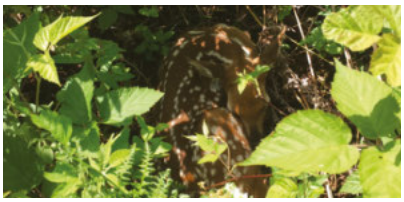
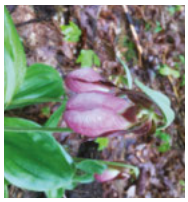
Biodiversity Research

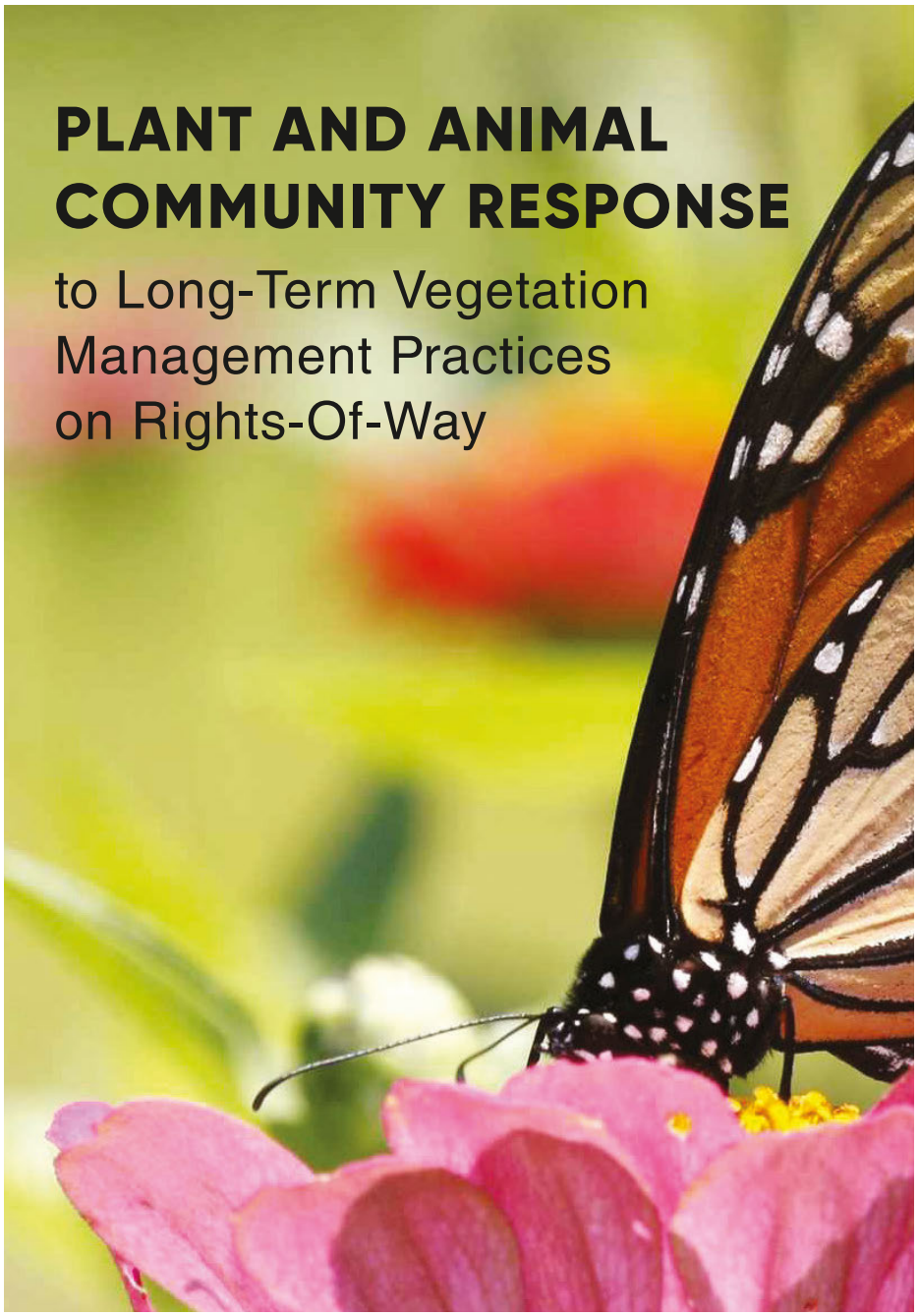
Building Public Trust in Utility Rights-of-Way Management





