Rights-Of-Way (ROW) Environmental Management: New ROW Development and Existing ROW Maintenance

WM-114621

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Workshop, December 1999

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1. INTRODUCTION

Description of the workshop

During October 27-29, 1997, the Electric Power Research Institute (EPRI) and the Empire State Electric Energy Research Corporation (ESEERCO) sponsored a workshop on "Rights-of-Way (ROW) Environmental Management: New ROW Development and Existing ROW Maintenance." The workshop convened a broad spectrum of experts representing electric and gas utilities, government, and academia to help EPRI and ESEERCO assess the need for a program of environmental research on ROW development and management, and to develop a research agenda, as appropriate.

Motivation for the workshop

The development and management of transmission and distribution (T&D) rights-of-way (ROW) by electric utilities are guided and constrained by Federal and state policies and regulations to protect the environment. These address esthetics and routing issues, environmentally-preferred construction practices, and ecological concerns related to vegetation management practices. In their efforts to comply with these regulations, electric utilities are seeking the most cost-effective ROW practices, which, at the same time, demonstrate stewardship of the environment. Mandated transmission access and the growth of competitive markets are causing pressures on capital and operational and maintenance budgets for T&D ROW systems. At the same time, the competitive market will demand high quality and reliable T&D service, and may, therefore, create incentives for new, and/or, upgraded transmission facilities.

Balancing cost, reliability and environmental protection is a major challenge for the industry. To remain competitive in the face of these multiple challenges, electric utilities need information and tools to cost-effectively address environmental concerns related to the development of new ROWs and upgrades, and for the management of existing ROW systems. It is through new research and synthesis of what has been learned through experience that the information and tools needed for these purposes will become known.

Objectives for the workshop

The workshop was held to assess the need for a program of environmental research on ROW development and management, and to develop a research agenda, as appropriate. This workshop built on 1993 and 1996 EPRI meetings, and on the 6th International Symposium on Environmental Concerns in Rights-of-Way Management held in February, 1997. If the need for an environmental ROW research program is established, EPRI intends to announce the program in the EPRI Environment Group's Progressive Flexibility 1999 Solicitation. This Solicitation is published in the Spring of 1998. Note that subsequent to this workshop, EPRI announced a new ROW Target in the Spring 1998 Solicitation; Target 106 Rights-of-Way Environmental Development and Management. The Target number changed to 43 for the Spring 1999 Solicitation. Call 1-800-313-3774 concerning Target membership and John Goodrich-Mahoney at 202-293-7516 (jmahoney@epri.com) for information on the Target.

Organization of this proceedings

This document is organized in several sections, which will be discussed here. Section 1 comprises this introduction. Section 2 describes the workshop process, which led to the development of a ranked listing of research topics. Section 3 sets out the results of the workshop, which is a ranked listing of research topics, with discussion. Section 4 is made up of four appendices. For those who wish to delve into the details of the workshop process and deliberations, Appendices A and B provide this information. Section 4 also contains a listing of additional research topics developed by the participants, but not discussed, the workshop agenda and the registration list.

2. WORKSHOP PROCESS

The workshop was organized into two distinct sessions, one on ROW development and one on ROW maintenance. Each session was conducted identically, and was held over a one day period. At the outset, a plenary session of all the participants was held at which a technical chair provided a list of four broad research topics or areas. Discussion was entertained on these topics, and the participants either accepted the research topics, as proposed, for further focus group discussions or made changes and adopted the changes through a consensus process. Each of the research topics was discussed in concurrent breakout session groups in which the research topics within each area were better defined. Each group was assigned a color code to facilitate evaluation of their output and the results of the subsequent priority setting exercises.

After discussion, a second plenary session was held at which the chairs of the breakout session groups gave presentations on the results of their respective sessions and answered questions to clarify the results. The results (i.e., problem areas and research topics) of all the sessions were ranked by each participant to develop a prioritization. The top-ranked research topics (there were five for ROW Development and eight for ROW Maintenance) were selected for further refinement by the session group that did the initial identification of the research topics. The purpose of the refinement was to incorporate suggestions from the plenary session, and to identify more specifically information needed to help solve the problem through research. As a final step, a third plenary session was held to establish a prioritization of the top-ranked research topics.

3. WORKSHOP RESULTS

Introduction

This section presents the results of the workshop. For each of the sessions, the top-ranked research topic or area is discussed in priority order. The identified information needs establish the bases for potential areas of ROW research. At this time, no effort has been made

to combine or synthesize similar research topics identified during the individual sessions. EPRI will undertake a synthesis during the development of a research program.

ROW DEVELOPMENT

A total of eleven research topics or areas was identified by breakout session groups. Each participant was provided with 12 votes, which were used to identify the research topics of highest priority. Based on this priority setting exercise, the top five research topics were selected for further refinement by the group that initially identified each of the eleven research topics. Following is a discussion of the top five research topics. Note that research topics 10 and 11 were combined into the high priority research topic 5.

ROWD - 1: Develop a Siting Manual

Review and research existing practices for planning and siting of utility ROWs. Define and describe the interrelationships among risk management, life-cycle costs, system reliability factors, engineering parameters, public perception and environmental siting constraints and considerations in the development of new ROWs. Prepare a document, which synthesizes and summarizes what is known about these various aspects of siting new ROWs.

ROWD - 2: Develop Communications and Training Materials

Develop a series of brochures addressing specialty topics (e.g., siting of rights-of-way, herbicide use, construction, etc.) for distribution to the public and non-technical audiences. Develop a curriculum for regional workshops for industry and regulatory audiences. Participation at these workshops should include representatives from electrical engineering; civil engineering; mechanical engineering; environmental and ROW managers; and the staff of real estate developers.

ROWD - 3: Define Impacts of Access Road Construction at Stream Crossings and Through Wetlands

This research effort is a comprehensive evaluation of all regulatory issues (including a critical evaluation of all mandated best management practices (BMPs)), cost implications, environmental concerns and constructability parameters in relation to the development of the transmission line access road/route system in the vicinity of water bodies, i.e., streams and wetlands.

ROWD - 4: Danger Tree Assessment and Management Techniques

Define the physical limits of the danger tree zone for different voltage levels for transmission and distribution lines by eco-zone/region.

Survey practitioners and examine literature and other pertinent data sources and develop methodologies to identify danger trees in an accurate and cost effective manner by eco-zone/region. This research study should also reveal effective practices for quickly

locating and assessing danger trees in the field. Determine which utilities are using (or could use) the techniques listed below:

Satellite imagery/remote sensing;
GPS for determining locations and heights of trees and conductors;
Laser/radar 3-dimensional imagery;
Ground truthing;
Aerial photography/mapping;
GIS database layers for mapping vegetative communities, environmental and other sensitivities, growth influence factors and danger tree locations; and
Other applicable available and emerging technologies.

Develop a model that relates line outage costs to costs of maintenance. The model would including danger tree removal to enhance reliability, and would provide the basis for determining the optimal maintenance level/cost for an acceptable level of risk by eco-zone/region. This model should include such factors, as follows:

Cost of danger tree outage;
Location on the ROW;
Species;
ROW width;
Probability of failure;
Distance to conductor;
Cost of remediation;
Tree growth regulators (location, species, distance to conductor);
Tree trimming (location, species, distance to conductor);
Herbicide applications (location, species, distance to conductor); and
Definition of the risk relationship between ROW width and voltage levels and line congestion for transmission and distribution lines, and recommendation of the acceptable level of risk.

Survey and describe effective practices for use during construction for danger tree removal from ROWs and treatment to prevent their recurrence by eco-zone/region.

