Integrated Vegetation Management on Pipeline Rights-of-Way: Part One

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Tens of thousands of miles of pipeline rights-of-way (ROW) traverse North America requiring vegetation management from the pipeline industry. Vegetation on pipeline ROW is predominantly managed by mechanical means (i.e., mowing, chainsaws, etc.) to maintain grass or woody plant communities. The potential exists to manage vegetation on pipeline ROW in a similar manner as electric transmission ROW because both experience similar vegetation management issues. Management methods for ROW vegetation management would best be conducted under the auspices of Integrated Vegetation Management (IVM). Applying and adapting the IVM approach used on electric ROW to manage pipeline ROW could lead to significant cost savings, minimize reliance on only one management method as the primary tool of vegetation management, and enhance the ecological conditions of the pipeline plant and animal communities. The benefits of IVM have been realized by other vegetation management industries, most notably electric utilities. Generally, IVM has not been used for pipeline ROW management. A summary of a presentation given at the Environmental Concerns in Rights-of-Way Management, 8th International Symposium, will be presented here in a two-part series.

FERC Compliance

The Federal Energy Regulatory Commission (FERC) requires certain certified compliance procedures for pipeline ROW. FERC requirements concerning revegetation and maintenance of the pipeline ROW can be found in “Upland Erosion Control, Revegetation, and Maintenance Plan” (2003). The FERC policy concerning pipeline ROW vegetation states that:

> "Routine vegetation maintenance clearing shall not be done more frequently than every three years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in a herbaceous state. In no case shall routine vegetation maintenance occur between April 15 and August 1 of any year."

The intent here is to protect wildlife habitat and nesting birds from mechanical cutting procedures. The term “clearing” refers to the physical elimination of the vegetation that obviously can be deleterious to wildlife, especially “ground-nesting” birds associated with the ROW vegetative communities. Other measures (i.e., herbicides) treatments can still be applied between April 15 and August 1 to manage incompatible vegetation on pipeline ROW.

Vegetation Management on Pipeline ROW

A small survey of natural gas companies and their subsidiaries was conducted to gather information about vegetation management on pipeline ROW (Nowak et al., 2002). Survey respondents indicated that more than 80 percent of the vegetation maintenance on their ROW was completed using mechanical procedures and reported that none had any full-time vegetation managers on their staff. The survey reiterated that mechanical methods were the dominant means of vegetation management for most pipeline companies. Mowing or other hand-cutting procedures often result in increasing the numbers of trees and shrubs due to prolific root suckering. It was noted that only about 10 percent of the ROW vegetation management procedures on pipeline ROW involve chemical (herbicide) applications.

Comparison of Pipeline and Electric ROW Construction and Maintenance

Excavation and construction related activities on pipeline and electric ROW can result in the following impacts to vegetation:

- Disruption and/or removal of existing vegetation
- Change in vegetation composition, habitat type, and/or habitat fragmentation
- Disruption of rare, threatened, and endangered plant species and habitat
- Introduction of invasive plant species

Since electric transmission lines are typically not placed underground, the amount of disturbance to the electric transmission ROW vegetation can be less.

The typical pipeline construction ROW of 75 feet generally includes a spoil side, a “working lane” and a “passing lane.” The spoil side is an area near the trench being excavated that holds the excavated material. The “working lane” is comprised of the area where the pipeline sections are welded together and lowered into the trench as shown in Figure 1. Typically adjacent to that region is the “passing lane” which is used for other equipment, inspectors and any other travel requirements. These practices cause considerable impact on pipeline ROW through compacted and exposed soils, and the existing vegetation is either eliminated or greatly disturbed. To prevent trees from establishing in the seedbed of disturbed soil, a herbaceous cover is planted to stabilize the soil and reduce invasion by woody plants.

