POWERLINE CORRIDOR VEGETATION MANAGEMENT TRENDS IN NEW YORK STATE: HAS A POST-HERBICIDE ERA BEGUN?

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Abstract. Selective use of herbicides has been generally practiced on electric transmission rights-of way since 1980. There is now a utility response to public concern about herbicides and the environment and human health. Currently there is a trend towards using a non-herbicide approach for vegetation management. Brush hogging, grub and seeding, and hand cutting have increased in use over the past decade. If a non-herbicide approach is taken for vegetation management, there could be a loss of wildlife and aesthetic values along the rights-of-way. The purpose of this paper is to evaluate whether a shift is occurring in philosophy in vegetation management on rights-of-way.

A change in vegetation management for electric transmission rights-of-way (ROWs) may be taking place in New York State. A recent trend toward nonherbicide vegetation management on powerline corridors has been observed. This may be a preemptory utility response to recurrent public concern about herbicides and their impact on the environment and human health.

In a 1991 workshop on herbicides and right-of-way management held in Albany, New York, the New York State Department of Environmental Conservation, Office of the New York State Attorney General, and the New York Coalition Against the Misuse of Pesticides expressed concerns about the use of herbicides for right-of-way (ROW) vegetation management (18,35). The Attorney General's Office stated that the utilities should "significantly reduce, and ultimately eliminate, herbicide use for ROW management" (35). Of the 21 invited papers presented at this workshop, none addressed the fact that there could be a loss of wildlife and aesthetic values from a right-of-way if a non-herbicide approach is taken for ROW vegetation management.

The purpose of this paper is evaluate vegetation management histories of ROWs to demonstrate whether this shift in management practice from selective herbicide to nonherbicide may be occurring, and demonstrate that there may be a loss of multiple values associated with this shift.

Methods

A retrospective examination of vegetation management information across New York State was begun in 1991 (28,30). This examination is based on a remeasurement of 70 permanent vegetation measurement plots established in 1975 by the Empire State Electric Energy Research Corporation (15). These plots are located on 21 ROW sites across New York. Management histories of all sites, from initial clearing through 1975, were summarized in 1977 (15). Management histories of all 70 plots were updated in 1991/1992 by contacting the seven utilities in New York State.

Prior to the 1980s, methods of herbicide treatment (e.g., basal vs. stem-foliar vs. helicopter) were commonly reported without documenting a specific herbicide formulation. Therefore, in order to generate meaningful trends in herbicide use, herbicides were grouped within mechanism of action classes (36; see Appendix Table 1). Mechanism of action is the activity of the herbicide within a plant that leads directly to its death (3). Other ROW herbicide formulations not part of the study site histories but used on New York ROWs would be grouped within these classes; therefore, a lack of complete herbicide formulation information does not preclude a general trend analysis of herbicide use.

The evaluation is divided into two sections: initial clearing and post-clearing. Each section outlines trends in treatment mode (nonselective or broadcast versus selective), treatment method, and herbicide use. This division between initial clearing and post-clearing phases is appropriate because there are different objectives for vegetation management and different plant communities

to manage during each phase. Initial clearing is performed prior to or during transmission facilities construction. Mature forests and abandoned agricultural fields at various stages of successional development are common plant communities. Post-clearing is performed the year during or soon after initial clearing, and periodically every one to 15 years thereafter. The plant communities are generally comprised of forbs, shrubs, and short trees in various combinations, depending on past management practice (9).

Only eight of the 21 study sites were treated in the 1990s. In order to improve the accuracy of the 1990s vegetation management assessment, additional information provided by the Niagara Mohawk Power Corporation was incorporated into the evaluation (C. Allen, personal communication). This information includes treatment methods and herbicide use for over 5000 acres of New York ROWs treated in 1991.