ROWD - 5: Transmission Line Impacts on Ecosystems

Compile and assess available information, practices and methodologies for defining transmission and distribution potential impacts, including identification of data needs for the following:

Biodiversity;
Habitat fragmentation;
Watershed management;
Wetlands;
Migratory birds, including waterfowl; and
Wildlife compatibility with ROW conditions.

Deliverables should include a report on each subject, with case studies and prioritization of research needs. Carry out follow-up research in areas of identified data deficiencies. Develop tools to quantify potential ecological impacts. Determine appropriate compensation and/or mitigation for identified and quantified impacts. Resulting reports should include assessment of current compensation practices and development of new approaches to compensation. Other products from this research effort should include the development of tools for decision analysis, consensus building, and ecosystem trading. Curricula for workshops with stakeholders could also be developed.

ROW MAINTENANCE

A total of 21 research problems with 20 distinct research areas were identified by the four breakout session groups. Each panelist was provided with 12 votes, which they could use to identify the research areas of highest priority. Based on this priority setting exercise, the top eight research areas were selected for further refinement by the group that did the initial identification of each of the 20 research areas. Following is a discussion of the top eight research areas. Note that research areas 1 and 9 both received the same level of priority (priority 7).

ROWM - 1: Synthesize What Is Known About the Effects of ROW Maintenance on the Environment

This group was originally assigned two research areas for refinement after the initial prioritization exercise. One area dealt with a wide variety of environmental effects resulting from ROW maintenance activities. The second research area was much narrower, focusing just on biodiversity. On further analysis the group decided to incorporate the biodiversity issue into the broader environmental effects research area. Thus original research areas #12 and #9 are now combined into research area #12 (see Appendix B).

This research area, while addressed in the context of ROW maintenance, could easily be expanded to include line construction and reconstruction as well. The array of topics includes impacts on the environment such as wildlife, ecological values and processes, soil and water, and biodiversity. The impacts on visual and cultural values, agricultural operations and other land management strategies should also be included. The subjects to be addressed include cost/benefit analysis, impacts on business, the importance of the topics to the public, to regulatory agencies and to environmental and other special interest (consumer) groups. The product(s) of this research area are anticipated to be a synthesis and analysis of what is known, based on published literature, and professional experiences. The product(s) are envisioned as a series of technical reports for utility specialists, regulatory professional staff and the interested lay public The products should also identify conclusions and critical information gaps, the later as a basis for possible future research efforts.

A communication plan (technology transfer agenda), on how the information acquired in this effort can be more widely disseminated needs to be included. It is likely that different synthesis products will be needed for these various audiences, but it is essential that there be a

detailed synthesis prepared first, and that this primary all inclusive document provide the baseline support information for all other forms of synthesis.

ROWM - 2: Identifying Multiple Uses of the ROW That Are Compatible

Multiple uses of the ROW are broadly defined for purposes of this research area. It includes the use of ROWs by co-located utility services such as gas, fiber optics, telephone, etc., as well as non-utility multiple uses, such as agriculture, hunting, and Christmas tree growing, etc. The research envisioned includes three parts, culminating in a report of findings, with recommendations for improving the success of multiple use activities. The three parts include the following:

a. Survey utilities and identify and categorize the various claims against utilities that result from multiple use activities on ROWs. Identify the type of multiple use activity involved, the settlement costs involved in any disputes, identify any remedial efforts, or mitigation strategies used, and specify how the claim was resolved;

b. Survey utilities and identify and categorize service outages that result from multiple use activities on ROWs. Identify the type of multiple use activity that caused the outage, and quantify the load involved and the number of customers affected over what period of time; and

c. Survey utilities and identify and categorize examples where there are multiple uses that are mutually beneficial, that is, the "win/win" situations. Important issues include cost savings to all parties/users (utility, underlying fee owner or abutting land owner and third parties, if any) and other benefits (such as public relations values) that accrue.

ROWM - 3: Danger Tree Assessment Techniques

The audience for this effort includes utility managers and construction managers, both those internal to the utility and those who might be external contractors. The objective is to provide managers with information on the available or emerging techniques so danger tree assessments can be made specific to the region, and to specific sites. It should include a synthesis of what is known now, as well as the proposing and demonstration of new techniques as they are developed. The deliverables of this research effort are the following:

a. Compilation and synthesis of what is known and is available now; and

b. Research and development of promising new tools for the management of danger trees.

ROWM - 4: Synthesize What Is Known About the Use and Impact Of Herbicides and Other Chemicals In and Around Substations

This research area is subdivided into four sub-elements, as follows:

a. Summarize what is known about the environmental behavior and impacts of the chemicals used for vegetation management in substations. This should include evaluation of runoff, drift and groundwater infiltration (movement and ultimate fate) as these specific processes are affected by rates and frequencies of application, rainfall, soil, eco-zone and the presence of natural and exotic species. The output should include recommendations on specific chemical agents, rates and frequency of application for the specific vegetation to be controlled and the environmental variables of specific sites. Data sources, in addition to the published literature, include chemical manufacturers, the pesticide registration information available from EPA, data from state and county weed boards, and the utility industry;

b. Evaluate alternative tools for vegetation management in substations. This includes biological control agents (arthropods, grazing, viruses, etc.), steam, paving, weedmats and the like. The specific objectives of this effort are to identify what techniques are new, and how well they work, their the cost effectiveness and the public acceptance of them;

c. Determine how to mitigate the effects of previous practices (for instance the use of arsenical herbicides or other chemicals that are no longer allowed for use). The research objectives include (1) how to determine if a substations is contaminated (and if this level warrants remedial action); (2) determination of the appropriate "cleanup" strategies for specific agents and environmental settings; and (3) what information and actions are needed to limit liability. Potentially useful data sources beyond the published literature are state regulatory bodies and litigation records; and

d. Identification of who should apply vegetation management techniques in substations? Should it be done by electrical workers, or landscapers, or others? At issue are electrical safety, licensing of applicators, potential conflicts with unions and costs. The research objectives are (1) a compilation and analysis of utility practices and experience, and (2) recommendations for best management practices.

ROWM - 5: Determine the Need and Techniques for Communication About Compatible Multiple Uses of ROW

The purpose of this effort is to prepare a white paper on communication needs, methods and effectiveness for working with multiple users of ROWs. This is envisioned as the result of a survey of utilities for the various methods that they are using, including descriptions of those that are successful and unsuccessful. For instance, how effective are brochures, videos, demonstrations areas etc.? (Note: Very similar to the objectives fo **ROWM - 2** research area above).

ROWM - 6: Evaluate New Vegetation Management Tools

The audience for this effort is internal to the utility industry. The objective is to provide an update and analysis (and as appropriate, testing and demonstration) of emerging concepts, strategies and techniques for vegetation management. The deliverable is envisioned as a report in a format that can be easily updated as new information becomes available. Perhaps this could be done with an EPRI member web site.

ROWM - 7: Describe the Strengths and Limitations of Vegetation Management Techniques

In further discussion by the group refining this topic, it was subdivided based on the audience. The rational is that the specific needs of an internal audience are quite different than are the needs of an external audience.

Internal audience: The objective is to provide sufficient information so that decision makers and those implementing decisions on the ground are able to evaluate alternatives and make sound decisions in choosing among cost-effective vegetation management options, geared to specific sites. The deliverables of this effort are the results of a user survey, and a synthesis report listing techniques with their merits, procedures and environmental impacts. The results would be in the form of a guidebook for users. Videos, web sites and workshops should also be used for sharing the results of this effort.

External audience: This includes the general public, regulators, real estate developers, ROW property owners, environmental and other special interest groups, etc. The objective of this effort is to educate these audiences about the effectiveness of various vegetation management techniques and strategies. The deliverables are envisioned as a glossy booklet, a video, a web site and brochures that are informational.

