The Utilization of Integrated Vegetation Management (IVM) for controlling undesirable tall growing woody vegetation, while at the same time promoting the desirable low growing plant communities on electric transmission rights-of-way (ROW) has been proven to be a successful treatment strategy. An overview of the New York Power Authority's (NYPA) program over the past four treatment cycles (1 treatment cycle = 4 years) clearly shows trends that managing for a desirable low growing stable plant community is definitely working. NYPA has collected extensive vegetation management data over the past four treatment cycles which clearly show that managing for a desirable stable plant community has proven effective in balancing the utilities operational, environmental, economic, social, reliability and safety goals. A look at work practices under the auspices of NYPA's evolving IVM program helps explain the success of IVM. IVM is clearly the right choice for managing vegetation on electric utility transmission line ROW. How the astute implementation of IVM performs so effectively will be conclusively demonstrated using data and other evidence from NYPA's successful vegetation management program conducted upon their 2253 kilometers (1400 miles) of high voltage transmission lines over the past 16 years.

Integrated Vegetation Management Works: The Proof is in the Program

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Keywords: Federal Energy Regulatory Commission (FERC), Geographical Information System (GIS), Herbicide, Integrated Vegetation Management (IVM), New York Power Authority (NYPA), North American Electric Reliability Corporation (NERC), Rights-of-Way (ROW), ROW Steward, Sustainability, Transmission Vegetation Management Plan (TVMP), Vegetation management, Best Management Practices (BMPs).

Environmental Concerns in Rights-of-Way Management
11th International Symposium
Jean Doucet (editor)

INTRODUCTION

IVM describes the processes and procedures to manage utility ROW vegetation. This strategy reflects a system approach to vegetation management where this process which balances the use of cultural, biological, physical and chemical controls are integrated together to produce desired, sustainable changes in the managed ROW that are compatible with the environment, economically beneficial and socially tolerable. Employing the processes of IVM ensures that tall growing trees and woody shrubs do not interfere with critically important electric power transmission facilities, which support the safe and reliable transmission of electric power in an economically, ecologically and environmentally sound manner. An overview of NYPA's program over the past four treatment cycles clearly shows trends that managing for a desirable low growing, relatively stable plant community is definitely working. A look at the various best management practices (BMPs) of NYPA's evolving IVM program will help explain the success of this approach to transmission vegetation management. IVM is clearly the right choice for managing vegetation on electric utility transmission ROW.

DESCRIPTIONS

NYPA is the country's largest state public power organization. It operates 16 generating facilities and over 2253 kilometers (1400 circuit miles) of transmission lines (100 kV and higher). In order to ensure the reliability of energy transmission, NYPA must maintain the vegetation growing on or near approximately 6,475 hectares (16,000 acres) of transmission ROW.

NYPA ROW corridors traverse nearly all of the major physiographic areas of New York, including the Erie and Ontario Lake plains, the glaciated Allegheny Plateau, the Adirondack highlands (but not the mountains) and the Catskill Mountains, and the Mohawk, Black, St. Lawrence and Hudson River valleys. These areas are associated with humid, temperate, warm-hot continental climate regimes that broadly support temperate broadleaf and mixed forest vegetation. Northern hardwoods are dominant throughout the State, including maples, birches, beech and cherries. Appalachian hardwoods, including oaks and hickories, dominate in the lakes plains, some river valleys (e.g., Hudson), and along the southern border with Pennsylvania (where the warm continental transitions to the hot continental climate).

NYPA has been in functional operation since the 1950s, whereas legislation for its formation was signed in 1931 (Power Authority Act). The Authority acquired and built its first transmission lines in the late 1950s and early 1960s in association with the construction of hydroelectric generation facilities in the St. Lawrence and Niagara Rivers. NYPA's vegetation management program in the early years was very much disjointed due to both the managerial break down creating six distinct line maintenance centers and the lack of professional resource management staff. These early years, vegetation management was primarily a combination of high volume foliar treatments and mechanical cutting and/or mowing. In the mid 1990's NYPA recognized that numerous issues relating to ROW vegetation management were being handled quite inconsistently from one project to another. In 1996 NYPA put together a team to investigate the causes and ramifications of these lapses in vegetation management. This team was charged with formulating and offering solutions to the problems identified. This team came up with eight suggested changes. They are as follows:

