KNOCK ON WOOD

Woodpeckers and utility pole damage

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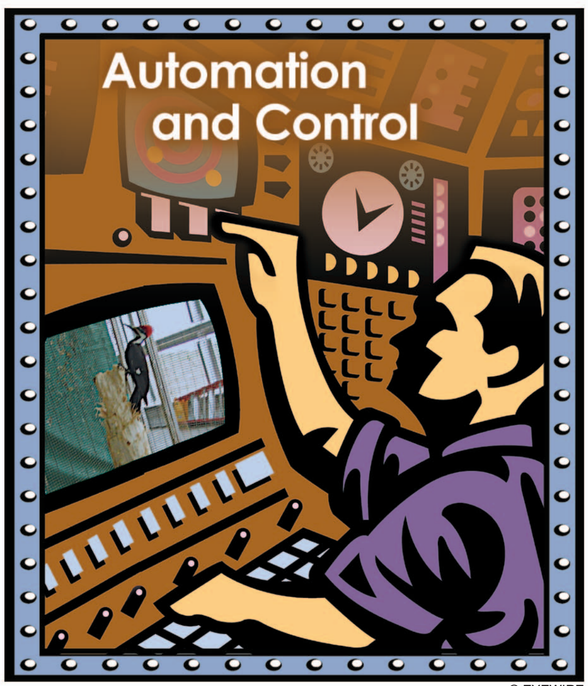

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A NUMBER OF methods have been tried to control woodpecker damage to utility poles. Decoys (e.g., owls and snakes) and loud noises may have some effect initially, but woodpeckers soon habituate and return to their previous activities. Most birds do not hear in the ultrasonic frequency, so ultrasonic or high frequency sound-producing devices are ineffective. Creating artificial nesting cavities is not likely to be effective in the long term, as cavity creation is a critical part of the breeding ritual, and very few woodpecker species use nest boxes. To date, no chemical repellents have been developed that have proven to be both significantly effective and environmentally friendly; however, the repellent approach still holds promise as a potentially cost-effective means to successfully mitigate woodpecker damage.

Wire mesh is the most widely used barrier to prevent damage. When selecting a barrier, it is critical to know which woodpecker species are causing pole damage. The most commonly used mesh is 19-gauge galvanized wire in a 1/4-in mesh pattern. Larger species, such as the pileated woodpecker, can penetrate 19-gauge wire, so a heavier gauge wire is required. It is becoming common for utilities to repair woodpecker cavities in wood poles with fillers in an effort to extend the pole's useful life. There are a variety of tools to calculate damage and determine if a pole can be repaired or must be replaced. A number of repair products are discussed in this article.

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Background

The most common form of deterioration of wood utility poles throughout North America is groundline decay. While great strides have been made in the mitigation of groundline deterioration, utilities continue to replace a large number of poles due to factors other than those that affect the groundline region, e.g., woodpecker damage. Woodpeckers cause severe damage to wood utility poles, resulting in significant annual economic losses to utility companies [1]. In fact, in some regions the effects of woodpecker damage are even more significant than the effects of groundline deterioration. Damage to poles caused by woodpeckers presents a safety hazard to workers, may promote further degradation due to decay fostered by water entrapped in holes, and may eventually lead to collapse under adverse conditions.

Woodpecker damage is not distributed uniformly across North America, rather, it is localized and relates to the species and numbers of woodpeckers present in a given location. Damage within a utility service territory is also often localized due to specific habitat requirements. There are 22 species of woodpeckers in North America, and the ones most often associated with utility pole damage include, but are not limited to:

- red-headed woodpecker (melanerpes erythrocephalus)
- red-bellied woodpecker (melanerpes carolinus)
- acorn woodpecker (melanerpes formicivorus)
- downy woodpecker (picoides pubescens)
- hairy woodpecker (picoides villosus)
- northern flicker (colaptes auratus)
- pileated woodpecker (dryocopus pileatus).