Conclusion

Based on the results of this workshop, EPRI and ESEERCO have a mandate to develop a ROW research program. After your comments are received, a ROW research plan will be developed, which will include a balance of short- and long-term research projects. As mentioned during the workshop, participants in this research program will have the benefit of early deliverables through the publication of updated ESEERCO/EPRI reports. It is intended to include a ROW Target in EPRI's Progress Flexibility 1999 Solicitation, which will be published in the Spring of 1998.

Acknowledgments

EPRI and ESEERCO wish to thank the participants for their enthusiasm and hard work during the workshop. Recognizing that the issues of ROW development and maintenance are of major importance, the attendees applied their expertise to produce a solid basis for a ROW research plan.

EPRI and ESEERCO also want to acknowledge the role of WAPA as host of the workshop, and in particular, the efforts of Mr. William Karsell, Director, Division of Environmental Affairs of WAPA, and the work of the technical chairs for ROW Development and Maintenance Sessions, respectively, Mr. David F. Jenkins of Foster Wheeler Environmental Corporation and Dr. Logan A. Norris of the College of Forestry, Oregon State University.

APPENDIX A:

DETAILED RESULTS OF THE ROW DEVELOPMENT SESSIONS

DETAILED RESULTS OF THE ROW DEVELOPMENT SESSIONS

1. Definition of Research Areas

During the first Plenary Session, the facilitator initially suggested the following possible Research Areas for consideration:

a) Corridor/ROW Routing Issues

i) Status of computer-based routing technologies

Different computer-based techniques for identifying general corridor locations on through ROW route alignments for transmission lines would be reviewed with respect to applicability, ease of use, the ability to realistically incorporate important factors considered in routing, etc.

ii) Applicability of publicly available GIS databases to computer-based routing methodologies

Existing, publicly available GIS databases would be reviewed to determine if they represent a useful tool for locating new transmission line corridor and routing of new transmission ROW, especially when in conjunction with computer-based routing technologies.

iii) Applicability of GPS (Global Positioning System)-based mapping to corridor/ROW routing

The use of GPS equipment and data formats would be reviewed to determine their value (if any) to ROW routing.

b. Aesthetics

i) Review of previous studies on structure selection

Several studies have been conducted over the past 10-15 years regarding transmission structure type vis-à-vis visual and aesthetic impacts. These studies would be reviewed regarding their current applicability and to determine if a more up-to-date study should be undertaken.

ii) Evaluation of alternative conductor and insulator types

State-of-the-art materials and design for conductors and insulators would be reviewed regarding their visual properties that could be modified or enhanced to reduce aesthetic impacts, as perceived by the general public.

iii) Evaluation of structure materials

State-of-the-art materials for transmission structures would be reviewed regarding their visual properties that could be modified or enhanced to reduce aesthetic impacts, as perceived by the general public. This would include review of materials, such as weathering (corten) steel , steel structures that could be painted with minimal requirements for maintenance (i.e., repainting), etc.

c. ROW Construction Best Management Practices

Best management practices (BMPs) for various aspects of ROW preparation activities have been identified and subsequently mandated by various Federal and state environmental regulatory agencies. These BMPs address, for example, 1) acceptable erosion and sediment control practices to be implemented; 2) forest clearing techniques; 3) salvage methods for merchantable materials and disposal of logging slash (woody residue management); 4) detailed construction specifications for access roads and routes along electric transmission lines and pipelines; and 5) all aspects of how and where access road/route crossings of waterbodies, such as streams and wetlands will be made. Additionally, the various methods and timing of ROW restoration activities and cleanup procedures are also often specified in the form of mandated BMPs. These regulatory mandated BMPs may or may not be the only nor the most economical or efficient methods from an environmental performance standard perspective. This Research Area would involve the evaluation of existing BMPs and the development and testing of potentially more cost effective BMPs for the construction of electric transmission lines and associated ROWs.

d. Construction-related Issues in Agricultural Areas

This Research Area would involve the synthesizing of existing data and research results on agricultural impacts and/or conducting original research on such items as 1) the relative effect of different support structure types on agricultural operations and resulting crop yields in the immediate vicinity of the structure; 2) how different types of construction equipment effect agricultural soils (e.g., compaction resulting from bearing weight of different equipment types, width of access requirements, etc.); and 3) effectiveness of different soil restoration procedures to mitigate construction impacts (e.g., the effectiveness of different types of deep tillage and subsoil decompaction equipment). For example, regulatory mandates often require that top soils in agricultural locations be removed from construction sites (access roads/routes and tower sites) and stock piled nearby. After construction is completed, the stock piled soils are returned and the site is graded to original surface grades.

In addition to the above possible Research Areas, the Plenary Session identified the following additional possible Research Areas (identified sequentially relative to the above Research Areas).

e. Life-cycle Cost Considerations

The discussion leading to this topic dealt with the long-term (life of the ROW) issues of ROW and transmission facility maintenance costs and how they would affect the siting and development of ROW

f. Effects of Line Loading

Concerns related to the effect of line sag under heavy loading (which will perhaps occur more frequently due to open access and competitive pressures) relative to center-line-separation with adjacent ROW lead to the suggestion for this research topic.

g. Evaluation of Risk Management Tools and Techniques

Risk management is becoming increasingly important relative to system maintenance and cost management in the competitive/deregulated market. The suggestion was that risk management techniques be evaluated with respect to facility siting issues.

h. Development of Data on the Impacts to Ecosystems

The Plenary Session recommended that the effect of ROW preparation and transmission line construction on an array of broad ecological topics be evaluated rather than focusing on specific issues (e.g., wetland impacts from ROW construction).

2. Assignment of Research Areas to Working Groups

The Plenary Session consolidated the eight possible Research Areas identified above (a-h) into four distinct Research Areas and each of four Working Groups was assigned one of the four, as noted below:

Assignments of Research Areas

Working Group	Possible Research Areas Reviewed
Green	a, b, e
Blue	c, d
Red	f, g
Gold	h

3. Definition of Research Topics

In the first Breakout Session, each Working Group was assigned the task of defining specific Research Topics within the Research Areas assigned to them. The following are the specific Research Topics identified by each Working Group. Research Topics are assigned a number (e.g., RT-1, etc.) for later prioritization.

Problem A. Identification and Exposition of all relevant Environmental, Socioeconomic, Engineering, and Management Concerns in Designing and Life-cycle Analysis of Utility ROW (Green Working Group)

Research Topic#1 Development of a computer program for corridor routing and siting of transmission ROW that would include the following:

Development of a manual (document) that addresses old and new concerns in ROW siting;
Development of curricula for training programs;
Development of guidance documents for use by utility professionals; and
Development of "tools" for use in designing and analyzing utility ROW.

Problem B. Definition of BMPs (Including Practices in Agricultural Areas) (Blue Working Group).

Research Topic #2 Site preparation, construction and maintenance of access roads in streams environs , through wetlands, and within areas of steep slopes.

Research Topic #3 Construction of transmission line support structure foundations in wetlands situations.

Research Topic #4 Perception issues (how well they actually work) as they relate to BMPs.

Research Topic #5 Disposal techniques (for slash, spoil, rock, etc.) for use on ROW.

Problem C. Line-Loading Problems and Risk Management Tools and Techniques (Red Working Group).

Research Topic #6 Review of proximity calculations relative to increased line loading and increased numbers of transmission lines on ROW , with specific emphasis on the number of transmission lines in close proximity, SF6 lines, the effect of load growth, the effect on inductance, etc.

Research Topic #7 Review of issues related to danger trees identification and removal: What data are available to expedite this tedious process. What new more efficient techniques may be available for danger tree identification and management that would reduce costs and/or increase accuracy. This research topic would include development of a model that relates costs of line outages to danger tree removal by species and other important site-specific factors.

