Human–Wildlife Conflicts 3(1):136–144, Spring 2009

External characteristics of houses prone to woodpecker damage

Emily G. Harding, Department of Natural Resources, Cornell University, Ithaca, NY 14853, USA
Sandra L. Vehrencamp, Cornell Lab of Ornithology, Cornell University, Ithaca, NY 14853, USA
Paul D. Curtis, Department of Natural Resources, Cornell University, Ithaca, NY 14853, USA
pdc1@cornell.edu

Abstract: Woodpecker (*Picidae* spp.) damage to houses and buildings is a widespread and locally severe problem, yet the probability and type of damage has never been quantified and related to home characteristics. Woodpeckers excavate holes in homes for a several reasons, mainly for building nest and roost cavities, drumming, and foraging for insects. We examined the external characteristics of houses that were contributing factors in attracting woodpeckers to bore holes in house siding and trim. From March 2001 through April 2002, we surveyed 1,185 houses in the town of Ithaca, Tompkins County, New York. Of the houses visited, 33% had woodpecker problems consisting of either property damage or noise disturbance. The probability of woodpecker-inflicted damage on a house was strongly dependent on siding type. Grooved plywood siding was more likely to be damaged than tongue-and-groove, board-and-batten, clapboard, and nonwood siding types. Probability of damage also increased as the tree density in the yard increased. Interactions occurred between sealant and yard type, and stained houses suffered greater probabilities of woodpecker damage in all wooded yards.

Key words: downy woodpecker, hairy woodpecker, house siding, human–wildlife conflicts, *Picoides villosus*, *Picoides pubescens*, wildlife damage

Six species of woodpeckers (*Picidae* spp.) are common to the northeastern United States: pileated (*Dryocopus pileatus*), northern flicker (*Colaptes auratus*), red-bellied (*Melanerpes carolinus*), hairy (*Picoides villosus*), downy (*Picoides pubescens*), and yellow-bellied sapsucker (*Sphyrapicus varius*; Kilham 1983). Woodpeckers can perform a great service by eating insects harmful to trees (Conner and Crawford 1974). However, they may cause damage by pecking on houses, buildings, and utility poles. Although it may seem like a small problem, woodpecker damage is prevalent throughout rural and wooded suburban areas, with estimated damage repair costs of $300 per house and millions of dollars annually in the United States (Craven 1984). It has been speculated that urban development in wooded ecosystems has degraded the woodpecker's habitat, driving birds to find new substrates on which to rap (Linn 1982).

Woodpeckers chisel holes in human dwellings for several reasons: (1) drumming, (2) excavating cavities, and (3) foraging for insects (Linn 1982, Craven 1984, Germano and Vehrencamp 2003). Drumming is the term given to woodpeckers' tapping loudly and rapidly on some resonating surface, such as a hollow tree branch, stop sign, chimney, or house. Because woodpeckers do not have a song as passerine birds do, drumming may serve as a territorial signal similar to bird song, and it may also serve to attract a mate (Short 1982, Marsh 1994).

Woodpeckers nest and roost in cavities excavated into trees or other wooden substrates. Nesting holes are excavated at the start of the breeding season, usually from late April into May. Roosting holes are usually built in the late summer and fall in preparation for winter (Kilham 1983). Some woodpeckers find the soft cedar siding of certain houses to be attractive nesting and roosting sites. When excavating holes into a house, woodpeckers first bore through the outer siding, then the sheathing, and finally drill through the plywood layers directly into the insulation. It is here that the nesting or roosting area is hollowed out. Potential reasons for the birds to excavate cavities in houses include: (1) the heat trapped in the insulation from the house provides extra protection from cold weather; (2) the seclusion of the hole from trees grants extra protection from predators; (3) there may be few or no suitable trees available for nesting or roosting

Table 1. Characteristics of each of the 5 different neighborhoods sampled in Ithaca, New York, April 2001 to March 2002.

Neighborhood	Number of houses	Percent of houses examined	Typical size of lots (ha)	Typical tree density
Cayuga Heights	821	69	1.2–1.6	Wooded
Northeast	470	100	0.2	Lightly wooded
Belle Sherman	141	100	0.1	Lightly wooded
Fall Creek	124	73	0.05	Open grassy
North Campus	46	67	0.2-0.4	Wooded

nearby; and (4) houses are often built with soft wood that woodpeckers can easily penetrate (Conner et al. 1976, Linn 1982).

