on Golf Courses**

- ***Retain large trees*** (>40 cm diameter at breast height) on golf courses, especially hard mast species like oak, beech, and hickory that provide important winter food sources.

- ***Allow dead limbs and snags to remain on golf courses where possible.*** At the very least, retain these structures in out-of-play areas. Consider creating dead limbs or snags by girdling certain trees or retaining trees in created wetlands or ponds (where the flooding will soon kill the trees). There are some observations of red-headed woodpeckers using artificial nest boxes, but providing natural nesting opportunities remains the best strategy to support breeding pairs.

- ***Promote an open forest structure*** that is characterized by large scattered trees and an open understory free from dense shrub or sapling growth. Red-headed woodpeckers are less likely to use woodlands containing the thick understory vegetation typical of many Midwestern woodlots. Keep in mind that any active or passive habitat

management will positively affect some species and negatively affect others. In this case, removal of understory vegetation will likely enhance the habitat for red-headed woodpeckers and other savanna-associated species, but may decrease suitability for other groups of wildlife, such as forest understory-nesting birds.

- ***Favor mast-producing species, such as oak, in tree plantings.*** Because the consequences of disease and insect outbreaks may be more severe in monocultures, planting multiple species of mast-producing trees is advisable.

- ***Consider limiting chemical use in areas known to be used by red-headed woodpeckers.*** Santiago (9) regularly observed woodpeckers foraging in turfgrass, and this may make them vulnerable to negative effects of pesticides and herbicides (but further study is needed). Because most woodpeckers foraged at distances less than 50-100 meters from their nests, exclusion of chemical applications within 100 meters of nests should be considered.

- ***Integrate efforts to enhance habitat for red-headed woodpeckers into a broader plan to manage wildlife on your golf course*** (see reference 3 for discussion of strategies). Also, do not forget to publicly highlight your wildlife management efforts to golfers - many will appreciate your efforts to conserve this charismatic species.

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