Research Topic #8 Development of a web site where users could access research papers, etc. related to ROW management.

Research Topic #9 Development of partnering arrangements with other professional organizations to identify and expand expertise and resources related to ROW management.

Problem D. Collection of Data on the Impacts to Ecosystems from ROW Development (Gold Working Group).

Research Topic #10 Investigations of ecosystem components for which environmental regulatory agencies have inadequate information for accurate impact estimates. Examples include the following:

Migratory Waterfowl Aversion to Transmission Lines and ROW;
Habitat Fragmentation;
Biodiversity Issues;
Wetlands Impacts (Some wetlands could benefit from a continually tree cleared ROW); and
Desert Tortoise.

Research Topic #11 Research that could reduce costs for ROW induced ecosystem impact mitigation activities or financial compensation. Examples of potential research efforts, include the following:

Assessment of the availability of and procedures to access baseline habitat databases;
Conduct of field studies to collect data to determine whether impacts have occurred;
Quantification of potential and regulatory alleged impacts;
Determination of appropriate compensation/ mitigation; and
Conduct of an industry survey to identify pertinent ROW related ecological issues.

3. Prioritization/Identification of High Priority Research Topics

The Plenary Session was reconvened and each member voted on each of the 11 proposed Research Topics, with the following results:

Results of Plenary Prioritization Voting of Research Topics

Research Topic	*Developed by (Group)*	*Votes by Green*	*Votes by Blue*	*Votes by Red*	*Votes by Gold*	*Total Votes*
RT-1 Routing/Siting Manual	Green	16	7	3	7	33
RT-2 Access in Streams/Wetlands	Blue	10	13	7	5	35
RT-3 Foundations in Wetlands	Blue	0	0	0	0	0
RT-4 Effect of Perceptions	Blue	5	8	3	7	23
RT-5 Disposal Techniques	Blue	2	3	0	2	7
RT-6 Proximity	Red	5	4	3	2	14
RT-7 Danger Tree Issues	Red	12	8	11	12	43
RT-8 Web Site	Red	6	6	5	4	21
RT-9 Partnering	Red	7	3	5	2	17
RT-10 Ecosystem Studies	Gold	9	8	6	6	29
RT-11 Ecosystem Impact Compensation	Gold	7	9	5	8	29

The top five Research Topics were defined as High Priority Research Topics and were reassigned to the Working Groups as follows:

Working Group	Research Topics
Green	RT-1
Blue	RT-2
Red	RT-7
Gold	RT-10, RT-11

4. Refinement of High Priority Research Topics

In the second Breakout Session, each Working Group was assigned the task of refining the research statement for each of the High Priority Research Topics and to the extent possible developing specific strategies, objectives, and work statements. The following are

the specific research statements developed by each Working Group, with an assigned number for later prioritization.

a. (HPRT-1) **Develop a Siting Manual** (Green Working Group).

Review and research existing practices for planning and siting of utility ROWs. Define and describe the interrelationships among risk management, life-cycle costs, system reliability factors, engineering parameters, public perception and environmental siting constraints and considerations in the development of new ROWs. Prepare a document which addresses these various aspects of siting new ROWs.

b. (HPRT-2) **Develop Communications and Training Materials** (Green Working Group).

Develop a series of brochures (consolidated compendiums) addressing specialty topics (e.g., siting of rights-of-way, herbicide use, construction, etc.) for distribution to the public and non-technical audiences. Develop a curriculum for regional workshops for industry and regulatory audiences. Participation should include representatives from electrical engineering; civil engineering; mechanical engineering; environmental and ROW managers; and real estate staff.

c. (HPRT-3) **Define Impacts of Access Road Construction at Stream Crossings and Through Wetlands** (Blue Working Group).

This research effort is a comprehensive evaluation of all regulatory issues (including a critical evaluation of all mandated BMPs), cost implications, environmental concerns and constructability parameters in relation to the development of the transmission line access road/route system in the vicinity of water bodies, i.e., streams and wetlands.

d. (HPRT-4) **Danger Tree Assessment and Management Techniques** (Red Working Group).

Define the physical limits of the danger tree zone for different voltage levels for transmission and distribution lines by eco-zone/region.

Survey practitioners and examine literature and other pertinent data sources for developing an expedited methodology to identify danger trees in an accurate and cost effective manner by eco-zone/region. This research study should also reveal effective practices for quickly locating and assessing danger trees in the field. Determine which utilities are using (or could use) the techniques listed below:

Satellite imagery/Remote sensing;
GPS for determining locations and heights of trees and conductors;
Laser/radar 3-dimensional imagery;
Ground truthing;
Aerial photography/mapping;

GIS database layers for mapping vegetative communities, environmental and other sensitivities, growth influence factors and danger tree locations; and
Other applicable available and emerging technologies.

Develop a model that relates line outage costs to costs of maintenance, including danger tree removal to enhance reliability, and to determine the optimal maintenance level/cost for an acceptable level of risk by eco-zone/region. This model should include such factors, as follows:

Cost of danger tree outage;
Location;
Species;
ROW Width;
Probability of failure;
Species;
Location;
Distance to conductor;
Cost of remediation;
Removal efforts(location, species, distance to ROW);
Tree growth regulators (location, species, distance to conductor);
Tree trimming (location, species, distance to conductor);
Herbicide applications (location, species, distance to conductor); and
Definition of the risk relationship between ROW width and voltage levels and line congestion for transmission and distribution lines, and recommenation of the acceptable level of risk.

Survey and describe effective practices during construction for danger tree removal from ROWs and treatment to prevent their recurrence by eco-zone/region.

e. (HPRT-5) **Transmission Line Impacts on Ecosystems** (Gold Working Group).

Assess and compile available information, practices and methodologies for defining transmission and distribution potential impacts, including identification of data needs for the follow:

Migratory waterfowl;
Habitat fragmentation;
Wetlands;
Biodiversity;
Watershed management; and
Wildlife compatibility with ROW conditions.

Deliverables should include a report on each subject, with case studies and prioritization of research needs. Carry out follow-up research in areas of identified data deficiencies. Develop tools to quantify potential ecological impacts. Determine appropriate compensation for identified and quantified impacts. Resulting reports should include

assessment of current compensation practices and development of new approaches to compensation. Other products from this research effort should include the development of tools for decision analysis, consensus building, and ecosystem "trading." Curricula for workshops with stakeholders could also be developed.

5. Prioritization of High Priority Research Topics

The Plenary Session was reconvened and each member voted on each of the 5 High Priority Research Topics, with the following results:

Results of Plenary Prioritization Voting of High Priority Research Topics

Research Topic	*Developed by (Group)*	*Votes by Green*	*Votes by Blue*	*Votes by Red*	*Votes by Gold*	*Total Votes*
HPRT-1 Siting Document	Green	0	4	6	1	11
HPRT-2 Training Material	Green	1	4	1	0	6
HPRT-3 Wetland Impacts	Blue	0	1	2	0	3
HPRT-4 Danger Tree Issues	Red	8	5	1	7	21
HPRT-5 Ecosystem Studies	Gold	3	6	8	8	25

APPENDIX B:

DETAILED RESULTS OF THE ROW MANAGEMENT SESSIONS

DETAILED RESULTS OF THE ROW MANAGEMENT SESSIONS

Problem Definition

The ROW maintenance session focused on four broad disciplinary topics, each of which include a large number of potential areas of research emphasis. These broad topic areas are, as follows:

1. Vegetation Management Efficacy and Efficiency;
2. Environmental Effects of ROW Maintenance;
3. Multiple Use of ROW; and
4. Substations and Wood Poles

Each of these topic areas were the subject of concurrent breakout sessions in which the problem areas or potential research topics within each area were better defined. Each group was assigned a color code to facilitate evaluation of their output and the results of the subsequent priority setting exercise.

