WILDLIFE RESPONSE TO MORE THAN 50 YEARS OF VEGETATION MAINTENANCE ON A PENNSYLVANIA, U.S., RIGHT-OF-WAY

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Abstract. The State Game Lands 33 Research and Demonstration Project (or the Bramble and Byrnes Study) was initiated in Pennsylvania, U.S., in 1952, which makes this project the longest continuous study documenting the effects of mechanical and herbicidal maintenance on wildlife and plants along an electric transmission right-of-way (ROW). The project has provided hands-on, scientific information on the effects of ROW maintenance for use by the scientific community, public, and utility companies. This paper briefly describes treatments, vegetation, and wildlife studies conducted on this ROW. In addition, the possible impact of highway development on the future of this study is discussed.

Key Words. Herbicides; Pennsylvania; rights-of-way; vegetation; wildlife.

The State Game Lands 33 Research and Demonstration Project (often called the Bramble and Byrnes Study) was initiated Pennsylvania, U.S., in 1952, which makes this 51-year-old project the longest continuous study documenting the effects of mechanical and herbicidal maintenance on wildlife and plants along an electric transmission right-of-way (ROW). This project has provided hands-on, scientific information on the effects of ROW maintenance for use by the scientific community, public, and utility companies. From the start, this project has been interdisciplinary, involving the Pennsylvania Game Commission and the Asplundh Tree Expert Company; other current cooperators are Dow AgroSciences and FirstEnergy Corporation. Researchers on the project have included Dr. Bill Bramble, Dr. Dick Byrnes, Dr. Rich Yahner, Dr. Russ Hutnik, and Mr. Steve Liscinsky (e.g., see Yahner et al. 2003).

The project began in response to hunters' concerns about the effects of herbicides on game species. Hence, the initial objectives of the project, which have continued over the years, have been to (1) compare the effectiveness of commonly used mechanical and herbicidal maintenance treatments on control of target trees and development of tree-resistant plant cover types, and (2) determine the effect of mechanical and herbicidal maintenance on wildlife habitat and selected wildlife species of high public interest. Results of these studies over the years have resulted in numerous publications, presentations, and videos directed at scientists, the public, and ROW managers.

An important feature of this project since the mid-1980s is the creation of a diverse wildlife habitat along the ROW by using a management technique known as the wire zone–border zone method (e.g., see Bramble and Byrnes 1996; Yahner et al. 2002). This method involves two phases: (1) the use of a herbicidal spray or mechanical treatment to initially control the density of target (undesirable) trees, i.e., those that have the potential of growing to a height that is not compatible with safe ROW maintenance, and (2) the development of a tree-resistant plant cover type to reduce tall, target tree [e.g., white oak (*Quercus alba*) or red maple (*Acer rubrum*)] invasion of the ROW. As a result, a diverse wildlife habitat develops on the ROW, with low-lying vegetation in the wire zone and taller vegetation in the border zone. Cover types in the wire zone have resisted invasion by target trees, thereby reducing maintenance costs for utility companies and mitigating the chance of a potential power outage. Furthermore, an electric transmission ROW, if maintained properly via the wire zone–border zone method, not only reduces maintenance costs to utility companies and to customers but also provides aesthetic values.

Six types of treatments (minimum of two replicates of each) are being tested on the ROW, including two mechanical (mowing and handcutting) and four herbicidal (mowing plus herbicide, stem–foliage spray, foliage spray, and low-volume basal spray). Handcutting is used as a reference, which demonstrates how a ROW would appear given basic maintenance without the use of herbicides. Treatments and herbicides used on individual treatments are those used by industry throughout Pennsylvania. Based on data collected in 2000, excellent control of target tree density (< 250 trees/ha) was noted in wire zones of mowing plus herbicide, stem–foliage spray, and foliage spray units; moderate control in low-volume basal spray units (740 trees/ha) and mowing (1,482 trees/ha); and poor control in handcutting units (2,840 trees/ha).