The diet of wood-pecking birds consists mainly of insects, berries, nuts, and seeds collected from trees and shrubs (Short 1982). The chisel-like bill is not only well-adapted for excavating roost holes, but also for chipping off bark, prying open crevasses, and excavating into the surface layers of tree trunks to obtain the larvae of wood-boring beetles, carpenter bees, and other wood-dwelling insects. Woodpeckers can do substantial damage to houses when searching for insects that may be taking shelter in the crevasses of house siding (Craven 1984, Germano and Vehrencamp 2003).

Some descriptive studies have been undertaken on woodpecker damage to houses in residential areas (Evans and Byford 1983, Craven 1984, Belant et al. 1997). The authors of these studies hypothesized that certain characteristics of houses, such as siding type, house color, and house sealant (e.g., paint, stain), may make them more susceptible to woodpecker damage. However, the studies generally had small sample sizes limited to newspaper questionnaires or telephone response surveys, and focused only on houses with woodpecker damage.

The scope of our study was to examine in detail the external characteristics of houses that attracted woodpeckers to damage the siding and trim. We used an extensive sample of houses, both with and without woodpecker damage, in order to ascertain woodpecker preferences for damaging certain structures.

Study area

We conducted this study during March 2001 through April 2002 in the Town of Ithaca, Tompkins County, located in upstate New York. We examined 1,185 houses in 5 different neighborhoods, including Cayuga Heights, North Campus, Northeast, Belle Sherman, and Fall Creek. Houses were situated in northern hardwood forest habitats containing housing developments, which varied in lot size, human population density, and proximity to wooded or natural areas (Table 1). Most houses in these neighborhoods were 2 stories, and were constructed during the early 1900s through the 1970s. Approximate house sizes ranged from 140 to 232 m^2. The majority of houses in our study area were in good to excellent condition, and very few had visible exterior maintenance problems.

We selected target neighborhoods in the Ithaca area based upon homeowner reports of woodpecker damage. Most houses (67-100%; Table 1) were examined in each neighborhood, bypassing only houses where landowners were not in residence, or did not wish to take part in the survey. With this sampling method, we obtained unbiased estimates of the probability that houses would be susceptible to woodpecker damage as a function of their external characteristics.

Methods

The peak of woodpecker activity and damage complaints in our area occurred during late spring or early fall. We first responded to phone calls received by the Cornell Laboratory of Ornithology regarding woodpecker conflicts in the Ithaca area. Next, we prepared a checklist to record the various traits of each yard and house. We visited houses with damage and recorded the following characteristics: type of siding, form of damage, extent of damage, sealant, house color, yard characteristics, neighborhood type, availability of bird feeders, and presence of insects within the siding. We then gathered an exhaustive sample of the other houses in the neighborhood. We recorded the total number of houses visited, and the percentage of houses actually sampled during the survey (Table 1). The percentages of houses sampled are those that we visited and for which we recorded woodpecker information.

Property observations

Siding type. We classified house exteriors by siding type. The numerous siding types available on the market were grouped together into 7 main categories: nonwood (vinyl, aluminum, brick, stucco, stone); board-and-batten (vertical boards alternating with inset or outset battens); grooved plywood (also known as Type-111, which is made from sheets of plywood into which long vertical grooves are cut); shakes (squares or rectangles of highly textured, natural grained wood applied in rows horizontally across the house); tongue-and-groove (vertically placed wooden boards, each having a tongue along 1 vertical side and a groove along the other vertical side); clapboards (horizontally applied wood siding); and re-sawn shakes (synthetic wood squares applied in rows horizontally across the house). Both tongue-and-groove and board-and-batten siding types experienced similar kinds of damage in similar locations, so, in order to simplify the dataset, these sidings were pooled into a single category (TG/BB). Similarly, natural shakes and re-sawn shakes were pooled into a single shake category.