1. Vegetation Management Efficacy And Efficiency (Red group).

The primary focus of this broad topic area is the efficiency and efficacy of achieving vegetation management objectives on ROWs. It is intended to be narrowly focused on the direct achievement of the vegetation management objectives of ROW maintenance. The group reported the following Problem Areas and suggested Research Areas (areas of potential research focus) within this rather comprehensive topic. The Research Areas were later prioritized as potential research topics.

Problem A. There is general agreement that there is a lack of available knowledge/information (particularly as it relates to a concise usable format) concerning the range of appropriate vegetation management techniques for a given situation. This is particularly true for purposes of communication with state and federal regulators (including Forest Service, Bureau of Land Management, Fish and Wildlife Service and other federal and state land management agencies), the public, landowners, and in some cases even ROW managers. In addition, ROW managers need; (a) a better basis to determine the efficacy and environmental impacts of the general treatment strategies (e.g., selective vs. non-selective and chemical vs. mechanical) and specific treatment techniques that they use or could consider using, and (b) readily available monitoring techniques that can provide a reliable basis for program evaluation.

> **Research Area 1**. Describe the strengths and limitations of currently available ROW vegetation management techniques. Conduct surveys of users (ROW managers) and review and evaluate the abundant but widely dispersed data and information to develop comprehensive state of the art/state of the science documents that describe the strengths and limitations of existing strategies and techniques of ROW vegetation management. A distinctly separate but related follow-on need, is the development of

simple ROW vegetation monitoring techniques that will allow for the rapid evaluation of treatments to determine overall effectiveness, as well as the current condition of the ROW, so as to be able to ascertain when and how the next treatment should be made.

The results of the survey/evaluation for monitoring strategies is intended primarily for use within the industry. The products dealing with the strengths and limitations of vegetation management techniques will need to be tailored for specific audiences within the ROW management industry and external to it. It is likely that different versions of both the internal and the external documents may be needed for specific audiences. For instance, the needs of the regulatory audience are not the same as those of the general public.

Problem B. Endangered species listings can inhibit the ability of the ROW manager to efficiently and effectively achieve vegetation management objectives.

No specific Research Areas were developed for this problem. Although documentation of ROW-endangered species "success stories" may be relevant.

Problem C. Danger trees affect vegetation management strategies.

Research Area 2. Danger Tree Assessment Techniques. This topic was also covered quite well in the ROW development portion of this workshop, and perhaps should be expanded to include the danger tree issues with a long-term ROW maintenance perspective.

Problem D. Danger tree management (removal) is complicated due to land development activities on abutment properties adjacent to ROW.

Research Area 3. Develop a guidebook on the evaluation of realistic danger tree situations. This guidebook is for land developers and realtors to help minimize the development of situations in which danger tree problems are increased.

Problem E. Wood waste management and disposal have several influences on vegetation management strategies. It impacts on crew productivity, may have environmental impacts, and in some cases it becomes a regulated material (solid waste), especially when deposited/disposed off-site. There may be beneficial and cost effective strategies for dealing with this problem.

Research Area 4. Develop guidelines for utility tree-trimming wood-waste management. Conduct a survey of the industry to identify the strategies that are potentially useful for the management of wood wastes. This includes evaluating their cost effectiveness, environmental impact, role in recycling and potential value for positive public relations ,i.e., give-a-way programs for landscaping materials or mulches. The product is a handbook of current and emerging wood waste management techniques and strategies for use by ROW managers.

Problem F. New tools/techniques for vegetation management on ROW are not developed and tested systematically. Examples include subsurface cutting of roots, and herbicide wiping technology.

> **Research Area 5**. Evaluate new tools. Conduct a continual search to identify new tools, evaluate their possible utility, and for those with some potential for application, field test their efficacy (how well they work) and efficiency (how readily are the treatments applied and are they cost effective) in a statistically valid scientific approach. This research area could also include the efficacy testing of conventionally used industrial vegetation management herbicides to determine the lowest effective dose and rate of application and any synergistic herbicide combinations or additives that would have the overall effect of increasing product efficacy.

Problem G. Record keeping related to vegetation management is highly variable within the industry. In some cases this reflects a lack of knowledge of options in this area. Efficiency of vegetation management would be enhanced if ROW managers had better records on costs, effectiveness of treatments, labor requirements and outage statistics. The challenge is to make the record keeping itself cost effective and the results of this activity readily available.

> **Research Area #6**. Develop a handbook of record keeping strategies.

Problem H. It is difficult to achieve effective identification and notification of underlying fee property owners (in the case of ROW easements) and adjacent property owners (when the ROW is owned by the utility) prior to the onset of ROW vegetation management activities. ROW managers are often not aware of the effectiveness of the various communication techniques that might be used for this purpose.

> **Research Area 7**. Develop guidelines of effective ROW land owner notification techniques. The handbook would describe specific communication techniques, and review the experience managers have had with them. The handbook would be developed from a survey of ROW managers and others to determine their experience.

Problem I. The vegetation management implications of multiple uses of ROW are not well developed. The various users of an individual ROW may have different vegetation management requirements. For instance, the clearance requirement is different for lower voltage distribution lines than it is for a fiber optic cable mounted on the same pole. This problem will be come more acute as the number of functions performed by a single ROW increase.

> **Research Area 8**. Develop a catalog of vegetation management requirements for different multiple uses. Conduct a survey of the various potential users of ROW (fiber optic, telephone, etc.) to determine their specific vegetation clearance requirements. Develop a catalog that summarizes these requirements to help guide the planing of ROW managers considering multiple uses of a single ROW. This topical area could be included as a chapter in Problem 1 Research Area A

2. Environmental Effects of ROW Maintenance (Blue group).

The primary focus of this broad topic area is achieving the vegetation management goals consistent with requirements for protecting the environment, human health and safety of both the work force and the general public. The group reported the following Problem Areas and suggested Research Areas (areas of potential research focus) within this rather extensive topic. The Research Areas were later prioritized as potential research topics.

Problem J. The effects on biodiversity resulting from the long-term implementation of integrated vegetation management (IVM) strategies on ROW are not well documented.

> **Research Area 9**. Develop a synthesis of the documented (peer reviewed, if available) literature on the effects of IVM on biodiversity. Search the literature, and other sources of related information to develop a documented synthesis of what is known in this area. This includes both specific on-site effects, as well as effects manifested at the landscape level. Based on this first step, additional field studies may be designed and implemented.

Problem K. The effects of mechanical methods of vegetation management on soil and water resources are not well documented. Often times mechanical treatments of ROW vegetation are viewed by regulators and even utility management as a benign alternative to herbicide applications and little if any scrutiny of these non-chemical methods for their environmental impacts are considered in the decision making process.

> **Research Area 10**. Develop a synthesis of the effects of mechanical methods of vegetation management on soil and water resources. Search the literature, and other sources of related information to develop a documented synthesis of what is known in this area. This includes specific on-site effects, as well as those effects manifested off-site (such as sedimentation of streams due to site erosion). This evaluation should diligently track the regulatory requirements for the control of nonpoint sources of water pollution along with some aspects of the permit requirements for stormwater discharges for point sources. These regulatory programs focus on water quality issues, i.e., the prevention and control of water pollution. In both programs, as they apply to the ROW maintenance situation, the focus is on using management practices to prevent, reduce, minimize or otherwise control the availability, release, or transport of substances (in this case sediment) that adversely affect surface and groundwaters.

Problem L. The effects of manual, mechanical and chemical methods of vegetation management on the health and safety of workers is not well documented.

> **Research Area 11.** Scope the health and safety risks of vegetation management methods on ROW workers. However, before a full synthesis (risk assessment) is undertaken a more limited effort should be conducted to scope the magnitude and importance of the issue.