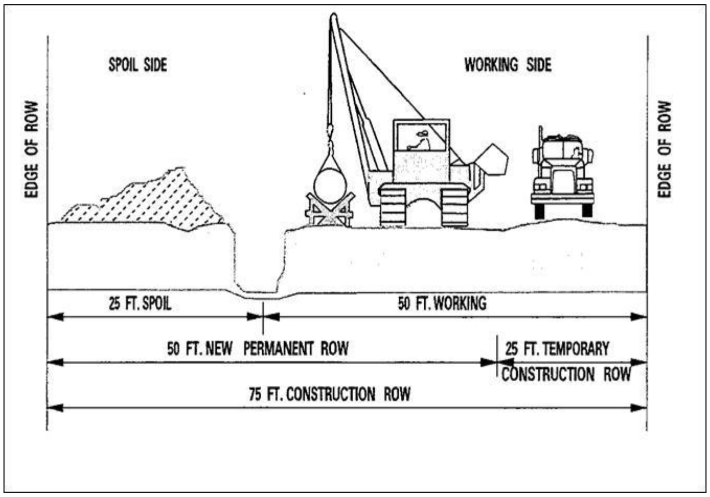

Figure 1: *Typical 75-foot construction right-of-way*

The greatest impacts on electric transmission ROW vegetation tend to occur at the intervals where support structures are installed and wire stringing occurs. Since electric transmission structures are usually spaced several hundred feet apart, there is less exposed soil subject to establishment of incompatible vegetation on their ROW compared to that of pipeline ROW.

Vegetation on electric transmission and pipeline ROW is managed for similar reasons, primarily to provide safe and reliable service. However, safety and reliability can be compromised by different mechanisms. Reliability on electric transmission ROW is achieved by maintaining appropriate distances between vegetation and conductors to prevent grounding. Management of vegetation on both pipeline and electric ROW helps provide access for inspection and maintenance activities. Vegetation maintenance on pipeline ROW is required to facilitate aerial and ground patrol for leak detection and encroachments. For pipeline ROW, being able to distinguish pipeline ROW and surrounding land (Figure2) is a significant issue.

One unique issue concerning buried pipelines is the relationship of tree roots to the safety and integrity of the pipeline. Protective coatings on buried steel pipelines separate the steel from potentially corrosive soil. Cathodic protection is used to direct strong electrochemical potential away from the metal pipe to another buried and more easily corroded “sacrificial anodes”. Root damage to pipeline coatings can occur, especially to coal tar and asphalt coatings. In soils with high resistivity, the cathodic protection system can act to transport water to the pipe-coating interface where it collects. Tree roots may grow along the coating surface. Here the roots can embed themselves into the pipe coating and cause deep grooves within the coating. Generally, tree root damage is associated with segments of the pipeline coating that has lost adhesion with the pipe surface (Nowak 2002). Although not a significant issue, tree roots following the moisture gradient and loosened soil associated with buried pipelines has been documented in the literature.