Form of damage. We classified house damage into 3 categories: roosting-hole or nesting-hole damage (deep round holes from 3 to 5 cm in diameter); foraging damage (including small deep holes in a horizontal or vertical row, oval holes from about 1 to 3 cm, and long trenches from 3 to 10 cm or more); and drumming damage (many small shallow holes in a cluster, or larger shallow cone-shaped depressions). We also noted where on the house the damage was located: near corners, on flat walls, between clapboards, on trim or fascia boards, or on metal downspouts, gutters, and chimneys.

Sealant. We separated house sealant types into 3 categories: paint, stain, and nonwood (vinyl, brick, stone, and aluminum sidings).

House color. We also classified house colors into 3 categories: earth (dark color tones, such as reds, browns, blues, greens, and natural), pastel (light shades, such as pink, purple, pale blue, yellow, etc.), and white.

Yard characteristics. We classified yard types into 4 categories based on tree density: open grassy with few or no shade trees, lightly wooded with shade trees covering at least a third of the yard, wooded yards with shade trees covering 50 to 75% of the yard, and heavily wooded yards with most of the area covered by shade trees.

Other data. We collected insects from a sampling of houses (n = 14) having grooved plywood sidings and sent the samples to the Cornell Entomology Lab for identification. We recorded the presence or absence of seed and suet feeders for a subset of 520 houses where residents were at house to determine if the availability of feeders could be attracting woodpeckers to houses or deterring them from foraging on the siding. Based on homeowner reports, we documented species of woodpecker, activity of the woodpecker, and time of year the bird was seen or heard. However, many of the homeowners were unsure of these answers and tended to guess; therefore this information was unreliable.

Data analysis

We analyzed the dataset of 1,185 houses using step-wise logistic regression (PROC GENMOD; SAS, Version 8, SAS Institute, Cary, N.C.) to identify the effects of house characteristics (independent variables) on the presence or absence of woodpecker damage (dependent variable). The initial model included the relevant main effects and all interaction terms. Nonsignificant terms were then removed systematically, beginning with the higher-order interactions, to find the reduced model that best represented the variables most significant in attracting woodpeckers. We reported the Wald χ^2 statistic and P-value for each term in the final model. Standardized parameter estimates were also calculated using least-squares means to conduct pairwise statistical comparisons among categories.

Results

Of the 1,185 sites we visited, 394 houses

(33%) had some woodpecker damage, either to property or nuisance activity (e.g., noise). Damage rates among the 5 neighborhoods were not significantly different (χ^2_4 = 8.22, P = 0.084). Using least-squares means from a logistic regression model to correct for other effects (sealant, yard type, and siding), we found no significant differences among the neighborhoods after adjusting the P-value for multiple comparisons (Figure 1). Woodpecker damage was most often reported by homeowners during Spring (April–May) and Fall (September–October).

Table 2. Significant variables in the final logistic regression model used to predict the presence versus absence of woodpecker damage to houses near Ithaca, New York, April 2001 to March 2002, including type of siding on house, kind of sealant, yard vegetation characteristics, and interactions terms.

Source	df	χ^2	P-value
Siding	4	75.78	<0.001
Sealant	2	44.87	<0.001
Yard	3	34.11	<0.001
Sealant, Yard	6	27.73	<0.001

Damage associated with exterior characteristics of houses

The initial logistic regression model for the analysis of damaged versus undamaged houses included siding, sealant, yard type, and all interaction terms. House color was not included in this model because it was autocorrelated with sealant. All 3 variables showed highly significant differences in their effects on woodpecker damage (Table 2). Siding types varied greatly in their susceptibility to damage, ranging from 21 to 73%, and most pairwise comparisons were significant (Figure 2). The density of trees in the yard also had a strong effect on the probability of damage. Houses in heavily wooded areas were the most prone to woodpecker damage, and the probability of damage decreased in a linear fashion as tree density decreased. The type of sealant on the house affected the likelihood of woodpecker damage, as well. The probability of damage was highest for stained wood (72%), intermediate for painted wood (29%), and lowest for nonwood siding (10%).

The final logistic regression model also included a significant interaction between sealant and yard type (Table 2). Stained houses suffered greater probabilities of damage in all wooded yards, but not in open grassy yards (Figure 3). Painted houses exhibited lower levels of damage, with damage probability increasing only in heavily-wooded yards. Damage rates on nonwood houses were unaffected by yard characteristics. There was also an association between yard and sealant type, with stained houses having a tendency to be situated in heavily-wooded areas (χ^2_6 = 52.6, P < 0.001). Among the houses with heavily-wooded yards, 32% had stained wood siding, and this percentage decreased to 26%, 18%, and 16%, respectively, in the less-wooded yard categories. Vinyl sidings were more common in lightly-wooded and open, grassy yards.

