

## ROW: Siting, Vegetation Management, and Avian Issues - Program 57

### Program Overview

#### Program Description

As the power grid is upgraded and expanded, safe and reliable operation takes on heightened importance. Efficient, cost-effective rights-of-way (ROW) vegetation management and transmission line siting are increasingly important as the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC) develop new standards. In addition, utilities need to reduce avian interactions with generation, transmission, and distribution (T&D) facilities and protect sensitive species and habitats during ROW construction and maintenance. Utilities also have opportunities to optimize ecological assets associated with new and existing ROWs.

The Electric Power Research Institute's (EPRI's) ROW program provides balanced, cost-effective solutions for addressing economic and environmental challenges associated with siting, developing, managing, and upgrading T&D ROWs. The program offers innovative tools, practical guidance, and state-of-the-art information to help companies control costs and improve service reliability while protecting natural resources and addressing public, other stakeholder, and regulator concerns.

#### Research Value

EPRI's ROW research expedites transmission line siting by reducing costs and ensuring system reliability. The program addresses ecological issues associated with NERC vegetation management standards, reduces ROW maintenance costs, and enhances ecological value through application of integrated vegetation management (IVM). The program also improves a utility's ability to prevent and assess bird strike impacts, enhances ecosystems along T&D ROW, and provides communication materials to help companies communicate with regulators and address public concerns. This research can provide

- constructive engagement on federal oversight and regulation of transmission vegetation management,
- opportunities for proactive environmental management,
- decreased potential for outages and associated fines,
- decreased costs for vegetation management, and
- shorter time frames for siting new transmission.

#### Approach

Program activities include field studies, best-practices surveys, risk assessments, workshops, and technology development and demonstration projects. This program delivers

- opportunities to shape research for the benefit of the public and industry as a whole while conducting research on company-specific needs;
- valuable working relationships with other industry groups, such as the Avian Power Line Interaction Committee, International Society of Arboriculture, Utility Arborist Association, NERC, and federal agencies such as FERC and the U.S. Fish and Wildlife Service;
- continuing support for the international symposia on Environmental Concerns in Rights-of-Way Management;
- IVM field assessments of transmission vegetation management practices to aid utilities in reducing vegetation management costs while addressing environmental and sustainability goals; and
- long-term vegetation management field studies to reduce vegetation management costs and/or address issues identified during an IVM field assessment.

## Accomplishments

EPRI's comprehensive approach enhances T&D infrastructure performance through complementary efforts to prevent vegetation-related outages and to plan and build new capacity that balance economic, environmental, and social goals. EPRI works with regulators and policymakers to fill knowledge gaps, promote sound decision making, inform regulatory deliberations, and incorporate new science into siting and permitting processes. The program also offers a vision for the future, investing in emerging issues and opportunities such as cumulative impact assessment. Program accomplishments include

- commercialization and deployment of the Bird Strike Indicator at utility sites to clarify operational impacts and to reduce financial and criminal liabilities due to avian interactions with facilities,
- analysis of NERC vegetation management regulations to assist utilities with compliance, and
- guidance and informational sources for addressing invasive species on transmission ROWs.

## Current Year Activities

Program R&D for 2010 will focus on providing information on best management practices (BMPs) for invasive plant species. Specific efforts will include the following:

- Several states are implementing or will implement regulations to control the spread of invasive plant species. The BMP manual will provide information to assist utilities in addressing emerging requirements.
- This research will provide information on alternatives to herbicides for transmission vegetation management where herbicide use restrictions are present.
- The research will provide information to help expedite transmission licensing.

## Estimated 2010 Program Funding

\$0.7M

## Program Manager

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## Summary of Projects

Project Number	Project Title	Description
P57.001	Integrated Vegetation Management (IVM)	This project develops information aimed at containing and reducing long-term vegetation management costs for T&D facilities while addressing reliability, regulatory, and environmental concerns.
P57.002	Transmission Siting Integrating National Corridors and NERC Compliance Requirements	The project will first collect and document increased transmission capacity options and their impacts. A workshop will be held to bring awareness of these alternative technologies to staff who are responsible for the environmental process. Alternative approaches on how these options can be incorporated into the Environmental Impact Statement will be presented and discussed. The merits of each approach will be evaluated and the best approach will be recommended.
P57.003	Avian Interactions with Utility Facilities	This research develops information and tools to mitigate avian and bat interactions with utility facilities (e.g., T&D facilities and wind turbines). Avian interactions may cause outages, and avian takes may result in fines and penalties under several federal laws.
P57.004	Reliability Analysis and Mitigation Options of Animal Interaction	This project will develop tools and training to enable utilities to effectively address animal-caused faults and outages as well as to enable sharing between members and industry awareness.
P57.005	Inspection Techniques as Applied to Vegetation Management	This project provides training and information that will help utilities to improve their vegetation inspection approach.