Woodpeckers range in size from 6.75 in in length for the downy woodpecker up to 16.5 in for the pileated woodpecker (Figure 1) [2]. Typically, the larger the bird, the more damage it is capable of doing. For example, typical pileated woodpecker cavities are constructed with a 3–4 in cathedral shaped hole and a chamber that may extend below the hole for an average of 19 in [3]. When addressing woodpecker issues, a successful solution requires knowledge of the species.

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A pileated woodpecker.

Why Woodpeckers Peck Wood

Woodpecker damage is typically the result of feeding or the need for housing. There are other reasons why woodpeckers peck wood, like communicating (drumming) and storing food (e.g., acorn woodpeckers), but the damage resulting from these activities is typically less significant.

Foraging

Woodpecker diets tend to vary markedly by species and season. Many woodpecker species consume copious amounts of insects, both larvae and adults during warmer months when supplies are plentiful. During winter, some woodpeckers supplement their diets with nuts, acorns, seeds, and fruit. Nestlings are typically fed insect matter, often ants. Woodpeckers use a variety of foraging methods. They may glean insects from the wood surface, without harm to the trees or structures they are foraging upon. Often woodpeckers will probe checks on utility poles or cracks and crevices on trees, or they may pull off loose outer sections of poles or loose bark from trees. This type of foraging causes little to no harm to poles or trees. It does not create structural damage and does not create significant avenues for moisture intrusion.

Drilling for foraging purposes varies widely among species. The most damaging foraging technique is the extensive excavation necessary for insects and insect larvae buried deep within wood. One of the most impressive foragers, the pileated woodpecker, can quickly remove large sections of a tree or utility pole in its search for insect colonies, especially its favorite diet of carpenter ants and their nests. These birds comb the surface of a tree or pole while tapping the surface periodically. It is thought that this tapping may be a method of detecting movement of insects deep within the wood. It has been suggested that woodpeckers can distinguish between the sound of solid wood and that which may have extensive insect borings.

Drumming

The least damaging type of behavior is a communication technique that is appropriately called drumming. Drumming is the rapid and repeated striking of an object by a woodpecker's bill. The most common purpose for drumming is to announce territorial boundaries in a manner similar to the way songbirds sing. Woodpeckers also drum for other reasons, such as to attract or signal mates. When announcing their territorial boundaries, woodpeckers often seek out locations that resonate (e.g., logs, poles, metal roofs) such that the sound will carry a great distance. If available, metal objects such as rain gutters or TV antennas are also favorite targets for drumming rituals. The drumming activity itself usually does not result in any damage to the substrate, beyond small indentations.

A woodpecker nest cavity.

Nesting Cavities

Woodpeckers excavate nesting holes in live trees, dead trees, and utility poles (Figure 2). The amount of time it takes a woodpecker to carve out an appropriate dwelling depends on many factors, such as the hardness of the wood and how urgently the dwelling is needed. Woodpeckers usually lay their eggs in a cavity that is newly excavated on a bed of fresh wood chips each year. As such, these factors lead to an increase in the amount of damage that a single woodpecker can cause to a given tree or pole throughout its lifetime. Woodpeckers prefer excavating into wood with a solid exterior in combination with a soft interior, often created by decay or disease. Through tapping the outer wood of a tree or pole, woodpeckers can usually detect if softer wood is present. If a woodpecker begins to excavate a cavity and finds that the wood is too hard or too soft, it will move to another area and try again. Woodpeckers may return to a previously unfinished excavation when the inner wood has softened. It is not clear whether woodpeckers create these start holes as a method to introduce decay. However, trees or poles with a woodpecker cavity tend to have several other unfinished holes present. The cavity size varies greatly among species of woodpeckers, and some species have a greater affinity for softer wood than others.