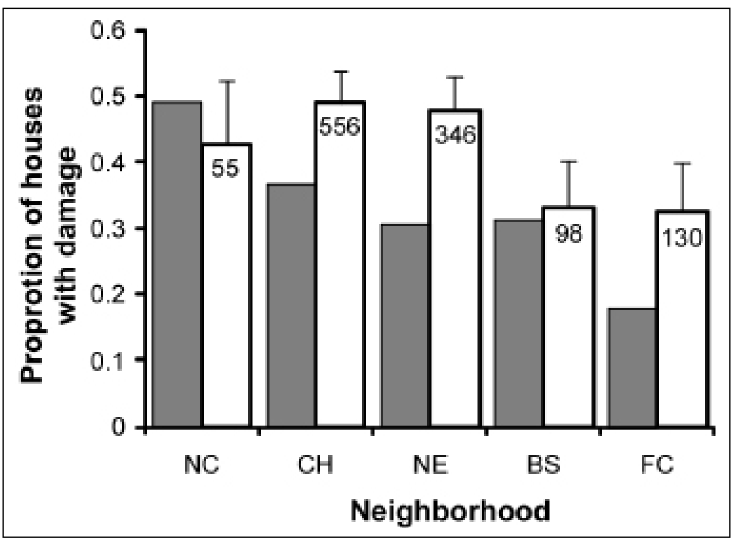

Figure 1. Woodpecker damage rates in different neighborhoods near Ithaca, New York, April 2001 to March 2002. Gray bars show uncorrected proportion of houses with woodpecker damage. White bars show least-squares mean proportion and standard error after correcting for house characteristic variables. NC = North Campus, CH = Cayuga Heights, NE = Northeast, BS = Belle Sherman, FC = Fall Creek. Numbers within bars represent total number of houses within each neighborhood.

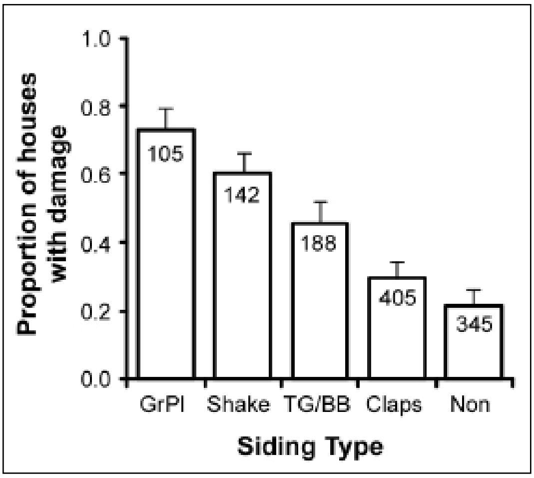

Figure 2. Proportion of houses near Ithaca, New York, April 2001 to March 2002, with woodpecker damage for each siding type (least-squares mean proportion and standard error after correcting for other house variables). GrPl = grooved plywood. TG/BB = tongue-and-groove and board-and-batten (pooled categories). Shake = natural and resawn shakes (pooled categories). Claps = natural and hardwood clapboards (pooled categories). Non = nonwood.

Table 3. Distribution of 3 types of woodpecker damage for different siding types on homes near Ithaca, New York, April 2001 to March 2002. Houses with multiple forms of damage were scored on the basis of the most serious form, with nesting or roosting holes > foraging > drumming. Chi-square test of independence for the entire table was $\chi^2_8 = 205.7$, $P < 0.0001$.

Siding Type	Drumming	Foraging	Nesting	Total
Clapboards	22	3	45	70
Grooved Plywood	7	56	11	74
Nonwood	21	3	6	30
Shakes	4	26	65	95
TG and BB[a]	4	4	55	63
Total	58	92	182	

[a] Tongue-and-groove (TG) and board-and-batten (BB) types of siding.