### P57.001 Integrated Vegetation Management (IVM) (101938)

#### Key Research Question

All ROWs are managed with the general goal of providing safe and reliable transport of electricity. ROW managers strive to meet these goals by developing low-growing vegetation that persists over the long term. For most ROW managers, active management is required to create desired vegetation and related environmental conditions. ROW vegetation management represents a major cost for the industry, with individual company costs in the range of \$5–\$20 million per year. Containing and lowering these costs, while maintaining high reliability and enhancing environmental productivity, are important to competitive success of the company and to environmental stewardship.

#### Approach

This research focuses on providing information and tools to ROW managers for the cost-effective management of vegetation, which is the largest recurring expenditure for ROWs. The project

- Continues IVM field research and utility assessments, leading to an industry certification program
- Assesses the impact of NERC vegetation management standards on IVM and ROW ecology
- Assesses the effectiveness of nonherbicide alternatives for vegetation management

#### Impact

- Provides practical IVM guidelines reflecting the latest field research
- Provides information to assist utilities in addressing NERC mandatory vegetation standards
- Reduces vegetation management costs and vegetation-related outages
- Addresses environmental ROW goals
- Enhances corporate environmental stewardship goals

## How to Apply Results

Results from this project will be useful to utility vegetation management and environmental departments. Vegetation managers can apply the information to reduce the cost of vegetation management and the frequency of outages on T&D systems. Environmental managers, in concert with vegetation managers, can apply the information to develop company stewardship goals. It is incumbent upon members to apply the results to meet internal and external needs.

## 2010 Products

Product Title & Description	Planned Completion Date	Product Type
<b>Guidance Manual on the Management of Danger Trees:</b> This manual will provide guidance on the identification of off-ROW danger trees using tree morphology and other techniques to reduce risk of noncompliance with NERC vegetation management regulations and to reduce costs by selective cutting based on the guidance.	12/31/10	Technical Report
<b>Electric Transmission Line Right-of-Way Post-Blackout Vegetation Management Strategies: 2009-2010 Update:</b> This report will provide an update on NERC Reliability Standards FAC-003-1 to provide transmission owners and vegetation managers with a clear understanding of current vegetation management regulations and to provide guidance for creating or modifying vegetation management programs to comply with the standards.	12/31/10	Technical Report
<b>Best Management Practices (BMPs) for Invasive Plant Species:</b> Federal and state governments are focusing attention on the spread of invasive species. This report will provide BMPs to reduce the spread onto and/or off of transmission ROWs of invasive species that pose a risk to indigenous species.	12/31/10	Technical Report
<b>Tree-Conductor Air Gap Spark-Over Distances:</b> This update will describe high-voltage testing of the air gap spark-over distances between growing rooted trees and energized transmission conductors under varying distances, loads, and environmental conditions to define the critical clearance zone to assist in compliance with NERC Reliability Standard FAC-003. This research will be conducted at EPRI's Lenox high voltage laboratory.	12/31/10	Technical Update

## Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<b>IVM Assessments Workshop:</b> This workshop will present results of several IVM assessments conducted with utilities so that other utilities may benefit from assessment results. The workshop will be conducted in a manner to protect the confidentiality of individual utility results.	12/30/11	Workshop, Training, or Conference
<b>Best Management Practices (BMPs) for Nonpoint Pollution from Transmission Rights-of-Way:</b> This report will provide BMPs to reduce nonpoint pollution from transmission ROWs during construction and maintenance to assist utilities in complying with emerging federal and state regulatory requirements.	12/30/11	Technical Report
<b>Safety Manual for Contractor Herbicide Use:</b> It has been observed during IVM assessments that utility contractors may not be fully compliant with herbicide label requirements. This manual will provide guidance on improving the safe use of herbicides commonly used to control vegetation along transmission ROWs.	12/31/12	Technical Report