1. Establish a System Forester position,
2. Develop and implement a System-wide Right-of-Way Management Plan for all transmission facilities,
3. Consolidate all transmission maintenance functions system-wide to come under a single source of control,
4. Standardize ROW treatment practices and herbicides throughout NYPA transmission system,
5. Expand the use of specialized ROW contractors,
6. Secure necessary regulatory permits system-wide,
7. Apply appropriate Geographic Information System (GIS) technology to ROW management system-wide,
8. Budgeting of sufficient funds for all proposed ROW maintenance activities.

In 1998 a System-wide Right-of-Way Management Plan was developed and implemented for all of NYPA Transmission facilities and a rigid protocol for performing vegetation inventories was reestablished. These new ROW vegetation inventories were completed in 1998 and were used to precisely define the work to be performed by contractors in 1999. In 2000 a major management reform occurred and the Transmission Business Unit was created that merged all the individual transmission offices into a single completely new operating organization. This included a System Forester to fill the professional resource management staff need.

The policy of the NYPA's ROW vegetation management program is to support the safe and reliable transmission of electric power in an economically, ecologically and environmentally sound manner. The vegetation management strategy that has been adopted by NYPA is IVM. This approach emphasizes the highly selective use of herbicides to completely remove (in so far as practical) all tall growing target species of vegetation from the ROW environs, while simultaneously preserving all other low growing desirable vegetation. This implementation of an IVM program has

resulted in the development of detailed annual work plans requiring treatment of approximately 1,620 hectares per year on a 4-year maintenance/treatment cycle. NYPA's Transmission ROW Vegetation Management Program includes comprehensive site data inventory, mapping and analysis that allows for the creation of specific annual work plans to selectively eliminate and discourage the establishment, growth and development of the non-compatible, tall-growing plant species while at the same time encouraging and promoting a relatively stable and diversified compatible plant community consisting of various low growing species such as shrubs, herbs, grasses, forbs and ferns, thereby enhancing wildlife habitat conditions on the ROW. The ROW Vegetation Management Program also includes a defined and multi-faceted inspection program as well as a framework for defining 'Minimum Clearance Distances' and 'Wire Security Zones' for the continual protection of conductors. NYPA applies the concept of an inviolate Wire Security Zone (WSZ) to determine the minimum appropriate distance to be allowed between the vegetation and the conductors which is maintained at all times. The actual distance of the WSZ is based upon the operating voltage of the transmission facility. This WSZ distance is then applied in the field at the design maximum sag and maximum sway or blow out of the conductors and follows the catenary of the line as viewed in the "as built" plan and profile drawings of the transmission facility. No species of tree or tall shrub is allowed to grow into the WSZ from the floor or side of the ROW.

Every 4 years, NYPA repeats the treatment of ROW vegetation (i.e., NYPA is on a four-year treatment cycle). A normal growing tree seedling will not reach the level of wire security zone within the intervening 4 years. To insure that an aberrant situation does not arise in which a tree (e.g., perhaps a stem skipped or missed during the previous treatment or a tree that was hand cut and not treated with herbicide) grows unabated, three provisions of the Authority's ROW IVM program provide additional protection.

First, the Authority's ROW vegetation management contract technical specifications require 95% control of all target species in the wire security zone by the Authority's contractor. NYPA withholds 10% of the payment to the contractor to insure this complete control objective. The year after the contractor performs the treatment, NYPA personnel inspect the entire ROW once again. The contractor must then remove any living trees found on the ROW before final payment of the withheld money (10%). Second, annual NYPA ground patrols have the dual responsibility of immediately removing (if they are few in number) any tall trees on the ROW that could threaten the wire security zone prior to the next regularly schedules treatment. If there are too many tall trees then the NYPA patrol must identify the trees that must be treated and this hot spotting work will be scheduled to accommodate the most efficient approach to treating those trees. Finally, the year before another entire treatment is scheduled; NYPA performs a detailed ROW vegetation inventory. The Authority's vegetation inventory crews must immediately inform the NYPA Regional Forester of any trees found on the ROW requiring immediate attention.