Roosting Cavities

In addition to nesting cavities, most woodpecker species create roosting cavities. The birds return to these cavities each night throughout the year. Although a woodpecker may use more than one cavity for roosting, they rarely share a hole with any other woodpecker. The exception to this occurs during nesting, when the male broods the young during the night. Thus, while woodpeckers maintain only a single nest site, the pair actively uses at least two holes at all times of the year. A cavity used as a woodpecker nest one year may serve as a roost hole the next year.

Laws Protecting Woodpeckers

The Migratory Bird Treaty Act (MBTA) protects all migratory birds with the exception of introduced species such as house sparrows (passer domesticus), European starlings (sturnus vulgaris), monk parakeets (myiopsitta monachus), and rock pigeons (columba livia). The MBTA protects all woodpeckers and their nests. Removing any active woodpecker nest requires a federal depredation permit. An active nest is defined as one with eggs or young. Additional protection may also be afforded to these birds by state law. Nest removal should be coordinated with the appropriate agency.

Woodpecker Damage

The direct effect of woodpecker damage resulting from their search for food, storage of food, or drumming is typically inconsequential (except for pileated woodpeckers) to the structural performance of a pole. However, the holes they create serve as avenues for moisture and fungi that typically result in decay. If the advancement of this decay is not inhibited, it is likely that the pole will eventually require some kind of restoration or even replacement.

The direct effects of woodpecker presence are most noticeable in the damage resulting from woodpecker nesting and roosting cavities. Not only do the cavities serve as an avenue for moisture intrusion and decay, but they can also reduce the structural integrity of the pole. Large, or numerous, excavations may require immediate restoration or replacement of the pole. Unfortunately, woodpeckers can cause extensive damage in a short period of time, which can result in pole failures in the interval between routine inspections and the implementation of maintenance/repair or replacement procedures.

The cavities also create problems for inspectors and maintenance personnel. Linemen may be understandably reluctant to climb a pole with woodpecker cavities for fear that the pole may fail at the cavity location. Even if the pole has sufficient capacity to support linemen, they may step into unnoticed woodpecker holes and lose their footing. Further, abandoned woodpecker cavities may harbor other occupants such as wasps or squirrels that may not welcome a lineman's foot in their new home.

Why Woodpeckers Use Utility Poles

There have been many different theories offered as to why woodpeckers are attracted to utility poles. One such idea proposed is that the vibrations transmitted by the conductors through a pole are mistaken by woodpeckers to be insects moving deep within the poles. This theory has been dismissed due to the fact many poles are damaged in the short time between their erection and the stringing of the conductors. Further, studies have been conducted showing a significant number of poles were attacked that did not have wires on them [4].

Another theory is the possibility that during the treating process, shakes are formed, increasing the resonance of the pole, thereby increasing the attractiveness to woodpeckers. Research performed by Rumsey [4] showed excavations were typically associated with shakes, but in some cases, excavations occurred in poles where there were no apparent shakes. He simply concluded internal voids are attractive to woodpeckers.

Most researchers conclude that the primary reason for a woodpecker's attraction to a utility pole is that it provides a broad view of the surrounding area, making the pole an excellent vantage point for announcing and defending territories and detecting potential predators. An ecological assessment of the use of utility poles for nesting by pileated woodpeckers in southeastern Manitoba concluded that the age of surrounding forest stands, the food supply, and the distance to forest cover were significantly associated with nest-site selection in utility poles [5]. It is theorized that while announcing their territories, woodpeckers may discover hollow-sounding areas they then excavate in search of food or to create nesting cavities. Clearing right-of-ways may exacerbate the problem by limiting natural nesting sites while concomitantly increasing the access to insects in clear-felled timber areas [6].

Mitigation of the Problem

Many techniques have been attempted in efforts to prevent woodpecker damage, such as lethal removal, mechanical and pyrotechnic devices, artificial nests, exclusion, chemical repellents, artificial poles, and ecological control.