PLANT AND ANIMAL COMMUNITY RESPONSE

to Long-Term Vegetation Management Practices on Rights-Of-Way

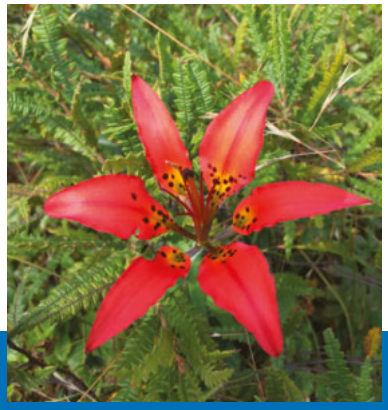


Results of 65 years of ecological research on Pennsylvania electric transmission rights-of-way demonstrate that plant communities can be selectively managed to support reliable electric service and a diverse plant community for wildlife habitat.

CORTEVA™ agriscience

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS



EXAMPLES OF VEGETATION COMPATIBLE WITH WILDLIFE within the electric transmission right of way in State Game Lands 33 Project Area are:

TREES AND TALL SHRUBS (border zone)

Witchhazel, *Hammamelis virginiana*

Bear oak, *Quercus ilicifolia*

LOW-GROWING SHRUBS (both zones)

Sweet fern, *Comptonia peregrina* Blueberry, *Vaccinium spp* Blackberry, *Rubus allegheniensis*

FORBS AND GRASS (both zones)

Rough goldenrod, *Solidago rugosa*

Narrow-leaf goldenrod, *Euthamia graminifolia*

Bracken fern, *Pteridium aquilinum*

Hay-scented fern, *Dennstaedtia punctilobula*

Whorled loosestrife, *Lysimachia quadrifolia*

Poverty grass, *Danthonia spicata*

The Pennsylvania State Game Lands 33 (SGL33) research project in central Pennsylvania began in 1953 in response to public concern—particularly from hunters—about the impact of vegetation management practices on wildlife habitat within electric transmission rights-of-way. Today, SGL33 is the site of the longest continuous study measuring the effects of herbicides and mechanical vegetation management practices on plant diversity, wildlife habitat, and wildlife use within a right-of-way. Similar studies have been conducted at a companion site, Green Lane Research and Demonstration Area (GLR&D), in southeastern Pennsylvania since 1987. Both projects provide invaluable information for understanding the response of plants and animals to vegetation management on rights-of-way.

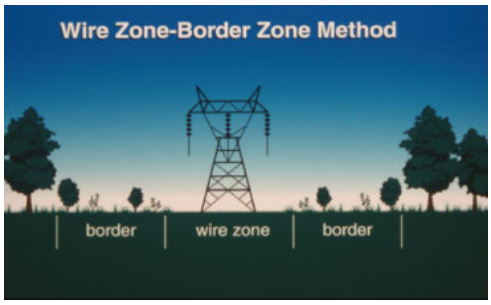
This on-going research is funded cooperatively by Corteva Agriscience™, Asplundh Tree Expert, LLC; FirstEnergy, and PECO Energy Company with researchers at the Pennsylvania State University.

THE ORIGINAL RESEARCH OBJECTIVES OF THE PROJECT REMAIN THE SAME TODAY

1. Compare the effectiveness of commonly used vegetation management practices on controlling trees incompatible with management objectives for right-of-way function;
2. Develop tree-resistant plant cover types; and
3. Determine the effect of vegetation management practices on wildlife habitat and select wildlife species of high public interest.

WIRE ZONE-BORDER ZONE METHOD

Since the mid-1980s a vegetation management approach called the wire zone-border zone has been applied at SGL33 and GLR&D sites. With this approach the zone located directly under the line (wire zone) is managed for a plant community consisting of grass, forbs, and low growing shrubs to minimize re-invasion of tall growing trees and shrubs that could interfere with the power lines. The "wire zone" adjoins a narrower "border zone" of low to mid-size shrubs where the right-of-way meets the natural forest.



This management technique is part of an integrated vegetation management (IVM) approach. IVM is recognized as an industry best management practice and includes a systematic approach which often uses a variety of mechanical, chemical, and/or biological approaches to vegetation management.

LEARN MORE ONLINE, GO TO:

http://sites.psu.edu/transmissionlineecology

• WIRE ZONE-BORDER ZONE METHOD • TREATMENT HISTORY
• FOUNDING RESEARCHERS • REFERENCE LIBRARY • AND MORE!