Desirable trees and tall shrubs on the State Game Lands 33 Research and Demonstration Project in both wire and border zones are witchhazel (*Hammamelis virginiana*) and bear oak (*Quercus ilicifolia*). Important low-growing shrubs in both zones on the ROW include a variety of other native species, such as sweet fern (*Comptonia peregrina*), blueberry

(*Vaccinium* spp.), and blackberry (*Rubus allegheniensis*). Common major forbs are rough goldenrod (*Solidago rugosa*), narrow-leaf goldenrod (*Euthamia graminifolia*), bracken fern (*Pteridium aquilinum*), hay-scented fern (*Dennstaedtia punctilobula*), and whorled loosestrife (*Lysimachia quadrifolia*) in wire zones, and rough goldenrod, hay-scented fern, bracken fern, and wild sarsaparilla (*Aralia nudicaulis*) in border zones. The prominent grass in both zones is poverty grass (*Danthonia spicata*).

Over the years, the researchers have noted that State Game Lands 33 ROW wildlife, such as black bear (*Ursus americanus*) and gray squirrel (*Sciurus carolinensis*), feed extensively on the fruit of witchhazel, bear oak, blueberries, and blackberries; white-tailed deer (*Odocoileus virginianus*) browse and graze on blackberry, sweet fern, grasses, goldenrod, whorled loosestrife, and other native plants; and songbird family groups forage extensively in search of insects in the brushy vegetation present on the ROW. Thus, wildlife habitat conditions created by herbicidal application provide abundant sources of food and cover for numerous species.

Especially since the late 1970s and early 1980s, wildlife biologists and the public have shown considerable interest in the effects of habitat management on the so-called "nongame" species of wildlife, such as songbirds (Yahner 2000). Much of this interest began with growing concerns about declines in forest songbirds, which received much press beginning with studies conducted by personnel from the U.S. Fish and Wildlife Service. In response to this interest, researchers involved with the State Game Lands 33 Research and Demonstration Project have made a concerted effort over the past two decades to focus on nongame wildlife research on the ROW. These studies have been published in the *Journal of Arboriculture* for dissemination to use by utility and rights-of-way managers, and results of these studies have been presented to a variety of audiences at conferences and meetings of parties interested in wildlife associated with rights-of-way.

BIRD POPULATION STUDIES

Long-term studies of bird populations are important because many species have shown regional declines, in part due to habitat loss (Yahner 2000). Birds can be indicators of the effects of maintenance on a local ecosystem, such as an electric transmission ROW. Bird populations have been extensively studied on the State Game Lands 33 ROW, beginning in 1982 (Bramble et al. 1992a; Yahner et al. 2002). More than 40 bird species have been noted on the ROW, with the most common being those that nest in brushy or grassy vegetation created by the wire zone–border zone method, such as chestnut-sided warbler (*Dendroica pensylvanica*), common yellowthroat (*Geothlypis trichas*), eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), and indigo bunting (*Passerina cyanea*). Later in the summer, family groups of several forest bird species commonly search for food in the brushy border zones, including black-capped chickadee (*Poecile atricapillus*), red-eyed vireo (*Vireo olivaceus*), and American redstart (*Setophaga ruticilla*). All treatments, with the exception of handcutting, provided valuable habitats for spring and summer bird populations. Overall, the abundance of birds along the ROW was about sevenfold higher than in the adjacent forest. Along the ROW, nearly four times as many birds were observed in the shrubby border zones as in the wire zones. Hence, the border zone is a very important habitat, with its combination of shrubs and a mix of herbaceous and tree species.

A ROW maintained with the wire zone–border zone method benefits many bird species, especially those adapted to brushy, early successional habitats. Incidentally, in the northeastern United States, populations of early successional bird species as a group are declining faster than other groups, such as forest or wetland birds (Askins 2001). Therefore, a properly managed ROW is key to the conservation of birds such as the chestnut-sided warbler or eastern towhee.