Problem M. The currently known/documented effects of various vegetation management strategies are poorly archived (i.e., the available literature is widely scattered and has not been summarized in a form useful for ROW managers).

> **Research Area 12**. Collect, review, analyze and evaluate the available information on what is known about the effects of ROW maintenance on the environment and provide a synthesis of this information in a format useful to ROW managers (i.e., guidelines, rules of thumb, known trends, etc.).

Problem N. Safety issues concerning trees in contact with distribution lines are poorly defined. It is possible that different clearance criteria and strategies are required to achieve safety objectives than are required for the operation of the line.

> **Research Area 13**. Characterize the problems of trees in contact with distribution lines. As with several other research areas, this is (may be) a matter of synthesis of what is already known in this area.

3. Multiple Use of ROWs (Green group).

The primary focus of this topic area is achieving multiple use objectives for ROWs. The context for this as a topic is that in some instances ROW sites are or can be explicitly managed to accommodate other compatible uses or to yield additional benefits. Examples of compatible uses include Christmas tree production, orchards, agricultural uses, and the installation of telephone lines, fiber optic cables and other communication devices on the ROW. In other instances, there are social or public relations benefits that can accrue if a ROW can be managed such that they provide increased opportunity for use by the general public (hiking, horseback riding, mountain biking, berry picking, hunting, etc.). The key is to achieve these ROW multiple use objectives in a way that is cost effective, does not reduce reliability, and that obtains the positive public relations benefits, while minimizing risk to the public or workers, and the attendant liability for bodily injury to third party users or property damages accruing to underlying or abuttting landowners.

The group reported two interconnected Problem Areas and suggested Research Areas (areas of potential research focus) within the ROW multiple use topic. The Research Areas were later prioritized as potential research topics.

Problem O. Definitions (identification) of compatible multiple uses of ROWs are lacking.

> **Research Area 14**. Assist utilities in identifying all existing multiple uses that are ROW compatible and in establishing criteria to determine future potential uses that are compatible to ROWs.
>
> <u>There are three specific areas of study in this research area</u>.

14a. Evaluate the potential for legal and financial liability is considered important. Case law and the experiences with outages resulting from multiple uses would be valuable in this effort.

14b. Identify the causes and number of outages, and their impacts resulting from conflicts involving multiple uses of ROWs.

14c. Identify specific instances in which mutual benefits accrue to multiple users and the utility (win-win situations). Examples include partnerships and stewardship efforts. This specific effort is seen as an important vehicle by which the industry can learn from instances where multiple uses have a history of success. Some elements important in these success stories will include the strategies used to enforce the limitations that are necessary for a multiple use to be successful. In some instances more than one utility service can use a ROW (telephone, cable TV and electrical services). It will be important to determine the real and/or potential interference (incompatibilities) that exist among multiple uses of this type.

Problem P. The importance of, and the techniques for communication with multiple users of ROW are poorly understood.

Research Area 15. Determine the need, and techniques for communication about compatible multiple uses of ROWs. Conduct a survey of ROW managers to determine the need for communication with current or potential multiple users of a ROW. Identify any negotiation requirements or contractual arrangements that may be necessary to insure continuous cooperation/compliance of the multiple users. If the need for communication is significant, then evaluate the techniques for this purpose. Both issues could be addressed in a single survey.

4. Substations and Wood Poles (Gold group).

The dual focus of this broad topic area is wood pole management and vegetation management around and in substations. It combines the emphases of the two other (1&2) broad research topic areas, i.e. the efficiency and efficacy of management tools and their use, and the environmental and health and safety issues involved with their use. The difference is that in the other two broad topic areas these issues deal with a myriad of ROW management situations whereas in this topical area they are focused on substations, as a special kind of ROW site, and wood poles as a special type of structure on ROWs.

The group reported two Problem Areas associated with substations, and three Problems Areas associated with wood poles. They developed suggested Research Areas (areas of potential research focus) for each problem area, and these were later prioritized as potential research topics.

Problem Q. There are several issues involving the use of herbicides or other chemicals (soil sterilents) in or near substations. These include the following:

a. Off-site airborne drift of herbicides;
b. Contamination of underlying groundwater and surface water by off-site movement of herbicide;
c. Corrosion of metal structures, possibly from the use of chemicals of various kinds used in the near vicinity;
d. Herbicide applications that are more intense or more frequent (unintentional overuse due to lack of understanding on efficacy rates) than actually required to meet vegetation management objectives;
e. Who should apply herbicides inside substations (electrical workers, landscapers, herbicide application crews)? The issues involve electrical safety, applicator licensing, potential conflicts with unions, and the cost to the utility;
f. Mitigation of effects of earlier pesticide uses (such as arsenical compounds);
g. Other non-pesticide agents potentially useful for controlling vegetation in substations is poorly understood (biological controls, steam); and
h. Vegetation can attract animals into the root zone, even when the above ground portions of the vegetation has been removed.

> **Research Area 16.** Synthesize what is known about the use, effectiveness/efficacy and impact of herbicides and other chemicals in and around substations.

Problem R. Buffer zones of vegetation can be both a benefit in screening substations, but they can also create problems, especially by providing easy access to the interior of the substation, as well as making the environs attractive to nuisance animals.

> **Research Area 17.** Synthesize what is known about vegetation in substation buffer zones, and identify vegetation screening strategies that work. A relatively simple survey of utilities to determine the screening strategies that are effective may help solve this problem. The results would need to be summarized in a comprehensive document.

Problem S. The differences in liability and costs associated with repairing or moving wood poles hit by motor vehicles is unknown particularly in relation to other types of electrical support structures.

> **Research Area 18**. Conduct an analysis of liability of replacing or moving poles damaged by vehicles as well as the use of other types of structures, e.g., concrete, fiberglass, steel, etc.

Problem T. The options for and consequences of various wood pole treatment agents are not well understood. Some of the uncertainties include the following:

a. Disposal costs of treated poles that are removed from service;
b. Recycling options for these poles;
c. Treatment strategies for sensitive sites, such as wetlands;
d. Human health effects for workers and the public; and
e. Impact on soil and water (both surface and groundwater).

Research Area #19. Conduct synthesis of what is known about wood pole treatment strategies and disposal and recycling options.

Problem U. The business consequences of multiple-use attachments to wood poles are not well documented. For instance, are vegetation management strategies and clearance distances different for different uses, such as fiber optics?

Research Area 20. Conduct an analysis of the business consequences of multiple-use attachments to wood poles.

Analysis And Priority Setting.

A total of 21 research problems with 20 distinct research areas were identified by the four problem definition panels (break out sessions). Each panelist was provided with 12 votes, which they could use to identify the research areas of highest priority. The following table shows each research area and the group from which it came, and shows the distribution of votes by each group, along with the total for each research area.