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS

Researchers began documenting game species such as white-tailed deer and eastern cottontails on treated SGL33 sites in the 1950s, and continue to monitor and measure plant and animal biodiversity within both study areas. From 1982 to the present, there has been a concerted effort to examine wildlife usage of rights-of-way through a series of studies focusing on songbirds, large and small mammals, butterflies, amphibians and reptiles. Key findings from these studies are described below.

PLANT COMMUNITY

KEY FINDINGS

1. Plant communities can be changed with the use of an appropriate herbicide and application method.
2. Vegetation management practices that include the use of selective herbicides result in diverse vegetation that provides forage and habitat for wildlife on rights-of-way.
3. Plant communities can be created that inhibit tree establishment, thereby reducing maintenance costs for utility companies and mitigating the potential for power outage.
4. IVM that combines the use of herbicides with a variety of application methods (e.g., low volume basal bark, hydraulic foliar, etc.) is more effective at limiting incompatible vegetation than mechanical methods (e.g., hand-cutting and mowing) alone.
5. Over 120 species of plants have been documented on the right-of-way project area with plant species richness as high on herbicide-treated as mechanically-treated sites.

When a transmission right-of-way is initially cleared, a short-term decrease in total vegetative cover occurs. Following tree canopy removal, plants that tolerate high levels of sunlight increase in dominance, and tree seeds present in the soil germinate and grow. Thus, follow-up management is necessary to maintain a low-growing plant community to optimize safe and reliable transmission of electricity.

Data collected from SGL33 and GLR&D sites indicate that herbicide treatments to remove incompatible species *(e.g., tall-statured trees)* produce a distinct change in the plant community.

Post-treatment vegetative cover ranges from grasses, to herbicide-tolerant wildflowers, shrubs and small trees. These new plant communities are relatively stable and have diversity that equals or exceeds non-treated areas.

The data also shows that right-of-way vegetation managers can predict cover types and develop the kind of vegetation desired in a particular situation by prescribing appropriate maintenance. Management units that were treated with herbicides alone or in combination with mowing had fewer incompatible trees per acre within the wire zone compared to units with mowing alone or hand-cutting treatments. The diverse plant community created within the right-of-way as the result of vegetation management practices produces a variety of native species important for wildlife food and cover.

BEE POPULATION AND POLLINATION STUDIES

KEY FINDINGS

Bee surveys were conducted monthly for four months on SGL 33 sites following six different vegetation management practices. The practices included the following treatment methods: hand-cutting, mowing, cut stubble, low volume basal, low or ultra-low volume foliar, and high volume foliar.

1. The most diverse communities of native bees were collected from sites where herbicides were used selectively to treat incompatible vegetation versus sites where mechanical methods or non-selective application of herbicides were used.
2. Several species of specialist bees were collected on the right-of-way and include rare species such as the yellow bumble bee (Bombus fervidus) and a rare oil-collecting bee, Macropis ciliata.

With at least 4,000 species of bees in North America, bees pollinate roughly 75% of the fruits, nuts and vegetables that are grown in the United States alone, and conservation of bees has become a worldwide priority.

There are a number of factors leading to the decline in native bee populations, species richness, and diversity, one of the greatest threats is the loss or fragmentation of habitat. There are millions of acres of transportation and power line rights-of-ways in the United States. Routinely managed vegetation within these corridors are and could serve as valuable habitat for native bee species. Understanding the impacts that commonly used vegetation management practices have on bees will allow vegetation specialists to develop improved strategies for promoting native flowering plants and suitable nesting habitat in these spaces.

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS

BUTTERFLIES

KEY FINDINGS

1. Flowering herbaceous plants (forbs/wildflowers) occurring within the right-of-way provide excellent habitat for butterflies.
2. With the exception of hand-cutting, all herbicide and mowing plus herbicide treatments provided habitat for a diverse butterfly community within the right-of-way.
3. The use herbicides on the right-of-way did not have a detrimental impact on butterfly species or total number of butterflies.

Butterflies are important indicators of environmental changes and are barometers of a healthy ecosystem. They are valuable pollinators to many wildflowers and are a food source for songbirds, small mammals, and other wildlife. Habitat loss has caused some butterfly populations to decline nationally.