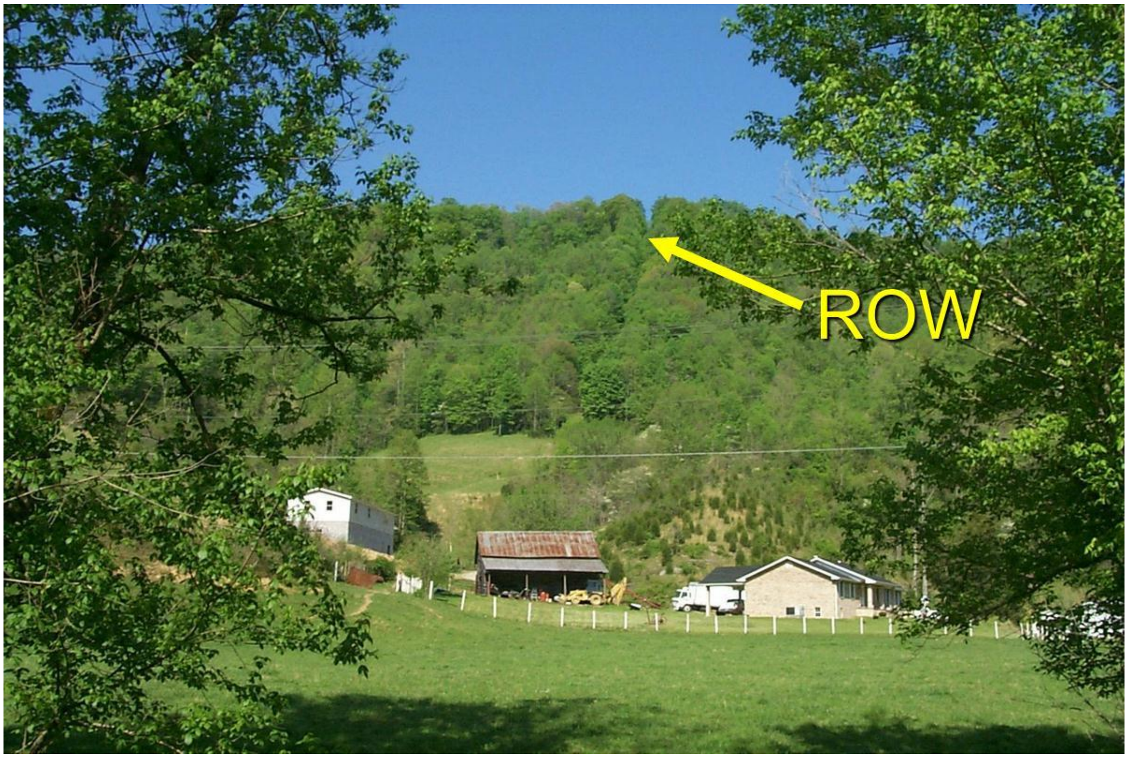

Figure 2. *A 40 year-old pipeline ROW has remained visible through vegetation maintenance.*

Electric transmission ROW and pipeline ROW can both be managed using distinct zones. Many electric transmission ROW are managed using the Wire Zone – Border Zone method (Figure 3). Low-growing vegetation is typically encouraged in the Wire Zone (i.e., under the overhead wires and in the immediate adjacent area). The Border Zone is a transition zone extending toward the edge of the ROW and is managed for taller vegetation. The zone designation used for electric transmission ROW can be applied to pipeline ROW (Figure 4). On pipeline ROW, vegetation could be managed according to where the plant is located on the ROW. Over the pipe zone, forbs and grasses may be encouraged while taller growing vegetation is managed on the edges of a pipeline ROW.

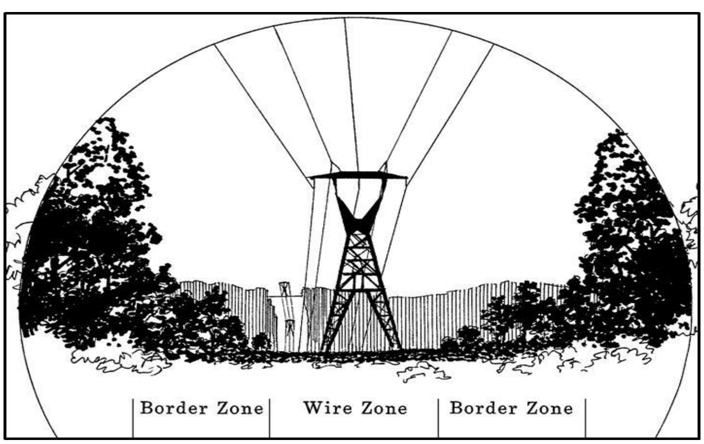

Figure 3. Wire zone-border zone concept for integrated vegetation management on electric transmission ROW.