An important assumption for this paper is that the 21 study sites are representative ROWs in New York State. Given that there are over 15,000 miles of ROWs in New York, and only 20 miles of ROW were included in this evaluation, this assumption appears tenuous. The sites do represent a wide range of site conditions and past management practice. They were originally chosen to represent all of the utilities, forest regions, and physiographic areas of New York State (15). Additionally, study plots within each site were generally chosen to represent hydric, mesic and xeric conditions (13,15). Average age of transmission lines was 40 years, ranging from 18 to 86 years. Transmission voltages varied from 34 to 345 kV. Since the purpose of this evaluation is to present some generalized trends for management, these study sites are adequate and representative of New York State.

Tables 1 and 2 in the Appendix serve as cross-references of groups, classes, common names, trade names, application methods, and decades of use of ROW herbicides referenced in the paper.

Selected Treatment Definitions. Most of the treatments are clearly defined by name, e.g., cut stump treatment is a herbicide treatment of the cambial area of a plant stump soon after it is cut. Two treatments, brush hogging and grub and seeding, are not consistently defined. Brush hogging is the use of equipment similar to a rotary mower with large fixed or hinged hydraulically driven blades that can cut/shred all vegetation, including woody vegetation up to 4 in diameter. Grub and seeding entails the use of bulldozers with root rakes to remove all woody vegetation from a site, including physical impediments such as boulders, followed by seeding (23). Brush hogging is commonly referred to as "mowing" in various studies and descriptions of operational practice (19). But since this could be confused with the mowing that is done with a grub and seed treatment scheme, it will be referred to as brush hogging in this paper.

Results and Discussion

Management history of electric transmission rights-of-way in New York State — Initial clearing trends.

Treatment Mode. There was no clear pattern for initial clearing treatment mode, although we can speculate that prior to the 1950s a "cut all that is cuttable" (14) approach was likely used. Since then, a more selective approach has been used whereby only tall growing trees are cut.

Treatment Method. From 1906 though the 1950s, hand cutting and bulldozing were prevalent management practices for clearing vegetation on powerline corridors in New York State. With the advent of the phenoxy herbicides in the 1950s, cut stump treatments gained broad use that has continued to the present. However, a trend may be developing for not using herbicides during initial clearing. Hand cutting or some other scheme of mechanical removal, followed one- or two growing seasons later with a selective stem-foliar or basal herbicide scheme, has gained increased use over the past two decades. This approach is a cost effective scheme (1,2,31). It is similar to operational practice in other areas of the Eastern U.S. (17).

Herbicide Use. From the 1950s through the 1970s, 2,4-D and 2,4,5-T were commonly used in mixtures, or 2,4,5-T was used alone, as a cut stump treatment. In the 1970s, Tordon 101™ (a mixture of 2,4-D and picloram) was a common cut stump treatment. Over the past few years,

glyphosate and imazapyr have been used for stump treatment.

Management history of electric transmission rights-of-way in New York State — Post-clearing trends.

Treatment Mode. From the early 1900s through the 1950s, hand cutting and mechanical reclearing were the only management schemes used to maintain ROW vegetation.

From the 1950s to the 1970s, broadcast application of herbicides was commonly used. This approach was viewed as cost effective as compared to treatment schemes used prior to the 1950s. The practice of using helicopters to broadcast spray herbicides was essentially discontinued in the early 1980s due to restrictions associated with a series of State regulations on the use of aerial spraying of ROWs (de Waal Malefyt, 1984).

Since the late 1970s-early 1980s, management of vegetation on powerline corridors in New York State has centered around the selective use of herbicides. This approach follows a nearly 40-yr-old prescription proposed by Egler (12,14) and Niering (26,27). Undesirable plants (tall-growing trees) are selectively removed, fostering the development of relatively stable, low-growing desirable plant communities. This leads to a reduction in undesirable plants over time, and subsequently less management input to maintain the ROW, including less herbicide use (29).

Over the past decade there has been an increase in selective and nonselective mechanical treatments. Six of the 21 sites received either brush hogging, grub and seeding, or hand cutting over the total study area during the past 7 years. Three of these sites were treated with brush hogging or brush hogging followed by grub and seeding since 1990.