Since 2001[1] these changes taken collectively as implemented, have completely altered the entire ROW vegetation management program at NYPA. IVM is now universally practiced in a consistent manner throughout the entire transmission ROW system. Tree stem densities are declining noticeably. The average height of the remaining trees is much less than previously. The continuance of a four year treatment cycle will insure that tree heights never become the dominant ROW vegetation management factor. The ROW edge encroachments (large trees left near the edge of the ROW over a number of years) have been pushed back to the legally defined ROW boundary. Tree screens have been dismantled by removal of the tall species. Desirable shrub/scrub plant communities have become well established and work as a biological control. NYPA's IVM program has continued to expand and evolve while still focusing on the strategies identified in the late nineties. These evolutions to the strategies are as follows:

1. The forestry staff was expanded to include 3 regional staff foresters,
2. A detailed comprehensive System-wide Long-Range Transmission ROW Vegetation Management Plan and Program fully compliant with the North American Electric Reliability Corporation (NERC) Transmission Vegetation Management Standard FAC-003-1 was put in place in 2007 and is revised annually,
3. ROW vegetation management is now a major component of NYPA's Transmission Maintenance Organization,
4. The IVM program now has developed procedures and specifications for numerous selective vegetation management techniques including the use of herbicides,
5. Use of qualified and trained line clearance tree contractors is now standard operating procedure,
6. All routine ROW maintenance activities when required are performed under system-wide regulatory permits,
7. GIS is the core tool for performing and documenting IVM, capturing multiple data layers from treatment, landowner, regulatory and LiDAR,

[1]Although IVM control tactics were initiated in 1998, the beginning of a regular 4 year treatment cycles and the collection of a full suite of GIS and other data commenced in 2001.

8. Sufficient budgeting has become a high priority tied to compliance,
9. Documentation, training, compliance and program monitoring/auditing are now key components.

One very important step in NYPA's IVM program is adaptive management and monitoring. Record keeping and data collecting that can produce credible and factual information is certainly a requirement of effective monitoring. Along with making adjustments when disparities are found between desired and achieved results. NYPA felt in order to claim IVM as their vegetation management strategy then monitoring needs to be done on a larger, overall program scale as well. Overall program monitoring has been through the Electric Power Research Institute (EPRI) performance assessment of IVM, an internal ROW Vegetation Management peer comparison study and the recently created ROW Stewardship accreditation.

The EPRI and various cooperators had been developing performance standards that define IVM. These standards are consistent with principles of sustainability, environmental management systems and the actual performance of IVM in the field. Elevated practice of IVM, as defined in the standards, can produce many benefits for the utility. EPRI then offered to perform an Electric Transmission Line ROW Vegetation Management Program Assessment to any program member utilities. In 2008 NYPA became the second utility in the country to participate in this assessment. IVM is both a philosophy and a system of vegetation management on power line corridors. Philosophically, IVM is built on precepts of sustainability and environmental stewardship. As a system, IVM is used as a framework to understand, justify, choose amongst, selectively apply, and monitor different types of treatments, with an overall goal of eliciting site-specific, ecosystem-sensitive, economically-sensible, and socially-responsible treatment effects that lead to refined, sustainable achievement of management objectives. IVM is compatible with Environmental Management systems, bringing full attention to field performance. IVM can be portrayed as a series of component steps. These steps must all be achieved before an organization can claim to be complete practitioners of IVM. Generally, in-depth and sophisticated information gathering, planning, implementing, reviewing, and improving vegetation management treatments and organizations are the key steps to IVM. These steps and some key related elements from Environmental Management systems form the basis of performance standards used in this EPRI assessment of NYPA electric transmission line vegetation management program. A third independent party, a performance standards and certification expert conducted the assessment in concert with a representative from EPRI and personnel from NYPA. NYPA was found to have performed well in all Principles, with opportunities for minor improvements in IVM performance associated with several of the principles. NYPA demonstrated exceptional strengths in nine of the 10 Principles.