A two-year study on the SGL33 and a companion study on GLR&D sites compared butterfly populations on hand-cutting units versus herbicide-treated units. Results show that the same or slightly more butterfly species occurred on the right-of-way than in the adjacent forest, and were more common in herbicide-treated units than on hand-cutting units.

A major factor affecting the abundance and diversity of butterflies on the right-way was the presence and use of flowering plants as nectar (food) sources during the growing season. The use of herbicides as part of integrated vegetation management practices promoted a rich wildflower community and habitat that supports a diverse butterfly community on the right-of-way.

BIRD POPULATION AND NESTING STUDIES

KEY FINDINGS

1. IVM provides valuable habitat for early successional bird populations during the spring and summer months.
2. Bird abundance, richness, and breeding productivity was higher on herbicide treated units compared to those that were mechanically treated.
3. Bird abundance, richness, and breeding productivity was higher in shrubby border zones than within the wire zone along rights-of-way. Hence, the border zone is a very important habitat, with its combination of herbaceous, shrub, and tree species.
4. The diversity of native plant species on the right-of-way provides a variety of nest sites for different bird species that depend on early successional habitat for breeding.

Bird populations have been extensively studied on the SGL33 right-of-way since 1982. Anywhere between 31 and 45 different bird species have been noted on the right-of-way during a given year, with the most common being those that nest in herbaceous or shrubby vegetation created by integrated vegetation management practices. Most common species include chestnut-sided warbler, common yellowthroat, indigo bunting, eastern towhee, field sparrow, and gray catbird. Throughout the history of the research conducted along the right-of-way, numerous studies have indicated that proper use of herbicides via integrated vegetation management practices have been beneficial to plant and animal communities. Sections of right-of-way managed using herbicides were comparable or more beneficial to bird communities in terms of abundance, species richness, indices of productivity, and nesting success than sections maintained via mechanical treatments both at the end and during the first breeding season post treatment of integrated vegetation management cycles. In areas treated with herbicides, there were 712 birds observed per day per 100 acres compared to 552 birds on areas mechanically maintained.

Breeding bird productivity can fluctuate quite dramatically from year to year and the presence of border zone vegetation may help to retain birds following extensive management within the wire zone. Nesting success rates have varied along the right-of-way throughout the history of the project with a low of 36% in 2017, 39% in 2002, 49% in 2016, 65% in 2003, and a high of 68% in 1991-92.

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS

BIRD POPULATION AND NESTING STUDIES

For comparison, nesting success was 42% along the GLR&D during 2003-04 and success rates average around 50% for different managed landscapes within Pennsylvania and Maryland. Native plant species including blueberry, blackberry, witch hazel, mountain laurel, hay-scented fern, and poverty grass provided a diversity of vegetative cover and structure within the right-of-way for different bird species that depend on early successional habitat for breeding.

Early successional habitats and components of their ecosystems (e.g., breeding bird communities) are dramatically declining throughout the United States. Properly maintained vegetation within a right-of-way benefits many bird species especially those adapted to brushy, early successional habitat. In the northeastern United States, bird species using early successional vegetation are declining faster than other groups such as forest or wetland birds. Since artificial disturbances not created solely for natural resource conservation now make up a majority (approximately 80%) of early successional habitats, rights-of-way maintained using integrated vegetation management will be vital to and can be used as examples of early successional habitat management for bird conservation.

SMALL MAMMAL POPULATIONS

KEY FINDINGS

1. Small mammals contribute to the diversity of wildlife within a right-of-way.
2. Small mammal population and diversity is greater within the treated right-of-way than the adjacent forest.
3. Cover types that benefit small mammals can be predicted through the implementation of specific right-of-way maintenance techniques.
4. Small mammals use a diversity of cover types from grass to shrub that result from integrated vegetation management on the right-of-way.
5. Small mammals are important in reducing tree reinvasion by feeding on tree seeds and seedlings.

Small mammals are important components of any ecosystem, including rights-of-way. From an ecological perspective, small mammals serve as prey for predators and are major links in the food chain.

A two-year study was conducted on SGL33 to determine relative abundance and species richness (number of species) of small mammals on the right-of-way compared to the adjacent forest. Results of the study showed that eight species of small mammals were noted on the right-of-way compared to only two in the adjacent forest. Five species of mice [whitefooted mouse (Peromyscus leucopus), meadow vole (Microtus pennsylvanicus), red-backed vole (Clethrionomys gapperi), woodland jumping mouse (Napaeozapus insignis), and meadow jumping mouse (Zapus hudsonius)], two shrew species [short-tailed (Blarina brevicauda) and masked (Sorex cinereus)], and a short-tailed weasel (Mustela erminea) occurred on the right-of-way.