Treatment Method. Basal, cut stump, and selective stem-foliar application of herbicides were used in New York since the 1960s, but these selective techniques did not gain widespread use until 1980, when the selective approach for using herbicides became regulation (11). These selective treatments were predominantly used in the 1980s and early 1990s.

Effectiveness of selective herbicide treatment schemes in terms of controlling vegetation is generally the same; however, direct costs are not. In a study on a recently cleared New York ROW, stem-foliar treatment schemes were shown to be more cost effective than basal (2,31). This difference was attributed to relatively high undesirable stem densities during the early post-clearing phase, and to the subsequent higher labor, equipment and herbicide cost for basal treatments as contrasted with stem-foliar. In lower undesirable stem density situations, basal and cut stump treatment schemes may be cost effective alternative for ROW vegetation management (31).

During the late 1980s-early 1990s, there was an increase in the use of hand cutting without herbicides and nonselective mechanical treatment (e.g., brush hogging and grub and seeding) of ROWs. Hand cutting, predominantly used in the buffer areas around wetlands over the past decade, was also used on upland areas on three sites.

Herbicide Use. Herbicides have been prominently used to maintain ROW vegetation since the 1950s. The phenoxy herbicides have been consistently used for the past four decades. Picolinic and benzoic acids were first used in the 1960s (picloram, dicamba) and were expanded in the 1980s with the introduction of triclopyr. Ammate, the only inorganic ROW herbicide, was used in the 60s and 70s. The phenoxy herbicide 2,4,5-T was not used after 1979 due to federal restrictions on its use for ROW management (10). Amino acid synthesis inhibitors were first used in the 1970s (fosamine). During the 1990s, other amino acid synthesis inhibitors (glyphosate, metsulfuron methyl, imazapyr) became commonly used.

Integration of ROW Values

Past vegetation management on powerline corridors in New York State can be categorized into two eras — preherbicide and herbicide (Figure 1). Apparent beginnings of a third era — the post-herbicide era — has been observed these past few years.

In the preherbicide era, from the early 1900s to the 1950s, the objective that guided vegetation management on electric transmission ROWs — economically create and maintain a corridor for the safe and reliable transmission of electricity — resulted in two values, safety and reliability.

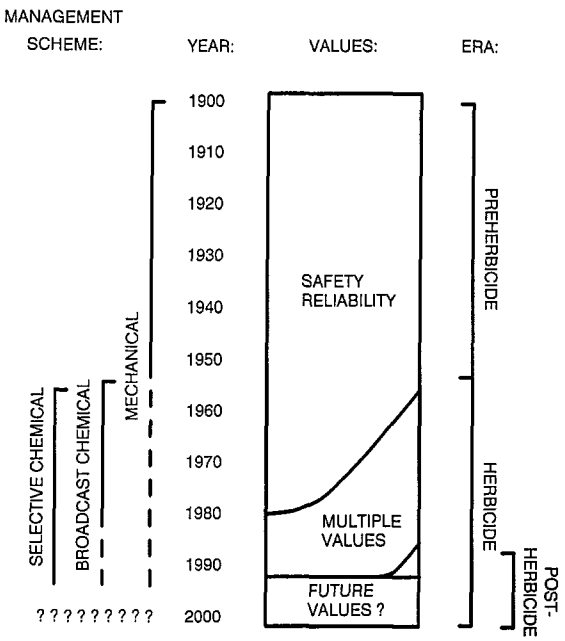

Figure 1. Changes in management schemes, values and eras of powerline corridor vegetation management in New York through the 20th century.

Since the 1950s, herbicides have provided a cost effective tool for achieving safe and reliable transmission of electricity. Herbicides also provided flexibility in terms of achieving corollary sets of values from ROWs, e.g., wildlife (6,7,8,9), aesthetics (21,23), general conservation values (26), and multiple uses (16).