In 2012 NYPA's Transmission Business Unit tasked internal resources to conduct a ROW Vegetation Management Study. This group was directed to identify regional Transmission Owners (TOs) whom were willing to participate in the study, develop a list of processes related to the management of monitoring of vendor contracted vegetation management activities to be studied, facilitate the exchange of information with the participating TOs and document the results of the information exchange to be shared with all participants. The study incorporated the results of facilitated interviews with nine TOs from across the Northeast region of the United States. The study was broken into eight distinct parts to allow the unique processes/activities to be separately understood. Additional supporting documents including detailed participant responses and provided supporting documents were included in the report. The eight parts are as follows: 1) overview of vegetation management programs, 2) internal resources and organizational structure, 3) contracting with third parties, 4) landowner management, 5) vendor management, 6) technology, 7) performance metrics/management, and 8) other topics. In summary this study provided valuable insight as to similarities and differences in vegetation programs across the region. The study highlights that all Participating TOs are focused on cost-effective vegetation treatment in accordance with IVM principles environmental stewardship, working with landowners to meet their needs, all while ensuring compliance with numerous and ever-changing regulatory requirements and applicable standards.

Since the EPRI ROW IVM assessment the ROW Steward Accreditation Program has evolved through the auspices of the ROW Stewardship Council. The ROW Steward Accreditation Program grew out of the utility vegetation management industry's commitment to the sustainable practice of IVM, building on a decade of research and development work by the Electric Power Research Institute (EPRI). The ROW Steward Accreditation Program was developed by a diverse group of stakeholders (electric utilities, industry trade groups, environmental NGO's, government representatives, the public, industry suppliers, contractors and consultants). Its purpose is to recognize excellence in the application and practice of IVM on the North American electric power grid. It acknowledges that to fully conduct IVM, a wide array of management components need to be brought together including elements from environmental, economic and social arenas. Additionally, a variety of administrative and institutional processes and procedures are needed in order to sustain IVM operations over time and space. All of these components of management have been brought together as a basis for formal recognition in the ROW Steward Accreditation Program which independently accredits ROW

vegetation management programs for exemplary and sustainable performance of IVM. The ROW Steward Technical Requirements define elements of IVM performance consistent with principles of sustainability and environmental management systems. The requirements feature a series of criteria and indicators that capture the full breadth of a sustainable IVM program that are aligned with American National Standards Institute (ANSI) A300 standards and the companion International Society of Arboriculture Best Management Practices for Integrated Vegetation Management. The Technical Requirements include 10 principles and 32 criteria. To be awarded accreditation, an Asset Manager/Owner must receive a passing score on all criteria.

In 2013 NYPA requested the ROW Steward Council to conduct an audit of its IVM program to determine if it meets the rigorous standards of the Technical Requirements. In summary, the Audit Team determined that NYPA passed all criteria and that in many ways NYPA ROW are a model of sustainable IVM. The overall audit score is 4.4 out of 5.0 indicating performance above industry norms. The Audit Team recommended that the ROW Steward Council recognize NYPA as an accredited ROW Steward. NYPA became the third utility in the country to receive this accreditation. In 2013 NYPA became a ROW Steward Utility Founder.

DISCUSSION

Since the inception of the System-wide Right-of-Way Management Plan in 1998 NYPA's IVM program has matured and continues to grow today. A closer look into the evolution of the strategies will support the concept of sustainable IVM. In 1998 IVM was not a new concept, but to put this practice into place in a very disjointed vegetation maintenance program required time and perseverance. Management of any kind involves making changes to a given system so that it consistently produces a high level of desired values. With a general system-wide management plan in place, focus was shifted to build components of a more robust comprehensive plan and program. Species lists were developed with both desirable and undesirable woody plant species being identified. The overarching goal of this new vegetation management program on NYPA's powerline corridors is to produce vegetation conditions that allow for safe and reliable transport of electricity. The focus for the IVM program was centered on the development of desirable, relatively stable, low-stature plant communities. This was important as the new GIS technology was being molded into the primary tool for the vegetation management program. Criteria for the vegetation management site designation and selection of appropriate treatment techniques were developed. GIS now became the platform to store these vegetation inventory data at the same time being able to capture data as the treatment of these inventoried sites occurred. GIS then becomes a historical data base for NYPA's vegetation management program.