Lethal Removal

Woodpeckers are classified as migratory nongame birds and are, therefore, protected by the MBTA. To legally kill a woodpecker, or remove an active nest, it is necessary to obtain a permit from the Law Enforcement Division of the U.S. Fish and Wildlife Service that can only be issued upon the recommendation of USDA-APHIS-Animal Damage Control personnel [7]. Further, state regulations often require further permits to be issued before the destruction of woodpeckers or their nests can be legally performed. There will need to be a compelling reason to get a permit to use lethal methods. Even if a permit can be secured, lethal control may also meet with public resistance.

Scare Tactics

People have tried various silhouettes and decoys to discourage woodpeckers. The most popular is the owl decoy. Other silhouettes and decoys include hawks, snakes, and cats. These devices may have some effect initially, but if the decoy does not move, woodpeckers soon realize that the decoy poses no threat and return to their destructive activities [8]. Other objects that move or reflect, such as toy windmills, pie plates, mirrors, and streamers, have also been used with minor success in hopes of frightening woodpeckers.

Repeated loud noises, such as hand clapping or banging on garbage can lids, have been used with some degree of success, but it has been suggested woodpeckers are responding to the presence of a human rather than the noise. Other noise-producing automated devices, such as propane canons, have had limited success because birds habituate to the repetitive sound. Although ultrasonic or high-frequency sound-producing devices are marketed as a method for bird control, most birds do not hear in ultrasonic frequency ranges above 20,000 Hz. Studies conducted and published by a number of researchers fail to demonstrate the usefulness of such bird control devices [9].

While scare tactics may work for a period of time, woodpeckers will eventually become habituated with the foreign object or sound, therefore, over time the scare tactics will be rendered ineffective. Any scare strategies that involve sound would likely not be acceptable in distribution areas surrounded by residential homes. Such strategies would also be difficult logistically for geographically large problem areas.

Artificial Nests

An early attempt at woodpecker damage prevention was to attach manufactured nest boxes to utility poles in hopes that woodpeckers would use the ready-made cavities instead of creating their own. Early tests conducted in Europe indicated that as many as 90% of 2,000 nest boxes were inhabited [10]. A very similar approach is still used occasionally by utilities; instead of attaching manufactured nest boxes, sections of a damaged pole, or even the entire pole, are attached or left standing next to the replacement pole in hopes that the woodpecker will return to the old damaged pole. Studies on woodpecker behavior in North America, however, indicate that the creation of a nesting cavity seems to be a critical part of the breeding ritual, and very few woodpecker species have been known to use nest boxes.

Barriers

Another form of mitigation includes the use of barriers. The simplest barrier technique is to drape netting over the target area. While this has merit in an effort to protect an individual's fruit tree or house, it is not practical for a utility pole. A system that uses a similar concept was tested on utility poles but cost, difficulty of installation, and the inherent inaccessibility of the pole to linemen rendered the system ineffective.

Other barrier approaches utilize materials applied directly to the surface of the poles. One approach is to apply a slick-surfaced material (e.g., fiberglass and neoprene solid wraps) making it difficult for woodpeckers to gain a foothold on the pole [11]. A smooth polyethylene material wrapped spirally from the top of a pole to 10–12 ft above the groundline was successfully used in central Louisiana over a 2-yr period to prevent woodpecker damage [12]. With these types of barriers, however, birds may still perch on hardware attachments and drill into the pole. Linemen are also reluctant to climb poles with barriers that may hide pole defects, especially when one considers barriers can trap moisture leading to decay beneath the barrier. In a Missouri study, plastic mesh failed to provide an acceptable level of protection against pileated woodpeckers [13]. Plastic coatings are known to break down by ultraviolet radiation and can be damaged when climbing the pole.