The findings of this study and a companion study conclude that specific treatments on the right-of-way produce cover types that benefit small mammals compared to the adjacent forest cover type. In addition, small mammals use a diversity of cover types found on the right-of-way from grass to shrub. Evidently, the right-of-way serves as a large forest clearing, which provides habitat for forest species (e.g., white-footed mouse and woodland jumping mouse) in border zones and habitat for early successional species (e.g., meadow vole and meadow jumping mouse) in wire zones.

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS

DEER POPULATIONS

KEY FINDINGS

1. Integrated vegetation management treatments within the right of way caused a shift in vegetation, but suitability of the habitat for deer remained high.
2. Deer use of woody plants was greater in the adjoining forest compared to the right-of-way where more herbaceous vegetation was browsed.
3. Deer use in the right of way was 48 percent greater than in the adjacent forest.
4. Deer can have a positive impact on a right-of-way by browsing on incompatible trees in wire and border zones, and by providing aesthetic value to a right-of-way.

White-tailed deer (Odocoileus virginiana) habitat and its use were evaluated on the SGL33 right-of-way before and after vegetation management treatments and compared to the adjoining forest. Deer presence increased post-treatment on the right-of-way between 1982 (treatment year) to 1984 (post-treatment). The right-of-way continued to provide desirable habitat for deer following herbicide treatment.

REPTILES AND AMPHIBIANS

KEY FINDINGS

1. Plant diversity and cover type within the right-of-way provided preferred habitat for most reptiles (snakes) and amphibians (salamanders).
2. With exception of the red-backed salamander (Plethodon cinereus), amphibians and reptiles were more common within the right-of-way compared to the adjacent forest.
3. Reptiles and amphibians were more prevalent on herbicide treated units compared to hand-cutting units.
4. Properly maintained rights-of-way do not appear to be a barrier to movement of native snakes.

Forest-management practices, such as clearcutting, can have negative impacts on some species of amphibians and reptiles. A two-year research study of amphibian and reptile populations on SGL33 and GLR&D sites concluded that the right-of-way contained a diverse assemblage of these species. Depending on the location, eight to nine different species were recorded on the right-of-way versus only two recorded in the adjacent forest. The most common species were red-backed salamander (Plethodon cinereus), Jefferson salamanders (Ambystoma jeffersonianum), northern redbelly snake (Storeria occipitomaculata occipitomaculata), and northern ringneck snake (Diadophis punctatus edwardsii). Border zones were valuable habitat to salamanders, whereas wire zones were used most often by snakes. The right-of-way contains a much more diverse community of reptiles and amphibians than the adjacent forest and provides an acceptable habitat for these important species of wildlife.

KEY RESEARCH FINDINGS

PLANT AND ANIMAL RESPONSE TO RIGHT-OF-WAY TREATMENTS

GROUND BEETLES

KEY FINDINGS

A new area of research is focused on ground beetles. The purpose of this research is to evaluate the impacts, if any, of common vegetation management techniques on the diversity and populations of ground beetles.

Ground beetles provide a unique opportunity to understand the ecosystem from the ground up. Ground beetles (Carabidae insect family) are a diverse group of insects with 2,000 species found in North America and more than 40,000 species worldwide. Found on the soil surface in nearly every habitat type, some species are associated with specific types of habitats such as meadows and woodlands. Habitat specificity makes these species useful biological indicators for ecosystem and habitat changes. Ground beetles are an easy assessment tool by also providing biological control of other insects and plant weed species while being a food source for higher animals in the food chain. Populations of ground beetles and diversity further our understanding of integrated vegetation management in power line rights of ways.

Long-term studies conducted on SGL33 and GLR&D sites have shown economic, aesthetic and wildlife habitat benefits associated with IVM practices on transmission line rights-of-way.

This information is critical to help right-of-way managers implement proper vegetation management practices that meet the needs of their industry, the public, and wildlife. Future research will be shaped based on the needs of the utility industry to address conservation issues, new vegetation management techniques, and concerns generated by the public and scientific community.

For details on all of the studies that lead to these finds and for more information, be sure to visit **https://sites.psu.edu/transmissionlineecology/**

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