This valuable data collection effort will enable NYPA to accurately track both in real time and for archival purposes a large number of important ROW variables simultaneously in a manner that is site specific yet easily convertible to data aggregations for a big picture viewing. Records are kept over time and various comparisons can be made to show trends in changes in the landscape, characteristics of the vegetation on the sites, species changes in heights and densities, relative efficacy and changes in herbicide rate of applications. One early change recognized and made in the guidelines for vegetation management site designation and treatment recommendations along NYPA ROW's was the change in the density categories of non-compatible species on the site from a three class to a five class designation. The designations were originally High - greater than 7413 stems/hectare (3000 stems/acre), Medium – 2471-7413 stems/hectare (1000-3000 stems/acre), Low – 1236-2471 stems/hectare (less than 1000 stems/acre), with Very Low – 124-1236 stems/hectare (50-500 stems/acre) and Ultra Low less than 124 stems/hectare (50 stems/acre)being added as the ROW target tree stem conditions changes with the application of IVM.

Details of all of the transmission facilities including such items as tower sites, tower types, access roads and routes, stream and wetland crossings, fences, gates, other utilities, etc. are located on GIS. Multiple data layers were also able to be added to the GIS tool. Regulatory layers such as federal and state mapped wetlands, protected streams, critical habitat, threatened and endangered species along with other areas of concern can be added. Tax map information, landowner information along with links to the line easements was also added. Plan and profile drawings were likewise linked to the platform. The newest technology LiDAR is being brought into the GIS tool on a cycle basis as well. One quarter of the system is now being flown each year and recorded using the LiDAR technology. This application is being performed during the QA/QC portion of the treatment cycle. These real time measurements are performed right after all annual vegetation management activities have been completed which provides an instant check to ensure accuracy of the work performed and provides areas to focus attention upon to insure that there are no vegetation conditions that could violate the wire security zone before the next cycle. These data are now captured in an ESRI data collecting program application and are captured in real time on tablets in the field. Another technological tool that is being utilized is a GPS fleet location tool. The vegetation maintenance contractor provides access to their GPS fleet locate program with rights to the NYPA forestry staff to locate all the vehicles on the property. This is used primarily to confirm the location of the crews at all times while they are working on the transmission system.

The vegetation treatments utilized by NYPA were the usual techniques in ROW vegetation management. Basal bark, stump treatment, i.e., cut & treat (CTR), low volume foliar (LVF), stem foliar and ultralow volume foliar are the identified techniques. One unique technique was identified; called LVF and CTR Combination or a Combo site. These two distinctly different treatment methods could be used on the same site in conjunction with one another. The first being CTR method where the non-compatible plant species are mechanically cut and a chemical treatment is applied to the cut surface and the other follow-up is a LVF herbicide application to the foliage of the non-compatible plant species. This treatment combination is used because the target vegetation height is not uniform on many ROW sites and ranges between 0.61 meter (2 feet) to greater than 3.66 meters (12 feet). The non-compatible species over 2.44 meters (8 feet) in the wire zone will be CTR and the remaining lower stature target species in this zone can be treated with the LVF method. Whereas target vegetation outside the wire zone (in the border zone) can be treated up to 3.66 meters (12 feet) with the LVF method and other target non-compatibles above that height will have the CTR method used on them.

It should be noted that the specific ROW treatment technique is initially chosen during the vegetation inventory phase but at the time of application of treatment, the treatment technique may be modified due to conditions observed at time of application. It was also important early to develop a list of herbicide mix rates per treatment techniques as well as to take into account other concerns such as wetlands or pastures. Crews performing the vegetation maintenance work shall utilize a pre-mixed closed loop or a closed container system for their herbicide application operations. This closed system will provide for applicator safety when handling herbicides, reduce mixing errors by the applicators and eliminate disposal of containers. Herbicides shall come to the field in a ready to use formulation or a concentrate formulation. Now both mechanical and chemical methods are used together to produce the desirable low growing relatively stable plant communities as important as the biological and ecological controls of undesirable trees.