A steady integration of a broader set of values derived from powerline corridors, based on the selective use of herbicides, began in the 1950s and increased in use through the 1980s (Figure 1). In 1980, these multiple values and selective approach to herbicide use were incorporated into New York State regulation (11). These regulations were initiated in response to the broadcast method of applying herbicides, which was viewed by the public as environmentally damaging and cost ineffective (11,14). Since 1980, the principal ROW vegetation management objective has been to remove undesirable plants and promote "the growth of low-growing, relatively stable plant communities that are aesthetically appealing, beneficial to wildlife, compatible with system reliability requirements, and need relatively little maintenance over the life of the ROW" (32 p. 4, Appendix A). A selective herbicide approach was recognized as the "best" approach to achieve these values (11).

A majority of ROWs in New York did receive selective herbicide applications during the 1980s and 1990s. An important trend was that use of the amino acid synthesis inhibitors increased through the 1980s and 1990s. These herbicides have profiles that connote relatively low risk of environmental and human health impacts (4,5,20,34). Their increased use could improve public perception of herbicides, and could lead to a revitalization of the herbicide/multiple value era of right-of-way vegetation management.

Since the late 1980s, a shift away from the multiple use approach to ROW vegetation management back to "safe and reliable" value only approach to ROW vegetation management apparently began in New York State (Figure 1). Increased hand cutting, brush hogging, and grub and seeding of powerline corridors in New York State may indicate a move into a post-herbicide era.

Hand cutting, brush hogging, and grub and seeding are broadcast in nature, similar in effect to the broadcast spraying of herbicides on ROWs during the 50s, 60s and 70s. Broadcast herbicide use resulted in ROWs with low aesthetic and wildlife value (14). Broadcast nonherbicide treatments could also result in a similar loss of these values.

Hand cutting is generally viewed as a selective treatment. However, when viewed over a long time scale, it is more like a broadcast treatment than a selective treatment. Over time, hand cut ROWs become dominated by undesirables through root and shoot sprouting (30). This leads to a uniform undesirable coverage across a ROW, similar to brush hogging (24), and a subsequent need to periodically reclear the total ROW with a concomitant loss of aesthetic and wildlife values.

Summary

Herbicide use has been a prominent part of managing powerline corridor vegetation for nearly 40 years. While treatment mode, treatment method, and herbicides have changed over this

time, electricity transmission has been consistently achieved in a cost effective, safe and reliable manner. Since the 1960s, a selective approach to herbicide use has gradually lead to the consideration of other values from ROWs related to wildlife and aesthetics. It has been assumed that these values are important to the general public. They are currently incorporated into regulation. These regulated values may be lost from ROWs if the trend towards a nonherbicide approach (brush hogging, grub and seeding, and hand cutting) continues and expands.

Public interest for multiple values from ROWs and general concern for herbicides will likely increase in the future. These interests and concerns may create a conflict of vegetation management objectives and the management practices needed to attain those objectives. Herbicides are needed to achieve multiple values. Therefore, either the desired values from ROWs need to be reduced to the original tandem of "safe and reliable", or herbicides will need to be accepted by the general public as a viable tool for ROW vegetation management.

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Appendix

Table 1. Classification of electric transmission right-of-way herbicides by primary mechanism of action.[a]

Growth Regulators:		
Phenoxy acetic acids		
	2,4-D	2,4,5-T
Phenoxy propionic acids		
	dichlorprop	silvex
Picolinic acid and related compounds		
	picloram	triclopyr
Benzoic acids		
	dicamba	
Inhibitors of Amino Acid Synthesis:		
	fosamine[b]	glyphosate
ulfonylureas		
	metsulfuron methyl	
midazolinones		
	imazapyr	
Dessication and Plasmolysis:		
	ammonium sulfamate[c]	

[a] Adapted from Warren (1975) and Ashton and Crafts (1981).
[b] Categorized as an amino acid synthesis inhibitor by Newton and Knight (1981).
[c] As defined by Gangstad (1989).