Research Priorities

Research Area	*Originating Group*	*Votes by Red*	*Votes by Blue*	*Votes by Green*	*Votes by Gold*	*Total Votes*	*Rank*
1. Strengths and limitations of techniques	red	9	8	2	2	71	7
2. Danger tree assessment techniques	red	11	9	6	7	33	3
3. Guidebook on danger trees	red	0	2	3	3	8	13
4. Handbook of wood waste management	red	7	3	2	7	19	8
5. Evaluate new vegetation management tools	red	10	5	3	4	22	6
6. Handbook of record keeping strategies	red	0	2	8	1	11	11
7. Handbook of communication techniques	red	7	3	6	3	19	8
8. Catalog of vegetation management requirements of other ROW users	red	3	3	6	2	14	10
9. Develop a synthesis on biodiversity	blue	5	11	2	3	21	7
10. Develop a synthesis on the effects mechanical methods	blue	3	7	4	3	17	9

Research Area	*Originating Group*	*Votes by Red*	*Votes by Blue*	*Votes by Green*	*Votes by Gold*	*Total Votes*	*Rank*
11. Scope the health and safety risks of workers	blue	1	13	2	3	19	8
12. Synthesize what is known about the effects of ROW maintenance on the environment	blue	7	18	10	7	42	1
13. Characterize of trees in distribution lines	blue	0	2	2	1	5	15
14. Assist utilities in identifying multiple uses that are compatible	green	10	7	11	6	34	2
15. Determine the need, and techniques for communication concerning multiple users of the ROW	green	3	2	11	8	24	5
16. Synthesize what is known about chemicals used in or near substations	gold	7	12	8	3	30	4

Research Area	*Originating Group*	*Votes by Red*	*Votes by Blue*	*Votes by Green*	*Votes by Gold*	*Total Votes*	*Rank*
17. Identify vegetation screening strategies for substations that work	gold	1	6	0	2	9	12
18. Conduct an analysis of liability of replacing or moving wood poles damaged by vehicles	gold	0	0	0	0	0	17
19. Synthesize what is known about wood pole treatment options	gold	0	2	0	5	7	14
20. Conduct an analysis of the business consequences of multiple-use attachments to wood poles	gold	0	0	1	2	3	16

Based on this priority setting exercise, the top eight research areas were selected for further refinement by the group that did the initial identification of each research area, as described in the following section of this report.

Refinement of Research Topics

In this section, the research areas given the highest priority were further refined. The purpose of the refinement was to incorporate suggestions from the entire workshop, and to identify the specific information needed to help solve the problem. The information needed forms the basis of potential programs of ROW research. The refinement of each high priority research area, in order of priority is shown below:

Priority 1 - Research Area 12. Synthesize what is known about the effects of ROW maintenance on the environment. Blue group.

Priority 2 - Research Area 14. Assist utilities in identifying multiple uses that are compatible. Green group.

Priority 3 - Research Area 2. Danger Tree Assessment Techniques. Red group.

Priority 4 - Research Area 16. Synthesize what is known about the use and impact of herbicides and other chemicals in and around substations. Gold group.

Priority 5 - Research Area 15. Determine the need, and techniques for communication about compatible multiple uses of ROW. Green group.

Priority 6 - Research Area 5. Evaluate new vegetation management tools. Red group.

Priority 7 - Research Area 1. Describe the strengths and limitations of vegetation management techniques. Red group.

Priority 7 - Research Area 9. Develop a synthesis of the effects of IVM on biodiversity. Blue group.

Note: Research areas 1 and 9 both received the same level of priority (priority 7).

Following are the results of the refinement of each of these research areas.

Priority 1 - Research Area 12. Synthesize what is known about the effects of ROW maintenance on the environment. Blue group.

This group was originally assigned two research areas for refinement after the initial prioritization exercise. One area dealt with a wide variety of environmental effects resulting from ROW maintenance activities. The second research area was much narrower, focusing just on biodiversity. On further analysis the group decided to incorporate the biodiversity issue into the broader environmental effects research area. Thus original research areas #12 and #9 are now combined into research area #12.

This research area, while addressed in the context of ROW maintenance, could be easily expanded to include line construction and reconstruction as well. The array of topics includes impacts on the environment such as wildlife, ecological values and processes, soil and water, and biodiversity. The impacts on visual and cultural values, agricultural operations and other land management strategies should also be included. The subjects to be addressed include cost/benefit analysis, impacts on business, the importance of the topics to the public, to regulatory agencies and to environmental and other special interest (consumer) groups. The product(s) of this research area are anticipated to be a synthesis and analysis of what is known, based on published literature, and professional experiences. The product(s) are envisioned as a series of technical reports for utility specialists, regulatory professional staff and the interested lay public The products should also identify conclusions and critical information gaps, the later as a basis for possible future research efforts.

A communication plan (technology transfer agenda), on how the information acquired in this effort can be more widely disseminated needs to be included. It is likely that different

synthesis products will be needed for these various audiences, but it is essential that there be a detailed synthesis prepared first, and that this primary all inclusive document provide the baseline support information for all other forms of synthesis.

Priority 2 - Research Area 14. Assist utilities in identifying multiple uses that are compatible. Green group.

Multiple uses are broadly defined for purposes of this research area. It includes the use of ROWs by co-located utility services such as gas, fiber optics, telephone, etc., as well as non-utility multiple uses, such as agriculture, hunting, and Christmas tree growing, etc. The effort envisioned includes three parts, culminating in a report of findings, with recommendations for improving the success of multiple use activities. The three parts include the following:

a. Survey utilities and identify and categorize the various claims that result from multiple use activities on ROWs. Identify the type of multiple use activity involved, the settlement costs involved in any disputes, identify any remedial efforts, or mitigation strategies used, and specify how the claim was resolved;

b. Survey utilities and identify and categorize any service outages that result from multiple use activities on ROWs. Identify the type of multiple use activity that caused the outage, and quantify the load involved and the number of customers affected over what period of time; and

c. Survey utilities and identify and categorize examples where there are multiple uses that are mutually beneficial, that is the "win/win" situations. Important issues include cost savings to all parties/users (utility, underlying fee owner or abutting land owner and third parties, if any) and other benefits (such as public relations values) that accrue.

Priority 3 - Research Area 2. Danger Tree Assessment Techniques. Red group.

The audience for this effort includes utility managers and construction managers, both those internal to the utility and those who might be external contractors. The objective is to provide managers with information on the available or emerging techniques so danger tree assessments can be made specific to the region, and to specific sites. It should include a synthesis of what is known now, as well the proposing and demonstration of new techniques as they are developed. The deliverables of this research effort are the following:

a. Compilation and synthesis of what is known and is available now; and

b. Research and development of promising new tools for the management of danger trees.

Priority 4 - Research Area 16. Synthesize what is known about the use and impact of herbicides and other chemicals in and around substations. Gold group.

This research area is subdivided into four sub-elements, as follows:

a. Summarize what is known about the environmental behavior and impacts of the chemicals used for vegetation management in substations. This should include evaluation of runoff, drift and groundwater infiltration (movement and ultimate fate) as these specific processes are affected by rates and frequencies of application, rainfall, soil, eco-zone and the presence of natural and exotic species. The output should include recommendations on specific chemical agents, rates and frequency of application for the specific vegetation to be controlled and the environmental variables of specific sites. Data sources, in additional to the published literature, includes chemical manufacturers, including the pesticide registration information available from EPA, data from state and county weed boards, and the utility industry;

b. Evaluate alternative tools for vegetation management in substations. This includes biological control agents (arthropods, grazing, viruses, etc.), steam, paving, weedmats and the like. The specific objectives of this effort are to identify what techniques are new, and how well they work, their the cost effectiveness and the public acceptance of them;

c. Determine how to mitigate the effects of previous practices (for instance the use of arsenical herbicides or other chemicals that are no longer allowed for use). The research objectives include (1) how to determine if a substations is contaminated (and if this level warrants remedial action); (2) determination of the appropriate "cleanup" strategies for specific agents and environmental settings; and (3) what information and actions are needed to limit liability. Potentially useful data sources beyond the published literature are state regulatory bodies and litigation records; and

d. Who should apply vegetation management techniques in substations? Should it be done by electrical workers, or landscapers, or others? At issue are electrical safety, licensing of applicators, potential conflicts with unions and costs. The research objectives are (1) a compilation and analysis of utility practices and experience, and (2) recommendations for best management practices.

Priority 5 - Research Area 15. Determine the need and techniques for communication about compatible multiple uses of ROW. Green group.