As all of this began to roll out in the early 2000's it became very clear how important it was to train and educate the work force in the field. Inspectors and vegetation management crews were trained on the principles of IVM, the goals of NYPA's vegetation management program and their responsibilities and role in this program. With focus on trying to have the ability to utilize herbicides on a nearly 100 percent of NYPA ROWs, the plan was to utilize a herbicide mix that would satisfy multiple site applications including locations in regulated areas (e.g., wetlands) and/or near surface water and wells or other potable water supplies. This mix ended up being a combination of a glyphosate and imazapyr. Rates were determined for the various types of applications. Because this mix is nonselective it became important to ensure that the crew members making the application were knowledgeable in plant identification as they now became the selective tool in the process.

Part of this ongoing training was creating technology education and outreach in support of research and development. This was done through the development of factsheets working with State University of New York College of Environmental Science and Forestry (SUNY ESF). Ensuring that the crew members have a basic understanding of IVM and their role in the program is critical. They are on the front lines where the vegetation management work is going on. They also are the individuals that will interface with landowners. Having knowledge to interact with landowners on a professional basis is a key component.

NYPA was committed in the beginning phase of the new plan that they would take a very active role to meet the requirements of the laws and regulations promulgated concerning landowner notification prior to the application of pesticides. Letters now provide landowners a link to NYPA's transmission vegetation management webpage. Links on this page also provide access to labels of herbicides being used along the ROW. The Authority holds most of its ROW in easement, meaning that the underlying landowner retains title to the land, and the Authority has purchased, or taken by eminent domain, the right to use the land for transmission line purposes and to manage the land in a way that provides for the safe and uninterrupted transmission of electricity. NYPA also recognizes that some landowners have preferences for how their land is managed and take into account concerns raised by landowners during the process of ROW inventory, access and treatment.

Vegetation management on electric transmission lines has become more and more complex over time. The careful and discriminate, highly selective removal of undesirable trees on powerlines is a key element of IVM. This increasing complexity of vegetation management on powerline corridors leads to increased responsibility to continuously acquire new information pertaining to IVM and thereby expand the practice. The IVM system represents the current state-of-art for the management of vegetation on powerline corridors. It guides vegetation management activities and can be used to assign management responsibility and to provide direction in learning more about related subject matters. Today selective treatment applications, including various methods of herbicide usage such as stump or backpack foliar, are primarily used to remove specific undesirable plants such as tall-growing trees. Selective removal of targeted trees allows for the careful conservation of desirable low-growing plants such as grasses, forbs, shrubs and short stature trees. Selective removal of undesirable trees and the carefully fostered development of desirable, relatively stable, low-stature plant communities is

the centerpiece of Integrated Vegetation Management on powerline corridors.

In 2007 a very detailed comprehensive System-wide Long Range Transmission ROW Vegetation Management Plan and Program was put into place. This new TVMP (Transmission Vegetation Management Program) was overdue and also became necessary as a component of the newly created federal standards of NERC FAC-003 Vegetation Management standard which resulted from the 2003 Northeast blackout. This plan and program is now reviewed and updated on an annual basis. This document spells out the organizational responsibility, policy, program goals, procedures and other pertinent areas of the vegetation management program. The original document was very large as it included history, background of IVM, and numerous appendices which were supporting documents. The large document has since been broken into multiple documents, with one main TVMP and multiple supporting documents, all of which are reviewed annually. A Danger Tree Management Plan was also developed to identify, acquire rights to and safely remove trees which are located outside of the ROW but due to their height and condition, pose a threat to the integrity of the transmission powerlines.

One component of NYPA's ROW management program that needed a closer evaluation after the implementation of NERC's FAC-003 Vegetation Management standard and the New York State Public Service Commission's (NYS PSC) June 2005 Order requiring Enhanced Transmission Right-of-Way Management Practice by Electric Utilities was the so called buffer zones on the ROW. The NYS PSC Order stated 'no tree having the characteristics of what has been called a danger tree should ever be permitted to remain on a ROW, including in buffer areas'. Buffer areas, which included road crossings, hedge rows and other types of screens, are now managed to reflect these new requirements. The implementation of IVM greatly reduces the need for screens and at the same time reduces the resources and risks associated with topping these trees in order to maintain them. Fine tuning IVM to dismantle these buffer areas is work necessary to improve the system.