Product Title & Description	Planned Completion Date	Product Type
<b>Guidance Manual on the Use of Herbicides in Riparian Areas:</b> This manual will provide guidance on the application of herbicides in riparian areas to reduce inappropriate applications.	12/31/12	Technical Report
<b>Cost-Effectiveness of Different Nonherbicide and Herbicide Alternatives for Treating Transmission Rights-of-Way Vegetation:</b> This research will focus on the development of information to support decisions on the selection of treatment options for the control of vegetation along transmission ROWs and to communicate to stakeholders the bases for treatment option decisions.	12/31/13	Technical Report
<b>Carbon Footprint for Transmission Vegetation Management:</b> With the growing interest in global climate change, it is likely that utilities will need to reduce CO <sub>2</sub> emissions at some future date. This research will provide information on CO <sub>2</sub> emissions for commonly used transmission vegetation management practices to support sustainability decisions.	12/31/14	Technical Report
<b>Global Climate Change and Vegetation Dynamics:</b> This research will involve linking regional global climate models with a plant growth model to evaluate changes in vegetation dynamics and to determine cost and other potential effects of global climate change.	12/31/15	Technical Report

## P57.002 Transmission Siting Integrating National Corridors and NERC Compliance Requirements (069222)

### Key Research Question

A comprehensive study is crucial for success in acquiring a license for the construction of a new transmission line. In addition to meeting national corridor and NERC compliance requirements, the applicant must demonstrate due diligence in justifying the new line as the best choice among all other possible solutions, including line upgrades and other increased transmission capacity options.

### Approach

This work is aimed at investigating and evaluating available methods to increase transmission capacity and to provide best solutions that comply with environmental and other regulatory requirements, including public perception, while meeting system needs. The project will

- develop and summarize alternative new-transmission capacity options for different needs,
- propose an approach to assist in the preparation of an Environmental Impact Statement for a new ROW, and
- develop ways to reduce the impact of a new transmission line.

### Impact

- Provides a guide for evaluating increased transmission capacity options
- Provides a tool to justify the need for a new ROW
- Addresses regulatory requirements
- Alleviates public concerns

### How to Apply Results

The method developed under this project will assist a utility in the application of a license for a transmission line ROW. In addition to the current impact evaluations, this analysis will strengthen and form part of the Environmental Impact Statement to be submitted to local and national regulatory agencies for ROW approval.

The analysis will ensure that regulatory requirements are met and that all mitigating measures are evaluated in a systematic and effective manner.

## 2010 Products

Product Title & Description	Planned Completion Date	Product Type
<b>Increased Transmission Capacity Options and Impacts:</b> This workshop will present available increased transmission capacity options in order to make participants aware of these technologies. The impact of each option will be discussed. Possible alternative approaches to complement existing ROW applications will be explored.	12/31/10	Workshop, Training, or Conference
<b>Alternative Approaches Complementing Right-of-Way Applications:</b> Alternative new transmission capacity options for different needs will be summarized. Alternative approaches to assist in the preparation of an Environmental Impact Statement for a new ROW will be discussed.	12/31/10	Technical Update

## Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<b>Technical Requirements for Right-of-Way Application:</b> Alternative approaches complementing right-of-way applications will be presented and discussed. A recommended approach will be explored.	12/31/11	Workshop, Training, or Conference
<b>An Approach Complementing Right-of-Way Applications:</b> Alternative approaches complementing right-of-way applications will be discussed. A recommended approach will be developed to assist the preparation of an Environment Impact Statement authenticating the need for a new ROW.	12/31/11	Technical Report
<b>Available Technologies to Alleviate Public Concerns:</b> The feasibility of adopting available technologies to alleviate public concerns about overhead lines will be discussed. The advantages and disadvantages of each technology will be presented and compared.	12/31/12	Workshop, Training, or Conference
<b>Technical Options to Address Some Public Concerns:</b> Various options that are available to address some of the public concerns about overhead lines will be presented and discussed. The advantages and disadvantages of these options will be compared. Options include technology, design, and material for overhead lines.	12/31/12	Technical Update

## P57.003 Avian Interactions with Utility Facilities (101940)

### Key Research Question

Birds interact with power and communications structures in many ways. Some structures (towers, poles, stacks) and associated ROW habitats can provide favorable sites for nesting, roosting, foraging, and hunting activities of a wide variety of bird species without affecting operations. At the same time, birds are at risk from potential interactions with these structures, including collision (wires, wind turbine blades, towers) and electrocution (transformers, conductor configurations). These and other interactions can result in disruption of service and cause negative effects on bird populations. Adverse effects on certain bird species, such as electrocutions of eagles, may result in fines and penalties. Litigation can be avoided through proactive planning to foster stewardship and reduce adverse impacts on avian populations.