Therefore, owners of houses in more-wooded areas that were already more susceptible to damage because of the higher density of resident woodpeckers, further exacerbated their vulnerability to damage by staining their wooden siding with natural colors. Stained wood houses in heavily-wooded yards had a 97% probability of damage.

Effects of siding type on the form of damage. Siding types differed in their susceptibility to the 3 kinds of woodpecker damage (Table 3). In 28% of the houses with damage, woodpeckers had carried out some type of foraging behavior. Grooved plywood was the siding type most susceptible to foraging damage, which often took the form of small holes in horizontal lines (Figure 4a). Our observations indicated that woodpeckers were feeding on insects living in the siding. When the vertical grooves were cut into the upper layers of the plywood to create the board-and-batten look, core gaps in the middle layers were exposed. These narrow tunnels provide an attractive, egg-laying and over-wintering site for insects. We removed the insects and insect casings from the core gaps of 14 houses with grooved plywood siding and sent them to the Cornell University Entomology Lab for identification. We found larval casings of grass bagworms (*Psyche casta*) in 13 (93%) of these samples, and larval casings of leafcutter bees (*Magachile* spp.) in 8 (57%). We also found sunflower seeds, most likely cached by black-capped chickadees (*Parus atricapillus*), as well as katydids (*Tettigoniidae*) and other unidentifiable matter in core gaps. Woodpeckers were clearly able to detect the insects hidden in core gaps, and they bored a series of holes into the wood to reach them.

Shake siding was also vulnerable to foraging damage, which took the form of small holes in vertical rows or vertical trenches (Figure 4b). As with grooved plywood, shake siding generates long, narrow gaps where insects can hide. Fascia board eaves, decking, and window trim also showed signs of woodpecker foraging in many houses throughout the study site (Figure 4c). The source of this form of damage appeared to be carpenter bees (*Xylocopa* spp.). The bees build nesting cavities by excavating tunnels into solid wood. Woodpeckers searching for carpenter bee larvae chiseled long trenches and holes about 1- to 3-cm deep.

Excavation of nesting or roosting holes. In 55% of the houses with damage, woodpeckers had excavated nesting or roosting holes. These large round holes were located on trim boards (3%), on corner boards (23%), or dispersed throughout the siding (30%). Nesting and roosting holes were most often found in houses that were close to wooded areas, had natural

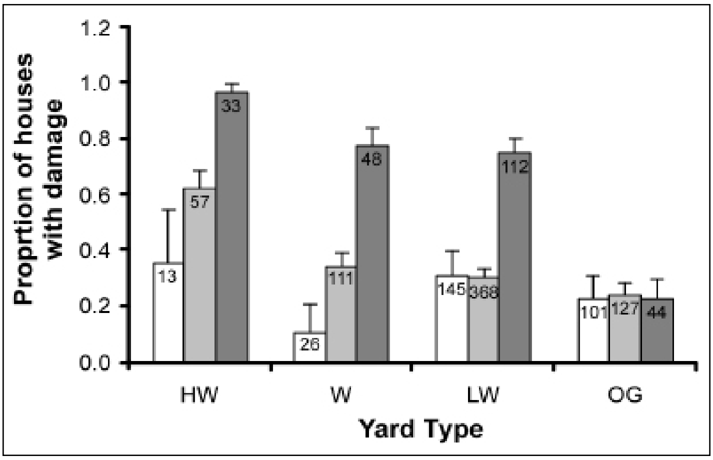

Figure 3. Proportion of houses near Ithaca, New York, April 2001 to March 2002, with woodpecker damage for each siding and yard type after correcting for interactions and other effects. Bar color indicates sealant type: white = nonwood, light gray = paint, dark gray = stain. Yard types: HW = heavily wooded, W = wooded, LW = lightly wooded, OG = open grassy.

wood or a dark-colored stain, and had clapboard siding, board-and-batten siding, or tongue-and-groove siding. Woodpeckers were more attracted to wood clapboards than to hardboard (i.e. wood composite) clapboards, which are harder for woodpeckers to penetrate than are natural wood boards.