Another barrier approach is to wrap utility poles with a protective layer or steel mesh that a woodpecker cannot penetrate. Wire mesh is the most widely used barrier. The most commonly used mesh is 19-gauge galvanized wire in a 1/4-in mesh pattern. Accounts, however, vary as to the effectiveness of wire mesh in preventing woodpecker damage. In the 1950s, it was reported that the wire mesh protective method was 95% effective in solving the problem, while other reports indicated that damage to poles wrapped in hardware cloth was just as extensive as that of those not wrapped [14]. This inconsistency is probably related to the species of woodpecker. Larger species, such as the pileated woodpecker, require a heavier gauge wire. Heavier gauge wire mesh is more resistant to attack but can be more difficult to install. All wire mesh increases pole conductivity, thereby potentially making them more dangerous to workers. Of all the species, the pileated woodpecker appears to be the one most able to penetrate wire mesh systems. Meshes can be either woven or welded. Because woodpeckers can stretch apart woven strands, galvanized welded wire is preferred.

Repellents

Various studies have been performed to try to identify or develop woodpecker repellents. One study involved the use of colors in an attempt to repel woodpeckers. Utility poles on a portion of a line were painted with four bands of different colors. Results of the study indicated that all of the colored areas were more heavily attacked than the control poles [15].

A wide variety of chemicals have been studied to assess their ability to prevent or limit woodpecker attack. The efficacy of these chemicals has been limited to a large extent by what appears to be a relatively poor sense of taste and smell in most woodpecker species. This is suggested by the propensity of some woodpecker species to nest in southern pine poles that were heavily treated with creosote [16].

However, limited data suggest that ammoniacal copper arsenate and its replacement, Chemonite [ammoniacal copper zinc arsenate (ACZA)], exhibit some woodpecker repellency [17], but the evidence supporting its efficacy is limited. This repellency is believed to either be a benefit of residual ammonia in the wood or in the wood hardness.

To date, no chemical repellents have been developed that have proven to be both significantly effective and environmentally friendly, however, the approach still holds promise as a potentially cost-effective means to successfully mitigate woodpecker damage. It is possible that chemical repellents could be incorporated in initial preservative treatments or applied remedially to poles in service. Currently, the National Wildlife Research Center and EDM International, Inc. are conducting chemical trials with several chemicals in Fort Collins, Colorado, using pileated woodpeckers. Several electric utility industry partners are funding this work.

Alternative Pole Types

Repeated pole attacks in some locations have led utilities to replace wood poles with steel, concrete, or fiberglass structures. Manufacturers have also suggested that glue-laminated wood poles are more resistant to woodpeckers, possibly because the poles lack footholds or because the poles are drier and, therefore, harder. An initial survey of laminated poles located across the United States revealed no evidence of significant woodpecker damage [18]. The results of this survey, however, must be viewed with some caution because laminated poles are not widely used. As such, the lack of damage may reflect the absence of laminated structures in woodpecker-prone regions. Recently, at least one northeast utility has reported woodpecker damage of new glue-laminated poles, suggesting that these structures are not completely immune to damage.

Ecological Control

Landscape fragmentation, human encroachment, agricultural activities, and forestry practices may exacerbate woodpecker-utility structure interactions by limiting natural nesting and foraging areas such as dead trees. Clearing a right-of-way for utility structures may also increase access to food because of increased insect production [6] and opportunities for woodpecker signaling. Poles located in open corridors may act as super-stimuli. In fact, Miller [5] reports food supply, maturity of vegetation, and distances to cover are all positively correlated to nest-site selection of utility poles.

When possible, it is advantageous to increase the availability of suitable natural nest and/or foraging trees to woodpeckers along the utility right-of-way. Danger trees should be topped versus removed, providing alternative nest locations. Many woodpeckers feed on carpenter ants, which often infest utility poles. Accordingly, poles should be inspected and controlled for insect damage. By the time a woodpecker starts foraging on a utility pole for carpenter ants, it is usually a sign that the pole is in need of repair or replacement. In essence, the woodpecker is not creating the damage, but merely pointing it out.