## Approach

This research provides information and monitoring systems to improve understanding and mitigate avian interactions with utility facilities. The project will

- Develop and commercialize the Bird Activity Monitoring System (BAMS), an integrated automatic video-based computer system for monitoring all activities on a continuous basis
- Conduct field trials of the BAMS
- Investigate avian vision perception to develop more-effective mitigation devices
- Conduct a workshop on technology advances in enabling mitigation of avian mortality

## Impact

- Reduces electrical outages
- Determines causes of interactions of birds and other species with utility facilities
- Evaluates the efficacy of mitigation devices
- Reduces liability under several federal laws
- Reduces impacts on avian populations

## How to Apply Results

Results from this project will be useful to utility environmental and power delivery departments to reduce outages and advance stewardship goals for the protection of birds and other federally protected populations. Once development of the BAMS is complete, EPRI will support field testing with interested utilities and others. Upon completion of the field studies, EPRI will commercialize the BAMS for utility use. EPRI will host one or more workshops to convey the results of research on the previously developed Bird Strike Indicator (BSI), the BAMS, and mitigation efficacy studies using both devices.

## 2010 Products

Product Title & Description	Planned Completion Date	Product Type
<b>Bat Interactions with Wind Turbine Blades:</b> This report will explore how to integrate acoustic bat detectors with software controlling wind turbine blade rotation to mitigate bat fatalities. It is known that high-risk periods for bat fatalities occur during low wind speeds when wind turbines are producing little or no electricity.	12/31/10	Technical Resource
<b>Avian Vision Perception:</b> This research will focus on determining the nature of avian vision perception to support the development of more-effective designs for bird flight diverters.	12/31/10	Peer Literature
<b>Bird Activity Monitoring System (BAMS):</b> Work will continue on the development of the BAMS, an integrated, automatic video-based computer system for monitoring all activity (bird, mammal, etc.) at a site around the clock.	12/31/10	Technical Update

## Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<b>Avian Protection Plan Framework:</b> This framework will provide guidance to utilities that wish to develop an avian protection plan.	12/30/11	Technical Resource
<b>Wind Turbine Syndrome:</b> Potential effects of low-frequency vibration on human health are being reported in the literature, and in some cases are being used to support setback requirements for turbines. This paper will summarize current research findings to assist utilities in the permitting process.	12/30/11	Technical Resource
<b>Bird Activity Monitoring System (BAMS):</b> Work will continue on the development of the BAMS, an integrated, automatic video-based computer system for monitoring all activity (bird, mammal, etc.) at a site around the clock.	12/30/11	Technical Update
<b>Workshop on Technology Advances in Enabling Mitigation of Avian Mortality:</b> This workshop will convey the results of the development and deployment of the BSI, the BAMS, and mitigation efficacy studies using both devices.	12/31/12	Workshop, Training, or Conference
<b>Bird Activity Monitoring System (BAMS):</b> Delivery of the BAMS hardware will complete the development of the system. BAMS is an integrated, automatic video-based computer system for monitoring all activity (bird, mammal, etc.) at a site around the clock.	12/31/12	Hardware

## P57.004 Reliability Analysis and Mitigation Options of Animal Interaction (069223)

### Key Research Question

Transmission and distribution assets can experience unknown faults and outages that may be the result of animal interactions. A consistent approach and methodology is needed to confirm that these faults and outages are due to animal interactions, determine the species, and select the most effective mitigation approach. The tradeoffs between different approaches to resolving the issue are also not well defined.

### Approach

This project will develop and document a well-defined approach to investigating animal-caused faults and outages. Such an approach would involve evaluating fault history and comparing against animal behavior, performing field investigations, selecting the best mitigation approach, implementing the approach, and verifying the performance of the selected mitigation method. Deliverables will include reference and field guides as well as training materials (e.g., a DVD). Use studies where mitigation methods have been applied will also be documented so that participants can learn from other experiences. In future years, a workshop will be held to share experiences. A database of available mitigation products and their application will also be developed and updated on an ongoing basis. This will allow participants to stay informed of existing and any new products or technologies.