Nesting or roosting holes in wood and hardboard clapboards were usually excavated at the seam of 2 adjacent clapboards. We usually found these holes dispersed throughout the house siding. We usually observed holes excavated into board-and-batten siding on the inverted batten between the 2 adjacent boards, again often dispersed throughout the siding, with some preference given to corner excavations (Figure 4d). Woodpeckers boring holes into tongue-and-groove sidings showed a definite preference for corner holes. We found

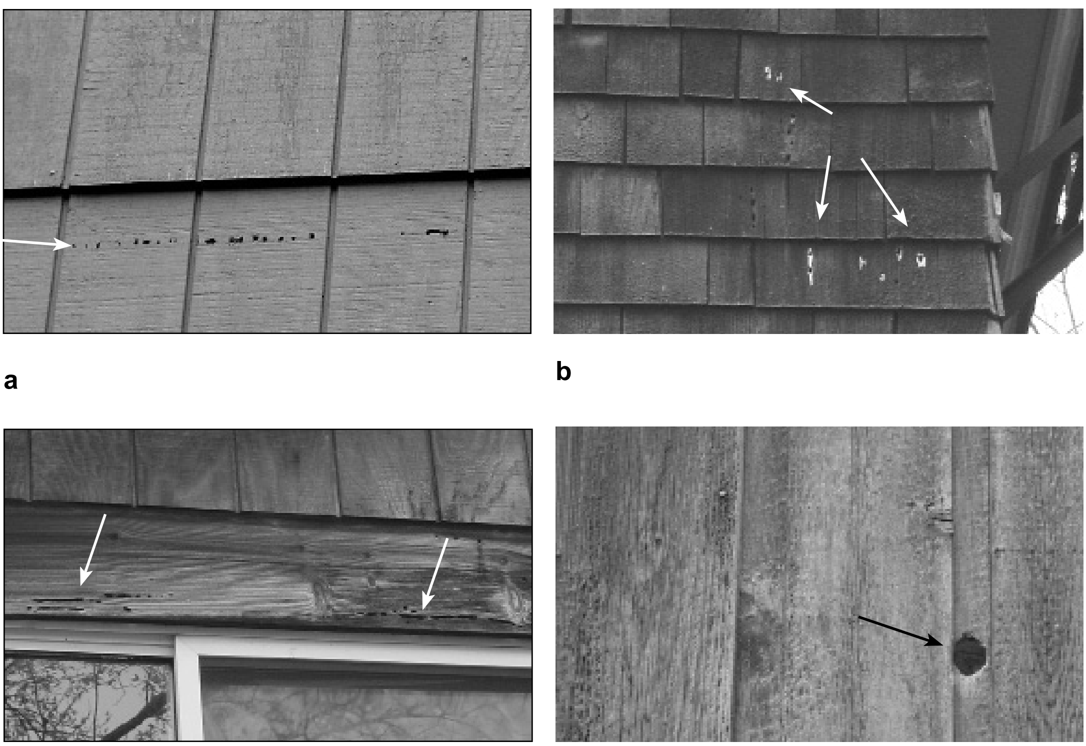

Figure 4. Examples of woodpecker damage to houses near Ithaca, New York, April 2001 to March 2002: (a) horizontal rows of foraging holes following core gaps in grooved plywood siding, (b) foraging damage on stained cedar shakes, (c) damage caused by foraging for carpenter bee larvae on fascia boards of a house, and (d) roosting or nesting holes in board-and-batten siding.

these holes at the seam of 2 vertical boards. This preference probably occurs because the space beneath the intersection of the 2 corner boards creates a hollow area. Re-sawn shakes and shingles were also more prone to have nesting and roosting holes along corners of the house. Usually these holes were made between abutting shingles, where the bottom and top of 2 shingles met.

Drumming damage. In 18% of the houses with damage, woodpeckers had been drumming at some location on the house. Any siding type was a potential instrument for woodpecker drumming. Even houses with nonwood siding were vulnerable to this form of damage because woodpeckers would drum on aluminum siding, as well as on the trim and fascia boards of wood, brick, and stucco houses. Metal downspouts, gutters, chimneys, and vents on any type of structure were also popular drumming sites. Drumming was often more annoying than damaging and generally stopped once breeding began in the spring. We observed that holes caused by drumming were often very small dents in the wood, grouped in clusters along the corners or fascia and trim boards of a house. Although woodpecker-made holes could sometimes be ≤3 cm in diameter, drumming holes generally were ≤1 cm in diameter, round or cone-shaped, and shallow.