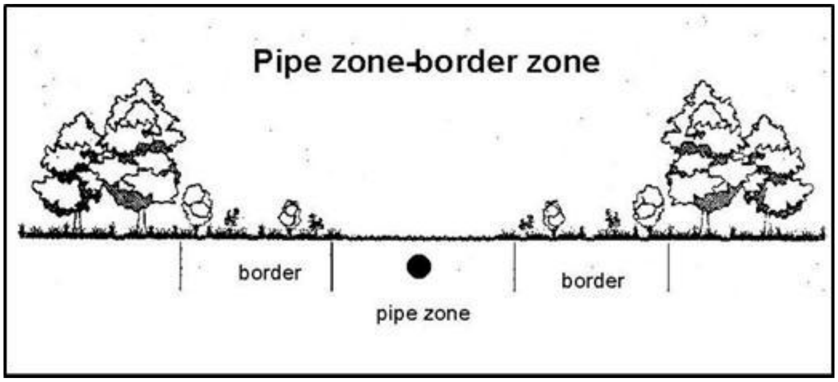

Figure 4. Pipe zone-border zone concept for integrated vegetation management on pipeline ROW (Yahner et al., 1999).

Vegetation management practices on ROW have been shown to provide valuable habitat for many species of wildlife, including game and non-game species, as well as threatened and endangered species. Similar benefits can accrue on gas pipeline ROW. There are many opportunities for pipeline and electric companies to work with public and private organizations to demonstrate that their energy transportation corridors can be compatible with wildlife protection and enhancement programs. Cooperative efforts with wildlife and other natural resource interests, along with a progressive vegetation management program, can provide efficient energy transportation and sound environmental protection.

Since the management issues are fairly similar, the pipeline industry could benefit from the IVM approach used by electric utilities to potentially reduce costs, minimize reliance on only one management method, and enhance the ecological conditions of the pipeline plant and animal communities. IVM is the art of controlling plant populations based on scientific principles, environmental impact(s), anticipated effectiveness, site characteristics, cost-effectiveness, safety, and other factors. Once IVM has been adapted and learned, new knowledge must be demonstrated to industry members and related stakeholders so that the advantages of an IVM program can be implemented industry-wide. Further information about IVM will be presented in part two of this two-part series.

Integrated Vegetation Management, Part 2

IVM is a process for managing plant communities that identifies compatible and incompatible vegetation, examines action thresholds, weighs control methods, and selects and implements controls to achieve specific objectives. The implementation of control methods is based upon the anticipated effectiveness, environmental impact, site characteristics, safety, security, economics, and other factors (ANSI A300 Part 7, 2006). Physical, chemical, cultural and biological suppression treatments for reducing incompatible plant populations to tolerable levels are examined during the application of IVM (McLoughlin, 1997). A part of IVM is to investigate and use treatment options to manage incompatible vegetation that are suitable for the environment, economically feasible and socially tolerable. No one treatment is consistently used to the exclusion of all others. Each management decision is made with full consideration of all treatment options. Implementing the correct treatment options can lead to ecological control of incompatible vegetation. Desirable, stable, diverse, short-stature plant communities are fostered using a combination of treatment methods to minimize the development of incompatible plant populations of tall-growing trees, shrubs, or other undesirable plants. As incompatible vegetation is minimized within the different zones of a pipeline ROW, the need for various treatments — including chemical — is also minimized. Ecological control of vegetation is a key product of IVM. Compatible plant communities are valued not only for economic benefits associated with reduced management effort, but also for various non-commodity benefits, such as providing wildlife habitat and visual values.

The various phases of IVM (ANSI A300 Part 7, 2006 and Miller, 2007) have been described as: 1) define and document objectives; 2) assess field conditions to evaluate the site for planning purpose; 3) set ecological and economic thresholds for incompatible vegetation that indicate a need for treatment; 4) prescribe site-specific treatments based on inventory of the site condition and knowledge of the compatible and incompatible organisms; 5) utilize a diverse array of treatment modes and methods implement IVM; and 6) monitor treatment effects on target and non-target organisms. This last phase of management is critical to IVM. It is the mechanism by which management is improved. When treatment methods work as expected, they are retained for future use without modification. However, when treatments do not produce desired results, the treatments may be altered or abandoned with subsequent modifications made to the IVM system. Vegetation is managed to sustainably produce desired conditions (plant community density, structure and composition) and associated values consistent with management objectives.