Table 2. Herbicides used on the 21 study sites over the past four decades for management of vegetation on electric transmission rights-of-way in New York.

Trade name(s)	Common name(s)	Application method	Decade(s) of use
2,4-D	2,4-D	cut stump, stem-foliar conventional bark basal (alone or with 2,4,5-T)	50s, 60s, 70s
2,4,5-T	2,4,5-T	cut stump, stem-foliar (alone or with 2,4-D), conventional bark basal	50s, 60s, 70s
Access	picloram and triclopyr	conventional bark basal (with Garlon 4)	80s
Accord	glyphosate	foliar (alone or withEscort)	90s
	Ammate	ammonium sulfamate stem-foliar	60s, 70s
Arsenal	imazapyr	foliar	90s
Banvel 520	dicamba and 2,4-D	conventional bark basal(alone and with Garlon 4)	70s, 80s
Chopper	imazapyr	low volume basal	90s
Compadre	glyphosate	cut stump	90s
Dacamine 2D/2T	2,4-D and 2,4,5-T	stem-foliar	50s
Escort	metsulfuron methyl	foliar (with Accord)	90s
Esteron	2,4-D and 2,4,5-T	stem-foliar	50s, 60s
Esteron 245	2,4,5-T	cut stump	50s, 60s
Garlon 3A	triclopyr	stem-foliar (with Tordon 101)	80s
Garlon 4	"	conventional bark basal, cut stump (with Weedone CB), stem-foliar (alone or with Tordon 101)	80s
Krenite	fosamine ammonium	stem-foliar	70s, 80s
Krenite S	" "	stem-foliar	80s
Kuron	2,4,5-TP	stem-foliar (with Tordon 101)	70s
Silvex	2,4,5-TP	stem-foliar, cut stump, basal	70s
Tordon 101	2,4-D and picloram	stem-foliar (alone and with Garlon 3A, Garlon 4 or Silvex)	50s, 60s, 70s, 80s
Tordon 155	2,4,5-T and picloram	conventional bark basal, cut stump	60s, 70s
Tordon 10K pellets	picloram	soil	
Tordon RTU	2,4-D and picloram	cut stump	90s

Résumé. L'emploi sélectif des herbicides a été pratiqué de manière générale sous les emprises de lignes électriques depuis 1980. Ceci est une réponse utilitaire à l'intérêt public face aux herbicides, à l'environnement et à la santé humaine. Couramment observe-t-on une tendance vers une approche de non-emploi d'herbicide pour la maîtrise de la végétation. Le rasage des broussailles, le déracinement et l'ensemencement, et la coupe manuelle se sont accrus au cours de la dernière décennie. Si une approche sans herbicide est prise pour la maîtrise de la végétation, il pourrait y avoir une perte de vie sauvage (animale et végétale) et de qualité esthétique le long des emprises. Le but de cet article est d'évaluer si un changement de philosophie se produit dans la gestion de la végétation dans les corridors d'emprise.

Zusammenfassung. Der selektive Gebrauch von Herbiziden wird seit 1980 generell nahe elektrischer Überlandleitungen angewandt. Dies ist eine nützliche Antwort auf die Sorge der Öffentlichkeit über Herbizide, die Umwelt und die Gesundheit des Menschen. Zur Zeit geht der Trend zum Nichteinsatz von Herbiziden in der Vegetationstechnik. Bodenbearbeitung und Aussaat sowie der Rückschnitt von Hand haben sich während des letzten Jahrzehnts anstelle der Herbizide bewährt. Sollte ein Verzicht von Herbiziden in der Vegetationstechnik sich durchsetzen, könnte die Natur und die Ästhetik entlang der Überlandleitungen darunter leiden. Ziel dieser Arbeit ist die Frage, ob die Philosophie der Vegetationstechnik an Überlandleitungen sich verändert.