Bird seed and suet feeders

We compared damage rates for houses with and without bird feeders using the subset of 520 houses with feeder data. We hypothesized that the presence of suet feeders might detract woodpeckers from foraging on houses. Although the mean probability of damage for houses with suet feeders present (12%) was half that of houses with no feeders (30%) or with seed feeders (26%), the logistic regression analysis with siding, yard, and sealant indicated that the presence of feeders was not significant ($\chi^2_2 = 0.80$, $P = 0.67$). However, feeder information was unreliable because it was impossible to determine if homeowners kept feeders filled throughout the winter and summer or if the feeders were allowed to remain empty for periods of time. There was a large difference between the uncorrected and corrected proportions because no houses in open grassy areas had suet feeders. Suet was more likely to be placed in wooded areas where woodpeckers (and the damage they cause) were more common. Correcting for yard type, thus, lowered overall estimates of damage.

Discussion

We found that the susceptibility of houses to woodpecker damage depended most on the type of siding. Grooved plywood siding had the highest proportion of woodpecker damage (73%), followed by shakes (60%), tongue-and-groove and board-and-batten (45%), clapboards (29%), and nonwood (21%). Each siding type sustained different kinds of woodpecker damage, depending on the woodpecker activity. Grooved plywood and shakes were most susceptible to foraging damage, clapboards, tongue-and-groove, and board-and-batten sidings were most susceptible to damage from roost-hole or nest-hole excavations, and nonwood sidings were most susceptible to woodpecker drumming.

Tree density in the yard also had a strong effect on woodpecker damage. There was a linear increase in the probability of damage as the abundance of trees increased. We believe that the more natural and wooded the yard environment, the greater the density and diversity of resident woodpeckers, and the greater the probability that some birds would probe and find the house siding an attractive place to peck. Open grassy yards probably contained fewer resident woodpeckers, thereby resulting in fewer houses damaged. This effect could be confounded by age of the house, as many neighborhoods described as "open grassy" were newer developments with few to no sizable shade trees.

Stained houses suffered more damage than did painted houses and nonwood houses. We believe that paint helps to fill the small gaps in wooden siding that can harbor insects and greatly reduces infestation by carpenter bees that woodpeckers find so attractive. Paint also comes in bright, nonearth-toned colors that woodpeckers seem to avoid (Harding et al. 2007). Sealant also showed an interactive effect with yard type. The highest probability of damage was observed in stained houses in heavily wooded areas (97%). Houses with aluminum or vinyl siding sustained physical damage mainly on the wooden trim and fascia, and were attractive as drumming sites. But nonwood houses also tended to occur in newer neighborhoods with open grassy yard types that harbored fewer resident woodpeckers; such houses had the lowest damage rate (21%).

It is very difficult to observe woodpeckers actually in the process of damaging houses that are not under constant supervision. When we or homeowners observed woodpeckers on house siding, we identified either hairy or downy woodpeckers. We observed yellow-bellied sapsuckers drumming on chimney caps, gutters, stop signs, or other metallic objects. Although the northern flicker has been associated with damage to houses in the Northeast (Andelt et al. 1999), we did not observe flicker conflicts in our study.

Management implications

Use of appropriate exterior construction materials for houses may be the best long-term solution for preventing woodpecker damage. If a house is located in wooded area with evidence of woodpecker activity nearby (e.g., tree cavities), contractors should use clapboards or nonwood siding types. Grooved plywood, wood shakes, tongue-and-groove, and board-and-batten sidings should be avoided at wooded sites, as these sidings are more prone to woodpecker damage.

Stain sealants, especially earth-toned colors (Harding et al. 2007), should be avoided on wooden structures found in lightly-wooded to heavily-wooded yards. For existing houses with wood siding in wooded areas, it would be better to paint such structures rather than reapply stain when it is time for exterior maintenance.

It is important to inform developers, builders, house buyers, and city planners concerning the risk of woodpecker damage associated with heavily wooded sites and wood siding materials. It is much simpler and more cost-effective to prevent structural damage, rather than make repeated repairs once woodpecker damage has occurred (Conklin et al. 2008). This may pose a challenge, as it seems many people want their houses to blend in with natural settings. However, it is just this scenario, houses with wood siding covered in earth-toned stains, which experience the highest risk (97%) of woodpecker damage.