Chemical treatments (i.e., herbicides) are an important treatment tool for controlling plant populations in IVM. In most situations, herbicides are recognized as the most effective way of directly controlling incompatible plants. IVM recognizes that herbicides are often the only way to control some plants, due to the fact that many incompatible species cannot be adequately controlled using physical or biological treatments at the level needed to produce desired management effects.

Benefits of IVM on Pipeline ROW

Vegetation on pipeline ROW is managed for low-growing plant communities to: 1) facilitate routine access to the ROW for inspection and testing of the pipe; 2) facilitate aerial patrol of the ROW (enable inspectors to distinguish the ROW from surrounding land); 3) facilitate access for maintenance activities; and 4) potentially provide other values (e.g., wildlife habitat, recreation). Application of IVM could help facilitate long-term sustainability of compatible vegetation to achieve these management objectives on pipeline ROW.

While FERC policy does not allow for physical removal of incompatible vegetation between April 15 and August 1, the use of herbicide treatment during this time frame is acceptable. The IVM process for prescribing treatment options could lead to the application of chemical treatment to manage pipeline ROW throughout the year. In the past, the pipeline industry has largely managed ROW with only mechanical treatment. Using only mechanical treatment on incompatible vegetation pipeline ROW often results in overgrown and difficult to inspect corridors (Figure 1).


Figure 1*. A 50 foot wide pipeline ROW overgrown to width of 30 feet.*

Numerous studies have demonstrated that ROW, when properly managed, can provide valuable habitat for many species of wildlife, including game and non-game species, as well as threatened and endangered species. Two major issues in wildlife management today are habitat loss and fragmentation. One method of changing these trends is to increase linkages among existing habitat patches. Pipeline ROW vegetation management could use IVM principles to create distinct zones of plant communities and serve as linear green ways connecting adjacent blocks of habitat. Many opportunities exist for pipeline companies to demonstrate that their energy transportation corridors can be compatible with wildlife protection and enhancement programs with the use of IVM. Cooperative efforts with wildlife and other natural resource interests, along with a progressive vegetation management program, can provide efficient energy transportation and sound environmental protection.

Natural gas pipeline and electric utility ROW have numerous similarities and differences with regard to alignment planning, construction practices, operational procedures, and maintenance policies. Mechanical cutting can be effective as an initial approach to clearing vegetation on ROW, but the expense, safety, and environmental issues associated with mechanical treatments (e.g., wildlife disturbance/mortality, petroleum hydrocarbon spillage, safety on steep slopes with cutting gear) indicate that more progressive procedures are needed to deal with ROW vegetation issues. Field research on pipeline ROW is needed to further understand how IVM can be adapted to pipeline vegetation management programs, and vice versa. There is significant opportunity to expand the application of IVM principles developed for electric transmission ROW to the management of vegetation on gas pipeline ROW. An addendum to the International Society of Arboriculture's *Best Management Practices: Integrated Vegetation Management* will provide a basis for and discussion of IVM techniques that can be utilized on pipeline ROW. The addendum will be available in 2012. Once learned, new knowledge must be demonstrated to industry members and related stakeholders so that the advantages of an IVM program can be distributed industry-wide. The gas transmission industry stands to gain significant environmental and socioeconomic benefits through the application of IVM.

For more information visit:

Gas Technology Institute (www.gastechnology.org) for the article –
Nowak, C., B. Ballard, P. Appelt, and D. Gartman. (2002). Integrated Vegetation Management of Gas Pipeline Rights-of-Way. Gas Technology Institute, GRI-01/0096. Available as of October 14, 2011, from Gas Technology Institute website http://www.gastechnology.org

Environmental Consults, Inc. (www.eci-consulting.com) for the presentation –
Nowak, C., B. Ballard, P. Appelt, and D. Gartman. (2004). Integrated Vegetation Management of Gas Pipeline Rights-of-Way.

International Society of Arboriculture (www.isa-arbor.com) for the booklet –
Miller, R. H. (2007). Best Management Practices: Integrated Vegetation Management. Champaign, IL: Printec.