As a result of preparing and updating this detailed TVMP and preparing for a NERC full audit, which occurred in 2010, NYPA developed a ROW Vegetation Management Four Year Cycle Flow Chart. This flow chart describes the four year cycle. The cycle consists of year one - vegetation inventory, year two - vegetation maintenance, year three -follow-up or QA/QC and year four - no work but includes an inspection. NYPA holds a 10% retainage to ensure full herbicide control. Bear in mind that each quarter of NYPA's system should be in one of the four work years listed. This flow chart has been very useful to explain the full vegetation management cycle process to management, regulators and auditors.

NYPA's Management has been involved and supportive since the beginning of the vegetation management program. The number one strategy that was suggested by the team was to establish a System Forester's position. This position now titled ROW Supervisor has become the lead responsible for all NYPA's vegetation management activities. This role became critical in maintaining management involvement. This included but was not limited to educating management about IVM and how it works, detailing a comprehensive annual budgets, work specifications, performance standards, compliance standards on both federal and state levels and operational procedures, as well as implementation of the ROW vegetation management program throughout the NYPA transmission system. Through this involvement with management and detailing the importance of maintaining an IVM program on the transmission system the ROW Supervisor was able to create three Regional Staff Forester positions. These positions began in 2012. Forming a field staff ensured that the day- to- day operations of IVM were being carried out to the detail that the program specified.

In NYPA's first treatment cycle of redeveloping and implementing its IVM program the 2003 Northeast blackout occurred. NERC under the guidance of FERC was looking to put standards into place to regulate utility vegetation management programs. Should NYPA dismiss IVM altogether and just mainly go back to its old ways of just mow or broadcast spray herbicides on the powerlines to insure full reliability. It is understood that removing specific undesirable plants such as tall growing trees allows for the careful conservation of desirable low-growing plants such as the grasses, forbs, shrubs and short trees. NYPA has been creating and maintaining a very plant rich biodiversity on the ROW. Vegetation management influences ROW biodiversity by affecting vegetation, wildlife, water, soil and air. The IVM program that was being implemented on the transmission ROW was creating a balance between maintaining service reliability and biodiversity. By changing and reverting back to an old practice of broadcast spraying or mowing all the vegetation, the vegetation capital of desirable, low-stature plants would be destroyed. As a result the biological control, which is a huge component to the IVM program, would be compromised. Wildlife habitat would be severely disturbed in the short term and negatively modified in the long term. The health and integrity of ecosystems associated with a diverse, native plant and animal communities would be upset. And aesthetics with this rich diverse ecosystem would no longer be as appealing. The NYPA IVM program was working. Clearances were maintained and the system was not at risk. At the same time there is a continuing effort to educate management so that they would not over react to take drastic measures in order to ensure full reliability and strict compliance with the new standards

which only emphasize reliability. The recent use of LiDAR has been an important tool to ensure that Management understands the underlying integrity of the vegetation management program.

Under this IVM system, the goal is to have no individual tree or incompatible plant species allowed to encroach into the WSZ under any circumstances. The process and benefits of using IVM, as practiced by the Authority, is expressed in the following; understanding pest and ecosystem dynamics, setting management objectives and tolerance levels, compiling a broad array of treatment options, accounting for economic and ecological effects of treatments, site-specific implementation of treatments and adaptive management and monitoring.