Acknowledgments

Our sincere thanks are expressed to all of the homeowners who participated in the survey. F. Vermeylan provided invaluable statistical consulting advice. We appreciated the assistance provided by the Cornell Entomology Lab, specifically E. R. Hoebeke, assistant curator. A. Wells, director of communications and outreach at the Cornell Lab of Ornithology assisted with homeowner contacts. We would also like to thank P. Kahwaty and K. Uvelli for assistance in the field. This research was supported in part by the Cornell University Agricultural Experiment Station federal formula funds, Project No. NYC-171406 received from Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture. Additional funding was provided by the Berryman Institute at Utah State University, and Bird-X Inc., Chicago, Ill.

Literature cited

Andelt, W. F., S. N. Hopper, and M. Cerato. 1999. Preventing woodpecker damage. Cooperative Extension Bulletin 6.516. Natural Resources Department, Colorado State University, Fort Collins, Colorado, USA.

Belant, J. L., T. W. Seamans, R. A. Dolbeer, and P. P. Woronecki. 1997. Evaluation of methyl anthranilate as a woodpecker repellent. International Journal of Pest Management 43:59–62.

Conklin, J. S., M. J. Delwiche, W. P. Gorenzel, and R. W. Coates. 2009. Deterring cliff-swallow nesting on highway structures using bioacoustics and surface modifications. Human–Wildlife Conflicts 3:93–102.

Conner, R. N., and H. S. Crawford. 1974. Woodpecker foraging in Appalachian clearcuts. Journal of Forestry 72:564–566.

Conner, R. N., O. K. Miller Jr., and C. S. Adkisson. 1976. Woodpecker dependence on trees infected by fungal heart rots. Wilson Bulletin 88:575–581.

Craven, S. R. 1984. Woodpeckers: a serious suburban problem. Proceedings of the Vertebrate Pest Conference 11:204–210.

Evans, D., and J. L. Byford. 1983. A characterization of woodpecker damage to houses in east

Tennessee. Proceedings of the Eastern Wildlife Damage Control Conference 1:325–329.

Germano, E. M., and S. L. Vehrencamp. 2003. Hammerheads: why woodpeckers drum on your house. Living Bird 22:25–29.

Harding, E. G., P. D. Curtis, and S. L. Vehrencamp. 2007. Assessment of management techniques to reduce woodpecker damage to homes. Journal of Wildlife Management 71:2061–2066.

Kilham, L. 1983. Life history studies of woodpeckers of eastern North America. Nuttall Ornithological Club, Cambridge, Massachusetts, USA.

Linn, J. W. 1982. Woodpeckers: natural habitat invaded; cedar siding lured birds to homes. Pest Control 50:29–30.

Marsh, R. E. 1994. Woodpeckers. Pages E139–E144 *in* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, editors. Prevention and control of wildlife damage, College of Agriculture and Natural Resources, University of Nebraska, Lincoln, Nebraska, USA.

Short, L. L. 1982. Woodpeckers of the world. Delaware Museum of Natural History, Cinnaminson, New Jersey, USA.

Emily G. Harding received her B.S. (2000) degree in natural resources and her M.S. (2004) degree in wildlife sciences from Cornell University. Her research as a graduate student focused on evaluating the damage caused by woodpeckers to houses in suburban areas.

Sandra L. Vehrencamp received a Ph.D. degree from Cornell University (1976) and a B.A. degree from the University of California at Berkeley (1970). She currently is a professor at Cornell University, with joint appointments in the Department of Neurobiology and Behavior and the Laboratory of Ornithology. Her research interests include behavioral ecology and animal communication, with a focus on birds and field studies.

Paul D. Curtis received a Ph.D. (1990) degree from North Carolina State University, an M.S. (1981) degree from Colorado State University, and a B.S. (1978) degree from West Virginia University. He is currently an associate professor and extension wildlife specialist at Cornell University, and he has coordinated the wildlife damage management program there during the past 16 years. His research interests include wildlife damage management in urban and agricultural landscapes, wildlife fertility control, and resolving community-based wildlife issues. He serves as faculty advisor for the Cornell University student chapter of The Wildlife Society, and is a former chair of the TWS-Wildlife Damage Management Working Group.