### Impact

A number of line faults and outages are caused by animal interactions. Identifying the issues and applying the most appropriate mitigation methods will increase system reliability. In addition, by selecting the most appropriate mitigation method, confirming its performance, and ensuring its life expectancy, the life-cycle cost of resolving these issues will be reduced.

## How to Apply Results

Members will be able to utilize the reference, field guides, and training DVD to evaluate animal-caused faults and outages and select the best mitigation method. The case studies and product database will allow participants to be aware of the latest technologies and other utilities' experiences with them. The workshop will enable sharing between different stakeholders and members.

## 2010 Products

Product Title & Description	Planned Completion Date	Product Type
<b>Reference Guide on Animal Interactions with Transmission and Distribution Assets (draft):</b> This first draft will focus on avian interactions with transmission lines. Future versions will include animal interactions with other transmission and distribution assets.	12/31/10	Technical Update
<b>Database on Animal Interaction Products:</b> This electronic database will contain information on animal interaction products and vendors.	12/31/10	Software
<b>DVD on Avian Interaction with Transmission Lines:</b> This product will be a training and resources DVD.	12/31/10	Technical Resource
<b>Field Guide on Avian Issues on Transmission Structures:</b> This product will be an illustrated field guide highlighting possible causes and resulting failure modes.	12/31/10	Technical Update

## Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<b>Reference Guide on Animal Interactions with Transmission and Distribution Assets (draft):</b> Future versions will include animal interactions with transmission and distribution assets other than transmission lines.	12/31/11	Technical Update
<b>Database on Animal Interaction Products (update):</b> This product will provide updated information on animal interaction products and vendors.	12/31/11	Software
<b>Workshop:</b> A workshop will be held for member utilities which will inform utility personnel of the latest approaches and technologies.	12/31/12	Workshop, Training, or Conference
<b>DVD on Avian Interactions with Distribution Assets:</b> This product will be a training and resources DVD.	12/31/12	Technical Resource

## P57.005 Inspection Techniques as Applied to Vegetation Management (069224)

### Key Research Question

As new regulations emerge, utilities and O&M organizations are putting in place more-sophisticated vegetation inspection and assessment programs. These programs often utilize new and emerging techniques, tools, and technologies to improve effectiveness and efficiency. The design of the vegetation inspection program and the tools and technologies vary by utility as a function of the environment, system design, and objectives. This project's objective is to help utilities select the best tools and technologies for their specific situations based on experience from other users and on sound technical information.

## Approach

The following three-phase approach will be taken:

- This project will identify and document all of the currently available inspection technologies that are being utilized by and offered to utilities. The technical specifications for each of the tools and technologies will be provided. Tools and technologies will include ground-based, satellite-based, and airborne systems.
- Utility experience with each of the tools and technologies will be determined. Common pitfalls will be identified so that a new adopter can take appropriate precautions.
- Finally, a workshop will be held where utility personnel can learn about the different tools and technologies as well as share experiences.

Any gaps in the currently available technologies will be identified and may be addressed in research in future years.

## Impact

By being aware of all of the available technologies, their applicability to specific situations, and other utilities' experiences, utilities will be able to select or refine their application of vegetation management tools, techniques, and technologies, thereby reducing their O&M costs and increasing reliability while meeting the required standards. In addition, gaps and opportunities for future development of technologies will be identified. These gaps may be addressed by vendors or by EPRI together with partners.

## How to Apply Results

By utilizing the report and attending the workshop, utilities will be able to refine their vegetation management inspection practices.

## 2010 Products

Product Title & Description	Planned Completion Date	Product Type
<b>Current Vegetation Inspection Practices, Tools and Technologies:</b> This report will document existing inspection practices, tools, and technologies and will also document utility experience	12/31/10	Technical Update
<b>Workshop on Vegetation Management Inspection Tools and Technologies:</b> This workshop will highlight vegetation management inspection tools and technologies and act as a forum for utilities to share inspection practices.	12/31/10	Workshop, Training, or Conference

## Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<b>Report Documenting New Tools and Emerging Technologies:</b> This report will document existing inspection practices, tools, and technologies and will also document utility experience.	12/31/11	Technical Update
<b>Current Vegetation Inspection Practices, Tools and Technologies As Well As Utility Experience:</b> This report will document current vegetation inspection practices, tools, and technologies as well as utility experience.	12/31/11	Technical Report
<b>Demonstrate New Available Technology:</b> The best available technology will be demonstrated at member sites.	12/31/12	Technical Resource