Woodpeckers are very territorial, so when a damaged pole must be replaced, it is advantageous to simply leave the old pole in place, if possible. Leaving the pole will allow the birds to continue using the damaged pole while driving off other nonresident woodpeckers.

Restorative Techniques

Replacement Versus Restoration

Many utility poles are replaced that could potentially be restored at a significantly lower cost [18]. Often, poles are replaced that have sufficient structural capacity even though they exhibit extensive damage. In this case, some minor preventive maintenance to inhibit the intrusion of moisture and decay may be all that is necessary. There are many different factors that determine the effect that woodpecker damage has on a structure. The most obvious is the size, or extent, of the damage. If the extent of the damage on a pole is measured, the remaining section modulus can be calculated, and the remaining bending capacity can be determined. This capacity can then be compared to the design load of the pole, and an educated decision can be made about what maintenance is necessary. The remaining section modulus can be quantified in the field with programs such as the D-Calc program. To quantify the size of such defects, tools such as the Resistograph F300 and F500 can be utilized to detect voids and decayed wood.

Another critical factor that is often overlooked is the location of the damage. Extensive woodpecker damage at a location on a pole that is not highly stressed may not be as significant as minor damage occurring at a location of maximum stress. While structural analysis is necessary to determine stress distributions throughout a structure, the extra effort required to perform an analysis may enable significant maintenance costs to be deferred. This can be accomplished using structural analysis tools such as PLS_POLE to evaluate the percent utilization relative to design capacity at points of interest throughout a structure. To aid the decision-making process, utilities should also develop a training guideline that documents the inspection process and aids the patrolman's judgment.

Structural Void Fillers

If an assessment has determined maintenance is necessary, the most popular maintenance performed in response to woodpecker damage involves the application of void fillers. In order for these fillers to provide strength, they need to bond to wood, be cohesive, and have the ability to transfer load. An important factor in the application of such materials is the effectiveness of the bond between the filler and the wood inside the cavity. If a bond is not developed that can adequately transfer the load between the two materials, the structural performance of the pole cannot be substantially improved and may create an avenue for further woodpecker damage. Foam or epoxy void fillers are used in conjunction with hardware cloth in an attempt to minimize additional damage that may result from future attacks or from the intrusion of moisture and the advancement of decay.

Bulking Agents

Fillers that only serve to fill space and do not have the material properties necessary to restore the structural integrity of a damaged pole are commonly referred to as bulking agents. These products are designed to protect the pole from moisture intrusion and future woodpecker attacks.

Line crews should be made aware of climbing issues related to the use of filler-type repairs and be trained in methods to inspect filled cavities to ensure their safety while climbing in the area of the repair.

Splints and Wraps

Splint or wrap systems are typically utilized when a section of a pole has been extensively damaged and requires complete structural restoration. Splint systems are utilized extensively for groundline restoration of poles and are also used, to a much lesser degree, to restore structural capacity to damaged sections of poles above ground. Wrap systems typically utilize several layers of resin-impregnated fiberglass or composite cloth that are wrapped around a pole, thereby creating a cast that transfers the load across the damaged section. Further technological developments in composite materials and resins and advancements in application techniques are continuing to increase the cost-effectiveness of these types of systems.

Conclusions

Until an effective deterrent for woodpeckers is developed, woodpeckers will continue to damage poles, resulting in millions of dollars of maintenance costs for utilities. Fortunately, there are a number of restorative and preventative techniques to address woodpecker damage. When selecting an approach to mitigate damage, it is critical to evaluate the products and to understand what species is causing the problem. Although valuable advancements are being made in the development of restorative techniques, additional research is needed to enhance current-deterrent techniques. The need still exists for an effective repellent that would provide long-lasting protection for newly installed wood poles and for those already in service. Research leading to the development of an effective woodpecker deterrent would result in annual savings of millions of maintenance dollars for utilities.

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