The vegetation management program implemented by NYPA now has a proven track record that IVM works. The application of IVM over numerous treatment cycles (4) clearly shows that NYPA has achieved this success through continued growth in the following; developed a comprehensive vegetation management system that selectively eliminates and discourages the establishment, growth and development of the non-compatible plant species, while encouraging and promoting a relatively stable and diversified compatible plant community consisting of various assemblages of lower growing species such as short trees, low growing woody shrubs, herbs, grasses, forbs and ferns. This total assemblage of desirable plants inhibits the establishment, growth and development of non-compatible tall growing tree species while enhancing wildlife habitat conditions and promoting other ROW multiple uses wherever they are compatible with the objectives of the Plan. NYPA has developed a process of periodic ROW vegetation inventory and documentation of vegetation management activities to allow for analysis, evaluation and continuous improvement in the overall ROW vegetation management program. It has also ensured the protection of streams, wetlands, rare, threatened and endangered species, and other sensitive environments through the implementation of appropriate protective measures and has maintained a routine site restoration and stabilization program to preserve and retain existing site land use characteristics. NYPA has incorporated the concepts of sustainable management through IVM by balancing work efforts across environmental, social and economic considerations on their power line corridors resulting in an overall positive influence on biodiversity. Finally, NYPA has created a system of information exchange with landowners affected by NYPA transmission facilities and to the extent reasonable and practicable, take into consideration the land use goals and objective of these underlying fee owners, and utilizing new and evolving technology in the various aspects of the vegetation management program. Having this sound and successful vegetation management program becomes critical to the overall business with the trend to put more power down the existing aging infrastructure. IVM is an art and a science which grows, evolves and changes as a management approach.

CONCLUSIONS

IVM is a system designed to promote full consideration of all factors necessary to produce desired vegetation conditions and associated values. There are many environmental, land use, social, financial and administrative factors that must be incorporated to fully execute the IVM system as practiced by NYPA. Although reliability of course takes a very high priority but not at the expense of other critical components of IVM. The proper implementation of IVM requires that the balance of environmental effects be positive to the extent possible while still meeting the primary function of the ROW which is the safe and reliable transmission of electricity. IVM as conducted under the guidance of NYPA works extremely well. Vegetation management on electric transmission line ROW becomes a long-range program. It balances work efforts and effects across environmental, social and economic considerations. NYPA recognized a need for a well-managed vegetation management strategy. NYPA laid the foundation and encouraged the program to mature and evolve over time. As a result of the well-developed IVM program NYPA is without incident or violation since the inception of IVM practices in 1998 and the ROW conditions have improved even more so since the adoption of a four year cycle beginning in 2001. NYPA has been recognized as a leader in ROW vegetation management, due to practicing IVM on their powerline corridors.

REFERENCES

Ballard, B.D., K.T. McLoughlin, and C.A. Nowak. 2007. New diagrams and applications for the wire zone-border zone approach to vegetation management on electric transmission line rights-of-way. Arboriculture and Urban Forestry 33(6):435-439.

Charlton, P.M., and N. Money. 2013. ROW Steward Pilot Audit Report-New York Power Authority (NYPA). Report of the New York Power Authority. Marcy, NY. 60pp.

Deaton, F., and S. Apa. 2012. ROW Vegetation Management Report. Report of the New York Power Authority. Marcy, NY. 47pp.

Electric Power Research Institute (EPRI). 2008. Electric Transmission Line Right-of-Way Vegetation Management Program Assessment Report for New York Power Authority. Report of the New York Power Authority. Marcy, NY. 72pp.

Gorski, K., J. Kooser, L. Payne, and J. Gwozdz. 2015. ROW Vegetation Changes Over Four Treatment Cycles: IVM Controls the Growth of Non-compatible Trees. 11th International Symposium: Environmental Concerns in Rights-of-Way Management. Paper presented in Halifax, Nova Scotia, September 21-23.

Gwozdz, J., L. Payne, J. Kooser, and K. Gorski. 2015. Herbicide Use over Four Treatment Cycles: Proof the IVM Tool is Working. 11th International Symposium: Environmental Concerns in Rights-of-Way Management. Paper presented in Halifax, Nova Scotia, September 21-23.

McLoughlin, K. 2014. Integrated Vegetation Management: From its Roots in IPM to the Present. In G. J. Doucet, ed., 10th International Symposium: Environmental Concerns in Rights-of-Way Management. Paper presented in Phoenix Arizona, Sept. 30-Oct. 3, 2012 (pp. 227-270). Available on-line: http://www.rights-of-way.org/