NESTING ECOLOGY STUDY

A ROW is a linear habitat that might enable many types of predators to easily hunt these habitats and destroy bird nests located in border or wire zones of the ROW. Thus, researchers on the State Game Lands 33 Project conducted a 2-year nesting ecology study of birds along the ROW (Bramble et al. 1994). Most nests were located in border zones of herbicidal treatments, with relatively few nests occurring in handcutting. Commonly observed nests were those of field sparrow, eastern towhee, chestnut-sided warbler, gray catbird (*Dumetella carolinenis*), and indigo bunting.

Overall, the nesting success along the ROW was 66%, which is relatively higher than success reported in other studies of songbirds (~ 50%), including those conducted in managed forest stands (clear-cuts) in central Pennsylvania (Yahner 1991). Only one of 42 nests was parasitized by the brown-headed cowbird (*Molothrus ater*). Native plant species used frequently by birds as nest sites on the ROW were blackberry, witchhazel, blueberry, hay-scented fern, and poverty grass. Hence, the diversity of native plant species on the ROW provided a variety of nest sites for different bird species that depended on this linear, early successional habitat for breeding.

SMALL MAMMAL POPULATION STUDY

Small mammals are important components of any ecosystem, including a ROW. Many small mammals consume tree seeds and thus play a role in mitigating target tree invasion of a ROW. From an ecological perspective, small mammals are prey of hawks, owls, foxes, and other predators and, therefore, are major links in the food chain.

During a 2-year study of small mammals on the State Game Lands 33 ROW, eight species of small mammals were noted on the ROW compared to only two in the adjacent forest (Bramble et al. 1992b). Five species of mice [white-footed 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 [ermine, (*Mustela erminea*)] occurred on the ROW. Evidently, the ROW served as a large forest clearing, which provided 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.

BUTTERFLY POPULATION STUDY

Butterflies are important indicators of environmental changes and are barometers of a healthy ecosystem. This aesthetic wildlife group adds beauty to a ROW and is valuable as pollinators of many wildflowers and, in the caterpillar stage of their life cycle, serve as food for songbirds, small mammals, and other wildlife. Some butterfly populations have shown population declines nationally because of habitat loss, wildflower loss, and pesticide use.

A 2-year study of butterfly populations was conducted by the researchers on the State Game Lands 33 ROW to compare populations on mechanical units (handcutting) versus herbicidal-treated units (Bramble et al. 1999). Nearly 30 butterfly species occurred on the ROW; among the common species were native species, such as aphrodite fritillary (*Speyeris aphrodite*), little wood satyr (*Megisto cymela*), monarch (*Danaus plexippus*), spicebush swallowtail (*Papilio troilus*), eastern tiger swallowtail (*P. glaucus*), and the exotic European skipper (*Thymelicus lineola*). Butterflies were much more common on herbicidal-treated units than on handcutting units.

A major factor affecting the abundance and diversity of butterflies on the ROW was the presence and use of many flowering plants as nectar (food) sources during the growing season. For example, blueberry and blackberry were present in late May and early June; mountain laurel (*Kalmia latifolia*) in late June and early July; Indian hemp (*Apocynum cannabinum*), spreading dogbane (*A. androsaemifolium*), and meadow-sweet (*Spiraea alba*) in late July and August; and goldenrod in September. Thus, use of herbicides on the ROW had no discernible impact on butterfly populations. Instead, the wire zone–border zone method provided habitat for many wildflower species during the year, thereby enabling a diverse butterfly community to coexist on the ROW.

AMPHIBIAN AND REPTILE POPULATION STUDY

Forest-management practices, such as clear-cutting, can have negative impacts on some species of amphibians and reptiles. These vertebrates are important components of a food chain, with amphibians feeding on many types of invertebrates (e.g., insects) and snakes preying on both invertebrates and small mammals. The decline of amphibians also has become a major conservation issue worldwide.