The purpose of this effort is to prepare a white paper on communication needs, methods and effectiveness for working with multiple users of ROWs. This is envisioned as the result of a survey of utilities for the various methods that they are using, including descriptions of those that are successful and unsuccessful. For instance, how effective are brochures, videos, demonstrations areas etc.? (Note: Very similar objectives to the **Priority 2** research area above).

Priority 6 - Research Area 5. Evaluate new vegetation management tools. Red group.

The audience for this effort is internal to the utility industry. The objective is to provide an update and analysis (and as appropriate, testing and demonstration) of emerging concepts, strategies and techniques for vegetation management. The deliverable is envisioned as a report in a format that can be easily updated as new information becomes available. Perhaps this could be done with an EPRI member web site.

Priority 7 - Research Area 1. Describe the strengths and limitations of vegetation management techniques. Red group.

In further discussion by the group refining this topic, it was subdivided based on the audience. The rational is that the specific needs of an internal audience are quite different than are the needs of an external audience.

Internal audience- The objective is to provide sufficient information so that decision makers and those implementing decisions on the ground are able to evaluate alternatives and make sound decisions in choosing among cost-effective vegetation management options, geared to specific sites. The deliverables of this effort are the results of a user survey, and a synthesis report listing techniques with their merits, procedures and environmental impacts. The results would be in the form of a guidebook for users. Videos, web sites and workshops should also be used for sharing the results of this effort.

External audience - This includes the general public, regulators, real estate developers, ROW property owners, environmental and other special interest groups, etc. The objective of this effort is to educate these audiences about the effectiveness of various vegetation management techniques and strategies, to put current practices in the "best light." The deliverables are envisioned as a glossy booklet, a video, a web site and brochures that are informational.

Reprioritization of Refined Research Areas

After the refinement of the eight highest priority research areas was completed, the group conducted a reprioritization, with each participant having four votes to cast for their highest priority items. The table lists the research areas in order of their original priority. The new rank shown in the far right hand column is the reprioritized rank after the last round of voting.

Research Priorities

Research NEW Area	***Original Priority***	***Originating Group***	***Votes by Red***	***Votes by Blue***	***Votes by Green***	***Votes by Gold***	***Total Votes***	***Rank***
12. Synthesize what is known about the effects of ROW maintenance on the environment	1	blue	5	12	3	3	21	1

Research NEW Area	*Original Priority*	*Originating Group*	*Votes by Red*	*Votes by Blue*	*Votes by Green*	*Votes by Gold*	*Total Votes*	*Rank*
14. Assist utilities in identifying multiple uses that are compatible	2	green	5	2	6	1	14	4
2. Danger tree assessment techniques	3	red	6	5	3	3	17	2
16. Synthesize what is known about the use and impact of herbicides and other chemicals in and around stations	4	gold	2	5	3	3	15	3
15. Determine the need, and techniques for communication concerning multiple uses of ROW	5	green	0	0	1	0	1	7
5. Evaluate new vegetation management tools	6	red	4	5	4	4	17	2
1. Describe the strengths and limitations of vegetation management techniques	7	red						
Internal audience			2	1	1	1	5	6
External audience			3	1	0	2	6	5

APPENDIX C:

ADDITIONAL RESEARCH TOPICS

Additional Research Topics

During the research area refinement breakout sessions, each group was asked to identify any research topics or areas that had been overlooked in the process used in the workshop. It was suggested that each workshop participant might offer one such topic, if they had one. Following is the list the groups provided. The items listed are not in any order of priority, and no further analysis of these as potential topics was undertaken.

Red group other topics:

1. Wood waste management
2. Noxious weeds (non-native exotic plants, and the strategies for their management)
3. Quantification of losses (megawatts and dollars) due to vegetation mediated conduction
4. Development of low stature vegetation ROW cover (also includes low stature tree development for use under distribution lines)
5. Evaluation of current tree replacement strategies

Blue group other topics:

1. Noxious weeds
2. Wildlife response to ROW conditions (quantitative)
3. Predictive models of vegetation development
4. Wood waste management
5. Effects of multiple uses of ROW on the various research areas that will be the subject of synthesis activities
6. Impacts of ROW management on hunting opportunities, and is this positive or negative, and should it be a target of active management

Green group other topics:

1. ISO 14000 T Lines
2. Wildlife related outages and successful solutions
3. Deregulation and its likely effects on vegetation management and line maintenance
4. Establishment, and maintenance of low growing, stable plant communities on ROW
5. Lack of ability to access literature, research findings and to accomplish technology transfer.

Gold group other topics:

1. Noxious weeds - learn from international experiences
2. Wood waste disposal, including wood poles and tree trimmings
3. Maintaining genetic integrity of native species in revegetation
4. How to generate public support for ROW maintenance activities

APPENDIX D:

WORKSHOP AGENDA

RIGHTS-OF-WAY (ROW) ENVIRONMENTAL MANAGEMENT WORKSHOP AGENDA

Monday 10/27 ROW Development Session

12:00 a.m. to 1:00 p.m.	**Hosted Luncheon**
1:00 p.m. to 2:00 p.m.	**Plenary Session** • **Opening Remarks** • **Technical Chair Presentation** • **Suggested Research Topics for Discussion** • **Instructions for Breakout Sessions**
2:00 p.m. to 4:30 pm	**Breakout Sessions**
4:30 p.m. to 5:00 p.m.	**Synthesis Session for Technical Chairs, Breakout Session Chairs and EPRI/ESEERCO Staff**
5:00 p.m. to 7:30 p.m.	**Hosted Ice Breaker**

Tuesday 10/28 ROW Development Session (Continued)

7:00 a.m. to 8:00 a.m.	**Hosted Continental Breakfast**
8:00 a.m. to 9:00 a.m.	**Plenary Session** • **Technical Chair Report on Sessions and Discussion**
9:00 a.m. to 10:30 a.m.	**Breakout Sessions**
10:30 a.m. to 11:00 a.m.	**Break**
11:00 a.m. to 12:00 a.m.	**Plenary Session** • **Final Technical Chair Report on Sessions and Ranking of Research Topics**
12:00 a.m. to 1:00 p.m.	**Hosted Lunch**

Tuesday 10/28 ROW Maintenance Session

1:00 p.m. to 2:00 p.m.	**Plenary Session** • **Opening Remarks** • **Technical Chair Presentation** • **Suggested Research Topics for Discussion** • **Instructions for Breakout Sessions**
2:00 p.m. to 4:30 pm	**Breakout Sessions**
4:30 p.m. to 5:00 p.m.	**Synthesis Session for Technical Chairs, Breakout Session Chairs and EPRI/ESEERCO Staff**
5:00 p.m. to 7:00 p.m.	**Hosted Ice Breaker** **Video on Integrated Vegetation Management**

Wednesday 10/29 ROW Maintenance Session (Continued)

7:00 a.m. to 8:00 a.m.	**Hosted Continental Breakfast**
8:00 a.m. to 9:00 a.m.	**Plenary Session** • **Technical Chair Report on Sessions and Discussion**
9:00 a.m. to 10:00 a.m.	**Breakout Sessions**
10:00 a.m. to 11:00 a.m.	**Break**
11:00 a.m. to 12:00 a.m.	**Plenary Session** • **Final Technical Chair Report on Sessions and Ranking of Research Topics**
12:00 a.m	**Adjournment**

About EPRI

EPRI creates science and technology solutions for the global energy and energy services industry. U.S. electric utilities established the Electric Power Research Institute in 1973 as a nonprofit research consortium for the benefit of utility members, their customers, and society. Now known simply as EPRI, the company provides a wide range of innovative products and services to more than 1000 energy-related organizations in 40 countries. EPRI's multidisciplinary team of scientists and engineers draws on a worldwide network of technical and business expertise to help solve today's toughest energy and environmental problems.

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