The researchers conducted a 2-year study of amphibian and reptile populations on the State Game Lands 33 ROW (Yahner et al. 2001). Surprisingly, the ROW contained a diverse assemblage of these species, with nine recorded on the ROW versus only two in the adjacent forest. The most common species were red-backed salamander (*Plethodon cinereus*), northern redbelly snake (*Storeria occipitomaculata occipitomaculata*), and northern ringneck snake (*Diadophis punctatus edwardsii*). As with other wildlife groups studied on the ROW, herbicidal-treated units were much more beneficial than handcutting units in terms of the number of species and abundance of each species. Border zones were valuable habitat to salamanders, whereas wire zones were used most often by snakes. With the exception of handcutting units, the wire zone-border zone method of ROW management afforded an acceptable habitat for many species of cryptic but important species of wildlife.

FUTURE OF THE PROJECT

Long-term studies are very rare today because of funding shortfalls, change in personnel, lack of sustained interest, and many other reasons. However, 50 years of dedicated study on the State Game Lands 33 Research and Demonstration Project have provided scientists, foresters, utility rights-of-way managers, and the public with a tremendous wealth of data. This study, with national and international prominence, has shown that sound habitat management via wise use of herbicides and the wire zone–border zone method of vegetation maintenance creates an aesthetic ecosystem that is very diverse in terms of animals and plants. This method of ROW maintenance also has cost saving to the utility companies, which in turn can be passed on to as consumers of electricity.

Research on the SGL 33 ROW is ongoing and will continue many years into the future. However, it is important to note here that at least a portion (southern) of this ROW, which in fact is the best-studied and visited portion of the ROW (Corridor O Project, www.corridor-o.com), may be destroyed by a major highway linking Port Matilda and Route 80 in the coming years. This loss would be a major one to utility companies, ROW managers, scientists, and the public. Nowhere in the United States has a long-term project of this nature provided the volume of information important to the management of an electric transmission ROW while simultaneously providing aesthetic, wildlife, and economic benefits.

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Résumé. Le Projet 33 de recherche et de démonstration de l'état *(State Game Lands 33 Research and Demonstration Project),* ou l'étude Bramble et Byrnes, a été initié en 1952, ce qui a fait de ce projet l'étude continue la plus longue pour documenter les effets de l'entretien mécanique et avec des herbicides sur la faune sauvage et les plantes à l'intérieur des emprises de lignes électriques de transport. Le projet a permis de fournir des informations scientifiques de première main sur les effets de l'entretien de ces emprises, et ce à l'intention de la communauté scientifique, du public et des compagnies de services publics. Dans cet article, on décrit brièvement les études menées sur cette emprise concernant les traitements, la végétation et la faune sauvage. De plus, on y mentionne l'impact possible sur le développement futur des emprises.

Zusammenfassung. Das Staatliche ‚Game Lands 33, Forschungs- und Demonstrationsprojekt wurde 1952 gegründet, was dieses Projekt zum längsten ununterbrochenen Studium macht, dass die Wirkungen mechanischer und chemischer Erhaltungsmaßnahmen auf die Fauna und Flora entlang von Überlandleitungen dokumentiert. Das Projekt lieferte greifbare wissenschaftliche Informationen über die Wirkung von Pflegemaßnahmen entlang von Leitungen, die für die wissenschaftliche Gemeinde, die Öffentlichkeit und Fachfirmen nützlich sind. In diesem Papier beschreibe ich kurz die Behandlungen, Vegetation und Wildlebenstudien, die hier durchgeführt wurden. Außerdem erwähne ich auch die Zukunft dieser Studie und mögliche Einflüsse auf die Autobahnentwicklung.

Resumen. El proyecto de investigación y demostración State Game Lands 33 (o el estudio Bramble y Byrnes) se inició en 1952, lo cual hace de este proyecto el estudio de mayor antigüedad, documentando los efectos del mantenimiento mecánico y con herbicidas en la vida silvestre y las plantas a lo largo del derecho de vía de las líneas de transmisión eléctrica (ROW). El proyecto ha proporcionado información científica sobre los efectos del mantenimiento del ROW para uso de la comunidad científica, el público y las compañías de servicios. En este reporte describo los tratamientos, la vegetación y los estudios de vida silvestre llevados a cabo en el ROW. Además, hago mención del posible impacto del desarrollo de autopistas en el futuro.